Hawaii Range Complex

Final Environmental Impact Statement/ Overseas Environmental Impact Statement (EIS/OEIS)

Volume 5 of 5: Appendices

May 2008

Coordinator
Hawaii Range Complex
Pacific Missile Range Facility
P.O. Box 128
Kekaha, Kauai, Hawaii 96752-0128

HAWAII RANGE COMPLEX
FINAL ENVIRONMENTAL IMPACT STATEMENT/ OVERSEAS ENVIRONMENTAL IMPACT STATEMENT

Volume 5 of 5

MAY 2008

Coordinator
Hawaii Range Complex
Pacific Missile Range Facility
P.O. Box 128
Kekaha, Kauai, Hawaii 96752-0128

COVER SHEET
FINAL ENVIRONMENTAL IMPACT STATEMENT/
OVERSEAS ENVIRONMENTAL IMPACT STATEMENT
HAWAII RANGE COMPLEX (HRC)

Lead Agency for the EIS:	U.S. Department of the Navy
Title of the Proposed Action:	Hawaii Range Complex
Affected Jurisdiction:	Kauai, Honolulu, Maui, and Hawaii Counties
Designation:	Final Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS)

Abstract

This Final EIS/OEIS has been prepared by the U.S. Department of the Navy (Navy) in compliance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code § 4321 et seq.); the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (Title 40 Code of Federal Regulations [CFR] §§ 1500-1508); Navy Procedures for Implementing NEPA (32 CFR § 775); and Executive Order 12114 (EO 12114), *Environmental Effects Abroad of Major Federal Actions*. The Navy has identified the need to support and conduct current, emerging, and future training and research, development, test, and evaluation (RDT&E) activities in the Hawaii Range Complex (HRC). The alternatives—the No-action Alternative, Alternative 1, Alternative 2, and Alternative 3—are analyzed in this Final EIS/OEIS. All alternatives include an analysis of potential environmental impacts associated with the use of mid-frequency active (MFA) and high-frequency active (HFA) sonar. The No-action Alternative stands as no change from current levels of HRC usage and includes HRC training, support, and RDT&E activities, Major Exercises, and maintenance of the technical and logistical facilities that support these activities and exercises. Alternative 1 includes all ongoing training associated with the No-action Alternative, an increased tempo and frequency of such training (including increases in MFA and HFA sonar use), a new training event (Field Carrier Landing Practice), enhanced and future RDT&E activities, enhancements to optimize HRC capabilities, and an increased number of Major Exercises. Alternative 2 includes all of the training associated with Alternative 1 plus additional increases in the tempo and frequency of training (including additional increases in MFA and HFA sonar use), enhanced RDT&E activities, future RDT&E activities, and additional Major Exercises, such as supporting three Strike Groups training at the same time. Alternative 3 would include all of the training and RDT&E activities associated with Alternative 2. The difference between Alternative 2 and Alternative 3 is the amount of MFA/HFA sonar usage. As described under Alternative 2, Alternative 3 would provide increased flexibility in training activities by increasing the tempo and frequency of training events, future and enhanced RDT&E activities, and the addition of Major Exercises. Alternative 3 would consist of the MFA/HFA sonar usage as analyzed under the No-action Alternative. Alternative 3 is the Navy's preferred alternative.

This Final EIS/OEIS addresses potential environmental impacts that result from activities that occur under the No-action Alternative and proposed activities that would occur under Alternatives 1, 2, and 3. This EIS/OEIS also addresses changes and associated environmental analyses that were presented in the Supplement to the Draft EIS/OEIS. Environmental resource topics evaluated include air quality, airspace, biological resources (open ocean, offshore, and onshore), cultural resources, geology and soils, hazardous materials and waste, health and safety, land use, noise, socioeconomics, transportation, utilities, and water resources.

Prepared by:	U.S. Department of Defense, Department of the Navy
Point of Contact:	Pacific Missile Range Facility Public Affairs Officer
	P.O. Box 128, Kekaha, Hawaii, 96752, (866) 767-3347

May 2008

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Appendix A
Cooperating Agencies Request and Acceptance Letters

APPENDIX A
COOPERATING AGENCIES REQUEST AND ACCEPTANCE LETTERS

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, DC 20350-2000

IN REPLY REFER TO

5090
Ser
3 October 2006

Dr. William T. Hogarth
Assistant Administrator
National Oceanic and Atmospheric
Administration (NOAA) Fisheries
1315 East West Highway
Silver Springs, MD 20910

Dear Dr. Hogarth:

The Navy is initiating an Environmental Impact Statement (EIS) to study the environmental effects of increasing usage and enhancing the capability of the Hawaii Range Complex to achieve and maintain Fleet readiness, and to conduct current, emerging, and future training and research, development, test, and evaluation (RDT&E) operations. Under the No Action Alternative, the Navy would continue current levels of training operations, RDT&E activities, ongoing base operations and maintenance of the technical and logistical facilities that support these operations and activities, and the monitoring of marine mammals in the Hawaii Range Complex. The No Action Alternative also includes the biennial Rim of Pacific exercises.

Two action Alternatives are proposed. Alternative 1 includes the activities described in the No Action Alternative plus increased training necessary to support the Fleet Response Training Plan, Hawaii Range Complex improvements and modernization, planned RDT&E activities, and necessary force structure changes. Alternative 2 includes the activities described in Alternative 1 plus major events such as supporting three carrier strike groups training at the same time, increasing the tempo of training exercises, and additional RDT&E programs at Pacific Missile Range Facility (PMRF). Future RDT&E programs proposed as part of Alternative 2 would include directed energy programs involving lasers.

In order to adequately evaluate the potential environmental effects of this proposed action, the Navy and NMFS would need to work together on assessing acoustic effects to marine species protected under the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). As well, resources protected by the Hawaiian Islands Humpback Whale National Marine Sanctuary and marine areas of the Northwest Hawaiian Islands Marine National Monument will need to be considered. It is Navy's desire to formalize this relationship as outlined in the CEQ guidelines (40 CFR Part 1501).

As defined in 40 CFR 1501.5, the Navy is the lead agency for the Hawaii Range Complex EIS. As NOAA Fisheries has jurisdiction by law and special expertise over the protected marine species that will potentially be affected by the proposed action, the Navy is requesting that NOAA Fisheries be a cooperating agency as defined in 40 CFR 1501.6.

As the lead agency, the Navy will be responsible for the following:

- Preparing the environmental analysis, background information and all necessary permit applications associated with acoustic issues on the underwater ranges.
- Working with NMFS personnel to develop and refine the method of estimating potential effects to protected marine species, including threatened and endangered species.
- Determining the scope of the EIS/OEIS, including the alternatives evaluated.
- Circulating the appropriate NEPA documentation to the general public and any other interested parties.
- Scheduling and supervising public meetings held in support of the NEPA process. This shall include without limitation, compiling and responding to comments received at these meetings.
- Participating, as appropriate, in public meetings hosted by the NOAA Fisheries for receipt of public comment on protected species permit applications. This shall also include assistance in NOAA Fisheries' response to comments.
- Maintaining an administrative record and responding to any Freedom of Information Act (FOIA) requests relating to the EIS.

As the cooperating agency, the NOAA Fisheries would be asked to support the Navy in the following manner:

- Providing timely comments after the Agency Information Meeting (which will be held at the onset of the NEPA process) and on working drafts of the EIS documents. The Navy requests that comments on draft EIS documents be provided within 21 calendar days.

- Coordinating, to the maximum extent practicable, any public comment periods necessary in the MMPA permitting process with the Navy's NEPA public comment periods.
- Participating, as appropriate, in public meetings hosted by the Navy for receipt of public comment on the NEPA document and environmental analysis.
- Scheduling meetings requested by Navy in a timely manner.
- Adhering to the overall schedule as set forth by the Navy.

The Navy views this agreement as important to the successful completion of the NEPA process for the Hawaii Islands Complex EIS. It is the Navy's goal to complete the analysis as expeditiously as possible, while using the best scientific information available. NOAA Fisheries assistance will be invaluable in that endeavor.

My point of contact for this action is Ms. Karen M. Foskey, (703) 602-2859, email: Karen.foskey@navy.mil.

Sincerely,

J. A. SYMONDS
Director, Environmental
Readiness Division (OPNAV N45)

Copy to:
ASN (I&E)
DASN (E), (I&F)
OAGC (I&E)
Commander, Naval Installations Command
Commander, Navy Region Hawaii
Commander, Pacific Missile Range Facility
COMPACFLT N01CE
COMPACFLT, N7 (Mr. Long)

3

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, DC 20350-2000

IN REPLY REFER TO

5090
Ser N456C/6U838240
3 October 2006

Honorable Keith E. Eastin
Office of the Assistant Secretary of the Army
(Installation and Environment)
110 Army Pentagon, Room 3E464
Washington, D.C. 20310-0110

Dear Mr. Eastin:

The Navy is initiating an Environmental Impact Statement (EIS) to study the environmental effects of increasing usage and enhancing the capability of the Hawaii Range Complex to achieve and maintain Fleet readiness, and to conduct current, emerging, and future training and research, development, test, and evaluation (RDT&E) operations. Under the No Action Alternative, the Navy would continue current levels of training operations, RDT&E activities, ongoing base operations and maintenance of the technical and logistical facilities that support these operations and activities, and the monitoring of marine mammals in the Hawaii Range Complex. The No Action Alternative also includes biennial Rim of Pacific exercises.

Two action Alternatives are proposed. Alternative 1 includes the activities described in the No Action Alternative plus increased training necessary to support the Fleet Response Training Plan, Hawaii Range Complex improvements and modernization, planned RDT&E activities, and necessary force structure changes. Alternative 2 includes the activities described in Alternative 1 plus major events such as supporting three carrier strike groups training at the same time, increasing the tempo of training exercises, and additional RDT&E programs at Pacific Missile Range Facility (PMRF). Future RDT&E programs proposed as part of Alternative 2 would include directed energy programs involving lasers.

Your agency's special expertise is needed to adequately evaluate the potential environmental effects from the RDT&E and training activities in which Army would be involved at PMRF as proposed under this action. It is Navy's desire to formalize this relationship as outlined in the CEQ guidelines (40 CFR Part 1501).

As the lead agency, the Navy will be responsible for overseeing preparation of the EIS/OEIS that includes but is not limited to the following:

- Gathering all necessary background information and preparing the EIS.
- Determining the scope of the EIS, including the alternatives evaluated.
- Working with appropriate Army personnel to evaluate potential impacts of Army RDT&E system elements and training operations.
- Circulating the appropriate NEPA documentation to the general public and any other interested parties.
- Scheduling and supervising public meetings held in support of the NEPA process. This shall include without limitation, compiling and responding to comments received at these meetings.
- Maintaining an administrative record and responding to any Freedom of Information Act (FOIA) requests relating to the EIS.

As the cooperating agency, the Navy requests U.S. Army support the Navy in the following manner:

- Providing timely comments after the Agency Information Meeting (which will be held at the onset of the NEPA process) and on working drafts of the EIS documents. The Navy requests that comments on draft EIS documents be provided within 21 calendar days.
- Responding to Navy requests for information. Timely input will be critical to ensure a successful NEPA process.
- Participating, as appropriate, in public meetings hosted by the Navy for receipt of public comment on the NEPA document and environmental analysis.
- Scheduling meetings requested by Navy in a timely manner.

2

- Adhering to the overall schedule as set forth by the Navy.

The Navy views this agreement as important to the successful completion of the NEPA process for the Hawaii Islands Complex EIS. It is the Navy's goal to complete the analysis as expeditiously as possible, while using the best scientific information available. The assistance of the U.S. Army will be invaluable in that endeavor.

My point of contact for this action is Ms. Karen M. Foskey, (703) 602-2859, email: Karen.foskey@navy.mil.

Sincerely,

J. A. SYMONDS
Rear Admiral, U.S. Navy
Director, Environmental Readiness
Division (OPNAV N45)

Copy to:
ASN (I&E)
DASN (E), (I&F)
OAGC (I&E)
Commander, Naval Installations Command
Commander, Naval Region Hawaii
Commander, Pacific Missile Range Facility
COMPACFLT (N01CE)
COMPACFLT, N7 (Mr. Long)

3

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, DC 20350-2000

IN REPLY REFER TO

5090
Ser N456C/6U838238
03 October 2006

Mr. Crate Spears
Missile Defense Agency
Federal Office Building #2
ATTN: MDA-TER
7100 Defense Pentagon
Washington, DC 20301-7100

Dear Mr. Spears:

The Navy is initiating an Environmental Impact Statement (EIS) to study the environmental effects of increasing usage and enhancing the capability of the Hawaii Range Complex to achieve and maintain Fleet readiness, and to conduct current, emerging, and future training and research, development, test, and evaluation (RDT&E) operations. Under the No Action Alternative, the Navy would continue current levels of training operations, RDT&E activities, ongoing base operations and maintenance of the technical and logistical facilities that support these operations and activities, and the monitoring of marine mammals in the Hawaii Range Complex. The No Action Alternative also includes biennial Rim of Pacific exercises.

Two action Alternatives are proposed. Alternative 1 includes the activities described in the No Action Alternative plus increased training necessary to support the Fleet Response Training Plan, Hawaii Range Complex improvements and modernization, planned RDT&E activities, and necessary force structure changes. Alternative 2 includes the activities described in Alternative 1 plus major events such as supporting three carrier strike groups training at the same time, increasing the tempo of training exercises, and additional RDT&E programs at Pacific Missile Range Facility (PMRF). Future RDT&E programs proposed as part of Alternative 2 would include directed energy programs involving lasers.

Your agency's special expertise is needed to adequately evaluate the potential environmental effects from the RDT&E activities involving various system elements of the Ballistic Missile Defense System, including the Flexible Target Family, as proposed under this action. It is Navy's desire to formalize this relationship as outlined in the CEQ guidelines by requesting that the Missile Defense Agency be a cooperating agency as defined in 40 CFR 1501.6.

As defined in 40 CFR 1501.5, the Navy is the lead agency for the Hawaii Range Complex EIS. As the lead agency, the Navy will be responsible for the following:

- Gathering all necessary background information and preparing the EIS.
- Determining the scope of the EIS, including the alternatives evaluated.
- Working with Missile Defense Agency personnel to evaluate potential impacts of RDT&E of system elements of the Ballistic Missile Defense System.
- Circulating the appropriate NEPA documentation to the general public and any other interested parties.
- Scheduling and supervising public meetings held in support of the NEPA process. This shall include without limitation, compiling and responding to comments received at these meetings.
- Maintaining an administrative record and responding to any Freedom of Information Act (FOIA) requests relating to the EIS.

As the cooperating agency, the Navy requests the Missile Defense Agency support the Navy in the following manner:

- Providing timely comments after the Agency Information Meeting (which will be held at the onset of the NEPA process) and on working drafts of the EIS documents. The Navy requests that comments on draft EIS documents be provided within 21 calendar days.
- Responding to Navy requests for information. Timely input will be critical to ensure a successful NEPA process.
- Participating, as appropriate, in public meetings hosted by the Navy for receipt of public comment on the NEPA document and environmental analysis.
- Scheduling meetings requested by Navy in a timely manner.

2

- Adhering to the overall schedule as set forth by the Navy.

The Navy views this agreement as important to the successful completion of the NEPA process for the Hawaii Islands Complex EIS. It is the Navy's goal to complete the analysis as expeditiously as possible, while using the best scientific information available. The assistance of the Missile Defense Agency will be invaluable in that endeavor.

My point of contact for this action is Ms. Karen M. Foskey, (703) 602-2859, email: karen.foskey@navy.mil.

Sincerely,

J. A. SYMONDS
Rear Admiral, U.S. Navy
Director, Environmental Readiness
Division (OPNAV N45)

Copy to:
ASN (I&E)
DASN (E), (I&F)
OAGC (I&E)
Commander, Naval Installations Command
Commander, Navy Region Hawaii
Commander, Pacific Missile Range Facility
COMPACFLT N01CE
COMPACFLT, N7 (Mr. Long)

3

DEPARTMENT OF THE NAVY
PACIFIC MISSILE RANGE FACILITY
P.O. BOX 128
KEKAHA, HI 96752-0128

IN REPLY REFER TO

5090
Ser 00/ 09 56

OCT 13 2005

Ms. Susan Lacy
US Department of Energy
National Nuclear Security Administration
Sandia Site Office
Albuquerque, NM 87185

Dear Ms. Lacy:

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS)/OVERSEAS EIS (OEIS)

In accordance with the National Environmental Policy Act (NEPA), the Department of the Navy (Navy) is initiating the preparation of an Environmental Impact Statement (EIS)/Overseas EIS (OEIS) to support decisions by the U.S. Navy concerning potential range enhancements at the Hawaii Range Complex. Your agency's assistance in adequately evaluating the potential environmental effects from potential enhancements to the Department of Energy (DOE) Kauai Test Facility at PMRF is needed to complete the EIS/OEIS. Therefore, in accordance with 40 CFR Part 1501 and the Council on Environmental Quality Cooperating Agency guidance issued on January 30, 2002, the Navy requests the DOE serve as a cooperating agency for the development of the EIS/OEIS.

The No-Action Alternative is the continuation of training operations, Research, Development, Test and Evaluation (RDT&E) activities, the ongoing base operations and maintenance of the technical and logistical facilities that support these operations and activities, and the monitoring of marine mammals in the Hawaii Range Complex.

The Proposed Action includes two action Alternatives. Alternative 1 includes the activities described in the No-Action Alternative with the addition of increased training necessary to support the Fleet Response Training Plan, Hawaii Range Complex improvements and modernization, planned RDT&E activities, and necessary force structure changes. Alternative 2 includes all of the activities described in Alternative 1 with the addition of major events, such as supporting three transient carrier strike group training exercises at the same time, increasing the tempo of training exercises, and additional RDT&E programs at Pacific Missile Range Facility (PMRF).

The purpose of the Proposed Action is to provide the Hawaii Range Complex with sufficient capabilities to support Fleet and DoD training, major exercises based on current and evolving world situations, and the development, testing, and evaluation of existing, upgraded and newly developed DoD and other federal agency systems. The Proposed Action will also provide additional range capabilities and support facilities at the Hawaii Range Complex, to include

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS)/OVERSEAS EIS (OEIS)

PMRF, to fully integrate range services in a modern, multi-threat, multi-dimensional environment, ensuring safe conduct and evaluation of training and RDT&E missions. The purpose of the Proposed Action is also to fulfill Navy commitment to update analyses on marine mammal impacts caused by noise in the water.

The EIS/OEIS will address measurably foreseeable activities in the particular geographical areas affected by the No-Action Alternative and action alternatives. Impacts could result from construction at launch and other support locations, sensor test preparations, launch preparation, missile flight tests, and intercept tests. The EIS/OEIS will also analyze the potential impacts of additional training missions and additional testing facilities. This EIS/OEIS will analyze the effects of sound in the water on marine mammals in the areas where Hawaii Range Complex activities occur. This analysis will be based on the initial results of Navy long-term research plans, which have studied the quantification of exposure of marine mammal species to acoustic emissions with differing experimental approaches and detailed observations of effects. In addition, other environmental resource areas that will be addressed as applicable in the EIS/OEIS include air quality; airspace; biological resources, including threatened and endangered species; cultural resources; geology and soils; hazardous materials and waste; health and safety; land use; noise; socioeconomics; transportation; utilities; visual and aesthetic resources; and water resources.

As the lead agency, the Navy will be responsible for overseeing preparation of the EIS/OEIS that includes but is not limited to the following:

- Gathering all necessary background information and preparing the EIS/OEIS.
- Working with DOE personnel to evaluate potential impacts of changes and enhancements to the DOE's Kauai Test Facility at PMRF.
- Determining the scope of the EIS/OEIS, including the alternatives evaluated.
- Circulating the appropriate NEPA documentation to the general public and any other interested parties.
- Scheduling and supervising meetings held in support of the NEPA process, and compiling any comments received.
- Maintaining an administrative record and responding to any Freedom of Information Act requests relating to the EIS/OEIS.

As the cooperating agency, the Navy requests DOE support the Navy in the following manner:

- Providing timely comments throughout the EIS process, to include, on working drafts of the EIS/OEIS documents. The Navy requests that comments on draft EIS/OEIS documents be provided within 21 calendar days.
- Responding to Navy requests for information. Timely DOE input will be critical to ensure a successful NEPA process.
- Participating, as necessary, in meetings hosted by the Navy for discussion of EIS/OEIS related issues.

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS)/OVERSEAS EIS (OEIS)

- Adhering to the overall schedule as set forth by the Navy.
- Providing a formal, written response to this request.

My point of contact for this is Neil Sheehan, (808) 471-7836, email: neil.a.sheehan.ctr@navy.mil.

Sincerely,

M. W. DARRAH
CAPT, U.S. NAVY
Commander, Hawaii Range Complex

Copy to:
Chief of Naval Operations (N45)
Commander, Naval Installations Command
Commander, Navy Region Hawaii
COMPACFLT, N01CE
COMPACFLT, N7 (Mr. Long)

DEPARTMENT OF THE NAVY
PACIFIC MISSILE RANGE FACILITY
P.O. BOX 128
KEKAHA, HI 96752-0128

IN REPLY REFER TO

5090
Ser 00/ 0957

OCT 13 2006

Mr. Patrick Leonard
Field Supervisor
US Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, HI 96850

Dear Mr. Leonard:

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS)/OVERSEAS EIS (OEIS)

In accordance with the National Environmental Policy Act (NEPA), the Department of the Navy (Navy) is initiating the preparation of an Environmental Impact Statement (EIS)/Overseas EIS (OEIS) to support decisions by the U.S. Navy concerning potential range enhancements at the Hawaii Range Complex. To assist in this effort, and in accordance with 40 CFR Part 1501 and the Council on Environmental Quality Cooperating Agency guidance issued on January 30, 2002, the Navy requests US Fish and Wildlife Service serve as a cooperating agency for the development of the EIS/OEIS.

The No-Action Alternative is the continuation of training operations, Research, Development, Test and Evaluation (RDT&E) activities, the ongoing base operations and maintenance of the technical and logistical facilities that support these operations and activities, and the monitoring of marine mammals in the Hawaii Range Complex.

The Proposed Action includes two action Alternatives. Alternative 1 includes the activities described in the No-Action Alternative with the addition of increased training necessary to support the Fleet Response Training Plan, Hawaii Range Complex improvements and modernization, planned RDT&E activities, and necessary force structure changes. Alternative 2 includes all of the activities described in Alternative 1 with the addition of major events, such as supporting three transient carrier strike group training exercises at the same time, increasing the tempo of training exercises, and additional RDT&E programs at Pacific Missile Range Facility (PMRF).

The purpose of the Proposed Action is to provide the Hawaii Range Complex with sufficient capabilities to support Fleet and DoD training, major exercises based on current and evolving world situations, and the development, testing, and evaluation of existing, upgraded and newly developed DoD and other federal agency systems. The Proposed Action will also provide additional range capabilities and support facilities at the Hawaii Range Complex, to include PMRF, to fully integrate range services in a modern, multi-threat, multi-dimensional environment, ensuring safe conduct and evaluation of training and RDT&E missions. The

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS)/OVERSEAS EIS (OEIS)

purpose of the Proposed Action is also to fulfill Navy commitment to update analyses on marine mammal impacts caused by noise in the water.

The EIS/OEIS will address measurably foreseeable activities in the particular geographical areas affected by the No-Action Alternative and action alternatives. Impacts could result from construction at launch and other support locations, sensor test preparations, launch preparation, missile flight tests, and intercept tests. The EIS/OEIS will also analyze the potential impacts of additional training missions and additional testing facilities. This EIS/OEIS will analyze the effects of sound in the water on marine mammals in the areas where Hawaii Range Complex activities occur. This analysis will be based on the initial results of Navy long-term research plans, which have studied the quantification of exposure of marine mammal species to acoustic emissions with differing experimental approaches and detailed observations of effects. In addition, other environmental resource areas that will be addressed as applicable in the EIS/OEIS include air quality; airspace; biological resources, including threatened and endangered species; cultural resources; geology and soils; hazardous materials and waste; health and safety; land use; noise; socioeconomics; transportation; utilities; visual and aesthetic resources; and water resources.

As the lead agency, the Navy will be responsible for overseeing preparation of the EIS/OEIS that includes but is not limited to the following:

- Gathering all necessary background information and preparing the EIS/OEIS.
- Working with USF&WS personnel to evaluate potential impacts on wildlife refuges, critical habitat, and wildlife resources including threatened and endangered species.
- Determining the scope of the EIS/OEIS, including the alternatives evaluated.
- Circulating the appropriate NEPA documentation to the general public and any other interested parties.
- Scheduling and supervising meetings held in support of the NEPA process, and compiling any comments received.
- Maintaining an administrative record and responding to any Freedom of Information Act requests relating to the EIS/OEIS.

As the cooperating agency, the Navy requests USF&WS support the Navy in the following manner:

- Providing timely comments throughout the EIS process, to include, on working drafts of the EIS/OEIS documents. The Navy requests that comments on draft EIS/OEIS documents be provided within 21 calendar days.
- Responding to Navy requests for information. Timely USF&WS input will be critical to ensure a successful NEPA process.
- Participating, as necessary, in meetings hosted by the Navy for discussion of EIS/OEIS related issues.
- Adhering to the overall schedule as set forth by the Navy.
- Providing a formal, written response to this request.

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT (EIS)/OVERSEAS EIS (OEIS)

My point of contact for this is Neil Sheehan, (808) 471-7836, email: neil.a.sheehan.ctr@navy.mil.

Sincerely,

M. W. DARRAH
CAPT, U. S. Navy
Commander, Hawaii Range Complex

Copy to:
Chief of Naval Operations (N45)
Commander, Naval Installations Command
Commander, Navy Region Hawaii
COMPACFLT, N01CE
COMPACFLT, N7 (Mr. Long)

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1315 East-West Highway
Silver Spring, Maryland 20910
THE DIRECTOR

NOV 16 2006

Admiral J.A. Symonds
Director, Environmental Readiness Division
Department of the Navy
2000 Navy Pentagon
Washington, DC 20350-2000

Dear Admiral Symonds:

Thank you for your letter requesting that NOAA's National Marine Fisheries Service (NMFS) be a cooperating agency in the preparation of an Environmental Impact Statement (EIS) on the Department of the Navy's plan to increase usage and enhance capability of the Hawaii Range Complex.

NMFS supports the Navy's decision to prepare an EIS on this activity and agrees to be a cooperating agency, due, in part, to our responsibilities under section 101(a)(5)(A) of the Marine Mammal Protection Act (MMPA) and section 7 of the Endangered Species Act. We will make every effort to support the Navy in the specific ways described in your October 3, 2006, letter. However, due to staffing constraints in Headquarters and the fact that comments will need to be compiled from multiple Offices (including NMFS' Pacific Islands Regional Office and the Hawaiian Islands Humpback Whale National Marine Sanctuary), we cannot guarantee that we will be able to provide comments on draft EIS documents within 21 calendar days. We ask that the Navy work with us to allow reasonable extensions to our comment periods when necessary. Additionally, to ensure that NMFS will be able to adopt the Navy's EIS to cover, pursuant to NEPA, our subsequent issuance of MMPA authorizations to the Navy for these activities, we request that the Navy include us as early as possible in the development of the EIS (specifically, the range of alternatives and the identification and analysis of potential mitigation measures).

If you need any additional information, please contact Ms. Jolie Harrison, at (301) 713-2289, ext. 166.

Sincerely,

William T. Hogarth, Ph.D.

THE ASSISTANT ADMINISTRATOR
FOR FISHERIES

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DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
INSTALLATIONS AND ENVIRONMENT
110 ARMY PENTAGON
WASHINGTON, DC 20310-0110

DEC 1 2 2006

SAIE-ESOH

MEMORANDUM FOR DIRECTOR, ENVIRONMENTAL READINESS DIVISION (OPNAV N45), OFFICE OF THE CHIEF OF NAVAL OPERATIONS

SUBJECT: Environmental Impact Statement (EIS)--Hawaii Range Complex

1. In response to your letter dated, 3 October 2006, to Assistant Secretary Eastin regarding the Navy's proposal to prepare an EIS to study environmental effects of increased usage and enhancement of the capability of the Hawaii Range Complex.

2. The Army agrees to become a cooperating agency and will provide information and comments on EIS documents, participate in public meetings, and provide additional assistance as appropriate.

3. The points of contact for this action are Mr. Mike Harada, U.S. Army Installation Management Command, Pacific Region, and Mr. Randy Gallien, U.S. Army Space and Missile Defense Command. Mr. Harada can be reached at (808) 438-9333 or email at michael.a.harada@us.army.mil, and Mr. Gallien can be reached at (256) 955-5027 or email at randy.gallien@us.army.mil.

Tad Davis

Addison D. Davis, IV
Deputy Assistant Secretary of the Army
(Environment, Safety and Occupational Health)

CF:
COMMANDING GENERAL, IMCOM
COMMANDING GENERAL, SMDC/ARSTRAT
DIRECTOR, ENVIRONMENTAL PROGRAMS, OACSIM

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DEPARTMENT OF DEFENSE
MISSILE DEFENSE AGENCY
7100 DEFENSE PENTAGON
WASHINGTON, DC 20301-7100

DT

JAN 0 9 2007

MEMORANDUM FOR DIRECTOR, ENVIRONMENTAL READINESS DIVISION, (OPNAV N45), U.S. NAVY
ATTN: MS. KAREN FOSKEY

SUBJECT: Hawaii Range Complex Environmental Impact Statement (EIS)

In response to your request (Ser N456C/6U838238) dated October 3, 2006, the Missile Defense Agency (MDA) hereby agrees to participate as a cooperating agency in the Hawaii Range Complex EIS process. As defined in 40 CFR 1501.6, MDA agrees to support the Navy by reviewing and submitting comments on working drafts of EIS documents, by responding to Navy requests for information about MDA test activities, and by participating, as appropriate, in public meetings hosted by the Navy. My points of contact for this issue are Mr. Steven Lopes, (703) 697-4747, email: steven.lopes@mda.mil, and Mr. Howard Finkel (SETAC), (703) 697-4403, email: howard.finkel.ctr@mda.mil.

CHRIS T. ANZALONE
Major General, USAF
Deputy for Test, Integration, and Fielding

National Nuclear Security Administration
Sandia Site Office
P.O. Box 5400
Albuquerque, New Mexico 87185-5400

MAY 0 4 2007

Aaron Cudnohufsky
Capt, U S. Navy
Commander, Hawaii Range Complex
Pacifica Missile Range Facility
Kekaha, HI 96752-0128

Dear Capt Cudnohufsky:

This letter is to inform you that the Department of Energy (DOE), National Nuclear Security Administration, Sandia Site Office is agreeing to participate as a cooperating agency in the preparation of the Hawaii Range Complex Environmental Impact Statement (EIS)/Overseas EIS. In accordance with DOE National Environmental Policy Act Implementing Regulations, 10 CFR 1021 Section 342, Interagency Cooperation; and the Council on Environmental Quality Regulations 40 CFR 1501.6, Cooperating agencies; the DOE will provide support to the U.S. Navy. DOE will provide information to the Navy as requested, will participate in the evaluation of potential impacts from DOE's Kauai Test Facility, and will participate as necessary in public meetings in support of the EIS/OEIS. The DOE point of contact for this effort is Ms. Susan Lacy of my staff. Ms. Lacy can be reached at (505) 845-5542. Thank you for the opportunity to participate in this effort. Your continued assistance is appreciated.

Sincerely,

Dan Pellegrino
for Patty Wagner
Manager

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Appendix B
Federal Register Notices

APPENDIX B
FEDERAL REGISTER NOTICES

51188 **Federal Register** / Vol. 71, No. 167 / Tuesday, August 29, 2006 / Notices

Background

Title V of the Trade and Development Act of 2000 (the Act) created two tariff rate quotas (TRQs), providing for temporary reductions in the import duties on limited quantities of two categories of worsted wool fabrics suitable for use in making suits, suit-type jackets, or trousers: (1) for worsted wool fabric with average fiber diameters greater than 18.5 microns (Harmonized Tariff Schedule of the United States (HTS) heading 9902.51.11); and (2) for worsted wool fabric with average fiber diameters of 18.5 microns or less (HTS heading 9902.51.12). On August 6, 2002, President Bush signed into law the Trade Act of 2002, which includes several amendments to Title V of the Act. On December 3, 2004, the Act was further amended pursuant to the Miscellaneous Trade Act of 2004, Public Law 108-429. The 2004 amendment included authority for the Department to allocate a TRQ for new HTS category, HTS 9902.51.16. This HTS category refers to worsted wool fabric with average fiber diameter of 18.5 microns or less. The amendment provided that HTS 9902.51.16 is for the benefit of persons (including firms, corporations, or other legal entities) who weave such worsted wool fabric in the United States that is suitable for making men's and boys' suits. The TRQ for HTS 9902.51.16 provided for temporary reductions in the import duties on 2,000,000 square meters annually for 2005 and 2006. The amendment requires that the TRQ be allocated to persons who weave worsted wool fabric with average fiber diameter of 18.5 microns or less, which is suitable for use in making men's and boys' suits, in the United States. On August 17, 2006, the Act was further amended pursuant to the Pension Protection Act of 2006, Public Law 109-280, which extended the TRQ for HTS 9902.51.16 through 2009.

On May 16, 2005, the Department published regulations establishing procedures for allocating the TRQ. 70 FR 25774, 15 CFR 335. In order to be eligible for an allocation, an applicant must submit an application on the form provided at *http://web.ita.doc.gov/tacgi/wooltrq.nsf/TRQApp/fabric* to the address listed above by 5 p.m. on September 28, 2006 in compliance with the requirements of 15 CFR 335. Any business confidential information that is marked business confidential will be kept confidential and protected from disclosure to the full extent permitted by law.

Dated: August 23, 2006.

Philip J. Martello,

Acting Deputy Assistant Secretary for Textiles and Apparel.

[FR Doc. E6–14333 Filed 8–28–06; 8:45 am]

BILLING CODE 3510–DS–S

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[I.D. 082306E]

North Pacific Fishery Management Council; Public Meeting

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice of a public committee meeting.

SUMMARY: The North Pacific Fishery Management Council's (Council) Steller Sea Lion Mitigation Committee (SSLMC) will meet in Seattle, WA.

DATES: The meeting will be held on September 12–14, 2006, from 8:30 a.m. to 5 p.m.

ADDRESSES: The meeting will be held at the Alaska Fishery Science Center, 7600 Sand Point Way NE, Building 4, Seattle, WA.

Council address: North Pacific Fishery Management Council, 605 W. 4th Ave., Suite 306, Anchorage, AK 99501–2252.

FOR FURTHER INFORMATION CONTACT: Bill Wilson, North Pacific Fishery Management Council; telephone: (907) 271–2809.

SUPPLEMENTARY INFORMATION: The main issues to be discussed by the SSLMC are the proposal ranking tool and the first chapters of the draft Biological Opinion. The Committee will complete work on development of the ranking tool and prepare a report for the Scientific and Statistical Committee (SSC).

Although non-emergency issues not contained in this agenda may come before this group for discussion, those issues may not be the subject of formal action during this meeting. Action will be restricted to those issues specifically identified in this notice and any issues arising after publication of this notice that require emergency action under section 305(c) of the Magnuson-Stevens Fishery Conservation and Management Act, provided the public has been notified of the Council's intent to take final action to address the emergency.

Special Accommodations

These meetings are physically accessible to people with disabilities. Requests for sign language interpretation or other auxiliary aids should be directed to Gail Bendixen, (907) 271–2809, at least 5 working days prior to the meeting date.

Dated: August 24, 2006.

James P. Burgess,

Acting Director, Office of Sustainable Fisheries, National Marine Fisheries Service.

[FR Doc. E6–14311 Filed 8–28–06; 8:45 am]

BILLING CODE 3510–22–S

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Intent To Prepare an Environmental Impact Statement (EIS)/Overseas Environmental Impact Statement (OEIS) for a Proposal To Enhance Training, Testing, and Operational Capability Within the Hawaii Range Complex and To Announce Public Scoping Meetings

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: Pursuant to Section 102(2)(C) of the National Environmental Policy Act of 1969, as implemented by the Council on Environmental Quality regulations (40 CFR parts 1500–1508), and Executive Order 12114 (Environmental Effects Abroad of Major Federal Actions), the Department of the Navy (DoN) announces its intent to prepare an EIS/OEIS. This EIS/OEIS will evaluate the potential environmental effects of increasing usage and enhancing the capability of the Hawaii Range Complex to achieve and maintain Fleet readiness and to conduct current, emerging, and future training and research, development, test, and evaluation (RDT&E) operations. The EIS/OEIS will consider two action Alternatives to accomplish these objectives, in addition to the No Action Alternative.

The following will be invited to be cooperating agencies: Department of Energy, Missile Defense Agency, U.S. Army, U.S. Fish and Wildlife Service, and National Marine Fisheries Service.

DATES: Public scoping meetings will be held in Hawaii to receive oral and/or written comments on environmental concerns that should be addressed in the EIS/OEIS. The public scoping meetings will be held on:

1. Wednesday, September 13, 2006, 4 p.m.–8 p.m., Maui Arts and Cultural Center, One Cameron Way, Kahului, Maui, Hawaii.
2. Thursday, September 14, 2006, 4 p.m.–8 p.m., Disabled American

Exhibit B-1. Notice of Intent, August 29, 2006

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Veterans Hall, 2685 North Nimitz Highway, Honolulu, Oahu, Hawaii.

3. Saturday, September 16, 2006, 4 p.m.–8 p.m., Hilo Hawaiian Hotel, 71 Banyan Drive, Hilo, Hawaii, Hawaii.

4. Monday, September 18, 2006, 4 p.m.–8 p.m., Kauai Civil Defense Agency, Suite 100, 3990 Kaana Street, Kauai, Lihue, Hawaii.

Each of the four scoping meetings will consist of an informal, open house session with information stations staffed by DoN representatives. Additional information concerning the meetings will be available on the EIS/OEIS Web page located at: *http://www.govsupport.us/navynepahawaii.*

FOR FURTHER INFORMATION CONTACT: Mr. Tom Clements, Pacific Missile Range Facility, P.O. Box 128, Kekaha, Kauai, Hawaii 96752–0128, telephone 1–866–767–3347.

SUPPLEMENTARY INFORMATION: The Hawaii Range Complex geographically encompasses offshore, nearshore, and onshore areas located on or around the major islands of the Hawaiian Island chain. The geographic scope of this EIS/OEIS (Study Area) includes the Hawaii Offshore Operation Areas, consisting of 170,000 square nautical miles of ocean, generally from 17 to 26 degrees north latitude and from 154 to 162 degrees west longitude, land areas used by the DoN within these Operation Areas, and the Pacific Missile Range Facility (PMRF) Temporary Operating Area, consisting of 2.1 million square nautical miles to the north and west of Kauai. These ranges and Operation Areas are used to conduct operations and training involving military hardware, personnel, tactics, munitions, explosives, and electronic combat systems. Several of the areas are also used for RDT&E, including missile defense testing.

The purpose of the Proposed Action is to: (1) Provide the Hawaii Range Complex with sufficient capabilities to support Fleet and DoD training, major exercises based on training requirements identified to support the U.S. Unified Commanders, and the development, testing, and evaluation of existing, upgraded, and newly developed DoD and other federal agency systems; (2) provide additional range capabilities and support facilities at the Hawaii Range Complex, to include the PMRF, to fully integrate range services in a modern, multi-threat, multi-dimensional environment, ensuring safe conduct and evaluation of training and RDT&E missions; and (3) fulfill DoN commitment to update analyses on marine mammal exposures to noise in the water.

The need for the Proposed Action is to: (1) Ensure a robust training, testing, and operational capability within the Hawaii Range Complex operating areas and to take advantage of Hawaii's location to not only provide training for local assets, but also provide capability for short notice and surge deployments from the West Coast; (2) support the acquisition and integration into the Fleet of advanced military technology and accommodate future increases in operational training tempo; and (3) maintain the long-term viability of the range complex while protecting human health and the environment.

The No Action Alternative is the continuation of training operations, RDT&E activities, ongoing base operations, and maintenance of the technical and logistical facilities that support these operations and activities, and the monitoring of marine mammals. The No Action Alternative includes the current level of training and test activities, including the biennial Rim of the Pacific exercises. Alternative 1 includes the activities described in the No Action Alternative with the addition of increased training necessary to support the Fleet Response Training Plan, Hawaii Range Complex improvements and modernizations, planned RDT&E activities, and necessary force structure changes. Alternative 2 would include all of the activities described in Alternative 1 with the addition of major events, such as supporting three carrier strike groups training at the same time, increasing the tempo of training exercises, and additional RDT&E programs at PMRF. Future RDT&E programs proposed as part of Alternative 2 would include directed energy programs involving lasers.

Key environmental issues that will be addressed in the EIS/OEIS, as applicable, include: biological resources (marine mammals and threatened and endangered species), cultural resources, environmental justice, health and safety, and noise. The DoN has been involved in long-term research plans studying the quantification of exposure of marine mammal species to acoustic emissions with differing experimental approaches and detailed observations of effects. Now that initial findings are available, this EIS/OEIS will include acoustic exposure modeling and effects-analysis for marine mammals within the defined study area.

The DoN is initiating the scoping process to identify community concerns and local issues that will be addressed in the EIS/OEIS. Federal, state, and local agencies, the public, and interested persons are encouraged to provide oral and/or written comments to the DoN to identify specific environmental issues or topics of environmental concern that the commenter believes the DoN should consider. All comments, written or provided orally at the scoping meetings, will receive the same consideration during EIS/OEIS preparation.

Written comments on the scope of the EIS/OEIS should be postmarked no later than October 13, 2006. Comments may be mailed to Mr. Tom Clements, Pacific Missile Range Facility, P.O. Box 128, Kekaha, Kauai, Hawaii 96752–0128.

Dated: August 24, 2006.

Saundra K. Melancon,

Paralegal Specialist, Alternate Federal Register Liaison Officer.

[FR Doc. E6–14324 Filed 8–28–06; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF EDUCATION

Notice of Proposed Information Collection Requests

AGENCY: Department of Education.

SUMMARY: The IC Clearance Official, Regulatory Information Management Services, Office of Management, invites comments on the proposed information collection requests as required by the Paperwork Reduction Act of 1995.

DATES: Interested persons are invited to submit comments on or before October 30, 2006.

SUPPLEMENTARY INFORMATION: Section 3506 of the Paperwork Reduction Act of 1995 (44 U.S.C. Chapter 35) requires that the Office of Management and Budget (OMB) provide interested Federal agencies and the public an early opportunity to comment on information collection requests. OMB may amend or waive the requirement for public consultation to the extent that public participation in the approval process would defeat the purpose of the information collection, violate State or Federal law, or substantially interfere with any agency's ability to perform its statutory obligations. The IC Clearance Official, Regulatory Information Management Services, Office of Management, publishes that notice containing proposed information collection requests prior to submission of these requests to OMB. Each proposed information collection, grouped by office, contains the following: (1) Type of review requested, e.g. new, revision, extension, existing or reinstatement; (2) Title; (3) Summary of the collection; (4) Description of the need for, and proposed use of, the information; (5) Respondents and frequency of collection; and (6)

Exhibit B-1. Notice of Intent, August 29, 2006 (Continued)

41324 **Federal Register** / Vol. 72, No. 144 / Friday, July 27, 2007 / Notices

the further reduction of designated ATV and OHV trails, and review the decision to retain road and trail miles that would have been eliminated under Alternative B. Also, we recommend giving consideration to the commitment of resources in Alternative E and its consistency with existing planning direction in the 2003 Forest Plan, and interagency agreements such as the Forest Service and Bureau of Land Management Protocol for Addressing Clean Water Act Section 303(d) Listed Waters.

EIS No. 20070199, ERP No. F–FHW–E40771–NC, Wilmington Bypass Transportation Improvements, U.S. 17 to U.S. 421, Funding, COE Section 10 and 404 Permits and U.S. Coast Guard Bridge Permit Issuance, Brunswick and New Hanover Counties, NC.

Summary: EPA continues to have environmental concerns about stream and wetland impacts, indirect and cumulative air quality impacts from Mobile Source Air Toxics and impacts to Significant Natural Heritage Areas. EPA requested additional avoidance and minimization measures be considered to lessen these impacts.

EIS No. 20070220, ERP No. F–BLM–J65468–WY, Casper Field Office Planning Area Resource Management Plan, Implementation, Natrona, Converse, Goshen, and Platte Counties, WY.

Summary: EPA continues to have environmental concerns about air quality impacts and the need to do a quantitative analysis based on dispersion modeling. In addition, there is potential for adverse impacts to wetlands from OHV use.

EIS No. 20070228, ERP No. F–AFS–G65102–NM, Canadian River Tamarisk Control, Proposes to Control the Nonnative Invasive Species Tamarisk (also known as salt cedar) Cibola National Forest, Canadian River, Harding and Mora Counties, New Mexico.

Summary: No formal comment letter was sent to the preparing agency.

EIS No. 20070242, ERP No. F–COE–F36167–OH, Dover Dam Safety Assurance Program Project, Modifications and Upgrades, Funding, Muskingum River Basin, Tuscarawas County, OH.

Summary: EPA's previous issues have been resolved; therefore, EPA does not object to the proposed action.

EIS No. 20070245, ERP No. F–FHW–C40336–NY, Long Island Expressway (LIE) Rest Area Upgrade Project, Upgrading the Existing Rest Area from Route 1–495/Long Island Expressway between Exits 51 and 52, Funding, Town of Huntington, Suffolk County, NY.

Summary: No formal comment letter was sent to the preparing agency.

EIS No. 20070246, ERP No. F–MMS–L02033–AK, Chukchi Sea Planning Area Oil and Gas Lease Sale 193 and Seismic Surveying Activities, Offshore Marine Environment, Chukchi Sea Coastal Plain, and the North Slope Borough of Alaska.

Summary: EPA's previous concerns have been resolved; therefore, EPA does not object to the action as proposed.

EIS No. 20070223, ERP No. FA–AFS–K65283–CA, Empire Vegetation Management Project, Reducing Fire Hazards, Harvesting of Trees Using Group Selection (GS) and Individual Trees Selection (ITS) Methods, Mt. Hough Ranger District, Plumas National Forest, Plumas County, CA.

Summary: No formal comment letter was sent to the preparing agency.

EIS No. 20070225, ERP No. FD–AFS–L65155–00, Northern Spotted Owl Management Plan, Removal or the Modification to the Survey and Manage Mitigation Measures, Standards and Guidelines (to the Northwest Forest Plan) New Information to Address Three Deficiencies Final Supplemental EIS (2004), Northwest Forest Plan, OR, WA, and CA.

Summary: The analysis in FEIS supports both the utilization of the Special Status Species Programs and previous determinations made as a part of the Annual Species Review Process. Given the importance of the current network of late successional forests in late-successional species' persistence and viability, EPA continues to encourage the Agencies to consider any reasonably foreseeable reserve network or management changes when predicting habitat outcomes.

EIS No. 20070226, ERP No. FS–AFS–J65417–MT, Frenchtown Face Ecosystem Restoration Project, Additional Information Maintenance and Improvement of Forest Health, Risk Reduction of Damage Insects and Disease, Lolo National Forest, Ninemile Ranger District, Missoula County, MT.

Summary: The final supplement addressed EPA's concerns about the preferred alternative. EPA believes watershed restoration activities included in the project will likely result in overall water quality improvement in the long-term.

Dated: July 24, 2007.

Robert W. Hargrove,

Director, NEPA Compliance Division, Office of Federal Activities.

[FR Doc. E7–14569 Filed 7–26–07; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[ER–6689–3]

Environmental Impacts Statements; Notice of Availability

Responsible Agency: Office of Federal Activities; General Information (202) 564–7167 or *http://www.epa.gov/compliance/nepa/.*

Weekly receipt of Environmental Impact Statements

Filed 07/16/2007 through 07/20/2007

Pursuant to 40 CFR 1506.9.

EIS No. 20070308, Draft EIS, AFS, MT, Marten Creek Project, Proposed Timber Harvest, Prescribed Fire Burning, Watershed Restoration, and Associated Activities Cabinet Ranger District, Kootenai National Forest, Sanders County, MT, *Comment Period Ends:* 09/10/2007. *Contact:* Dave Clay, 406–827–0717.

EIS No. 20070309, Final EIS, FRC, 00, Spokane River and Post Falls Hydroelectric Project, Applications for two New Licenses for Existing 14.75 (mw) Post Falls No. 12606 and 122.9 (mw) Spokane River No. 2545, Kootenai and Benewah Counties, ID and Spokane, Lincoln and Stevens Counties WA, *Wait Period Ends:* 08/27/2007. *Contact:* Andy Black, 1–866–208–3372.

EIS No. 20070310, Draft EIS, AFS, WA, Old Curlew Ranger Station Facilities Disposal Project, Proposal to Sell 3-Acre Parcel Including Buildings, Republic Ranger District, Colville National Forest, South Side of Curlew, Ferry County, WA, *Comment Period Ends:* 09/10/2007. *Contact:* James L. Parker, 509–775–7462.

EIS No. 20070311, Draft Supplement, COE, CO, Rueter-Hess Reservoir Expansion Project, Enlarges Reservoir to Provide Storage of Denver Basin Groundwater for Meeting Peak Municipal Water Supply, U.S. Army COE Section 404 Permit, Town of Parker, Douglas County, CO. *Comment Period Ends:* 09/10/2007. *Contact:* Rodney J. Schwartz, 402–221–4939.

EIS No. 20070312, Draft EIS, USN, HI, Hawaii Range Complex (HRC) Project, To Support and Maintain Navy Pacific Fleet Training, and Research, Development, Test, and Evaluation

Exhibit B-2. Notice of Availability, Draft EIS/OEIS, July 27, 2007

(RDT&E) Operations, Kauai, Honolulu, Maui and Hawaii Counties, HI. *Comment Period Ends:* 09/10/2007. *Contact:* Tom Clements, 866–767–3347.

EIS No. 20070313, Draft EIS, NOA, 00, Amendment 2 to the Consolidated Atlantic Highly Migratory Species Fishery Management Plan, To Implement Management Measures that Prevent Overfishing and Rebuild Overfished Stocks Implementation, Exclusive Economic Zone (EEZ) of the Atlantic Ocean, Gulf of Mexico and Caribbean Sea. *Comment Period Ends:* 10/10/2007. *Contact:* Margo Schulze-Haugen, 301–713–2347.

EIS No. 20070314, Final EIS, FTA, UT, Mid-Jordan Transit Corridor Project, Proposed Light Rail Transit Service, Funding, Salt Lake County, UT. *Wait Period Ends:* 08/27/2007. *Contact:* Charmaine Knighton, 720–963–3327.

Amended Notices

EIS No. 20070144, Final EIS, AFS, CA, VOID—REPORT—Brown Project, Proposal to Improve Forest Health by Reducing Overcrowded Forest Stand Conditions, Trinity River Management Unit, Shasta-Trinity National Forest, Weaverville Ranger District, Trinity County, CA, *Wait Period Ends:* 05/21/2007. *Contact:* Joyce Andersen 530–623–2121. This FEIS was inadvertently refilled and published in 04/20/2007. FR. The Correct FEIS #20060252 was published in 06/16/2006 FR.

Dated: July 23, 2007.

Robert W. Hargrove,

Director, NEPA Compliance Division, Office of Federal Activities.

[FR Doc. E7–14568 Filed 7–26–07; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[EPA–HQ–2006–0735; FRL–8446–7]

Draft Risk Assessment Report for Lead

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of a draft for public review and comment.

SUMMARY: On or about July 31, 2007, the Office of Air Quality Planning and Standards (OAQPS) of EPA will make available for public review and comment a draft technical support document in EPA's review of the national ambient air quality standards (NAAQS) for lead, Lead Human Exposure and Health Risk Assessments for Selected Case Studies (Draft Risk Assessment Report). The purpose of the Draft Risk Assessment Report is to describe the design, methodology and results of the human exposure and health risk assessments for lead.

DATES: Comments on the Draft Risk Assessment Report must be received on or before August 29, 2007.

ADDRESSEES: Submit your comments, identified by Docket ID No. EPA–HQ–OAR–2006–0735, by one of the following methods:

- *www.regulations.gov:* follow the on-line instructions for submitting comments.
- *E-mail:* Comments may be sent by electronic mail (e-mail) to *a-and-r-Docket@epa.gov*, Attention Docket ID No. EPA–HQ–OAR–2006–0735.
- *Fax:* Fax your comments to: 202–566–9744, Attention Docket ID. No. EPA–HQ–OAR–2006–0735.
- *Mail:* Send your comments to: Air and Radiation Docket and Information Center, Environmental Protection Agency, Mail Code: 6102T, 1200 Pennsylvania Ave., NW., Washington, DC, 20460, Attention Docket ID No. EPA–HQ–OAR–2006–0735.
- *Hand Delivery or Courier:* Deliver your comments to: EPA Docket Center, 1301 Constitution Ave., NW., Room 3334, Washington, DC. Such deliveries are only accepted during the Docket's normal hours of operation, and special arrangements should be made for deliveries of boxed information.

Instructions: Direct your comments to Docket ID No. EPA–HQ–OAR–2006–0735. The EPA's policy is that all comments received will be included in the public docket without change and may be made available online at *www.regulations.gov* (including any personal information provided, unless the comment includes information claimed to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute). Do not submit information that you consider to be CBI or otherwise protected through *www.regulations.gov*, or e-mail. The *www.regulations.gov* is an "anonymous access" system, which means EPA will not know your identity or contact information unless you provide it in the body of your comment. If you send an e-mail comment directly to EPA without going through *www.regulations.gov*, your e-mail address will be automatically captured and included as part of the comment that is placed in the public docket and made available on the Internet. If you submit an electronic comment, EPA recommends that you include your name and other contact information in the body of your comment and with any disk or CD–ROM you submit. If EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, EPA may not be able to consider your comment. Electronic files should avoid the use of special characters, any form of encryption, and be free of any defects or viruses. For additional information about EPA's public docket visit the EPA Docket Center homepage at *http://www.epa.gov/epahome/dockets.htm*.

Docket: All documents in the docket are listed in the *www.regulations.gov* index. Although listed in the index, some information is not publicly available, e.g., CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, will be publicly available only in hard copy. Publicly available docket materials are available either electronically in *www.regulations.gov* or in hard copy at the Air Docket in the EPA Docket Center, (EPA/DC) EPA West, Room 3334, 1301 Constitution Ave., NW., Washington, DC. This Docket Facility is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The Docket telephone number is (202) 566–1742; fax (202) 566–9744.

FOR FURTHER INFORMATION CONTACT: Dr. Zachary Pekar, Office of Air Quality Planning and Standards (mail code C504–06), U.S. Environmental Protection Agency, Research Triangle Park, NC 27711; e-mail: *pekar.zachary@epa.gov*; telephone: (919) 541–3704; fax: (919) 541–0237.

General Information

A. What Should I Consider as I Prepare My Comments for EPA?

1. Submitting CBI. Do not submit this information to EPA through *www.regulations.gov* or e-mail. Clearly mark the part or all of the information that you claim to be CBI. For CBI information in a disk or CD ROM that you mail to EPA, mark the outside of the disk or CD ROM as CBI and then identify electronically within the disk or CD ROM the specific information that is claimed as CBI. In addition to one complete version of the comment that includes information claimed as CBI, a copy of the comment that does not contain the information claimed as CBI must be submitted for inclusion in the public docket. Information so marked will not be disclosed except in accordance with procedures set forth in 40 CFR part 2.

2. Tips for Preparing Your Comments. When submitting comments, remember to:

Exhibit B-2. Notice of Availability, Draft EIS/OEIS, July 27, 2007 (Continued)

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DEPARTMENT OF DEFENSE

Department of the Army; Corps of Engineers

Intent To Prepare an Environmental Impact Statement for Improvements to the Freeport Harbor Navigation Project, Brazoria County, TX

AGENCY: Department of the Army, U.S. Army Corps of Engineers, DoD.

ACTION: Notice of Intent.

SUMMARY: The U.S. Army Corps of Engineers, Galveston District, is issuing this notice to announce its intent to prepare a Draft Environmental Impact Statement (DEIS), for the proposed deepening and widening of the deep-draft Freeport Harbor Navigation Project, connecting port facilities in Freeport to the Gulf of Mexico. The District will conduct a study to evaluate deepening and widening alternatives, and dredged material disposal options, which will include both upland confined disposal and ocean disposal at designated sites in the Gulf of Mexico.

The Freeport Harbor Navigation Project study area is located on the mid to upper Texas coast in Brazoria County, TX, extending from approximately 3 miles offshore at the 60-foot depth contour in the Gulf of Mexico, through the jettied Freeport Harbor entrance channel upstream to the Stauffer Channel Turing Basin. Depths and widths of up to 60-feet and 600-feet respectively are being considered from seaward, along with varying dimensions for upstream reaches and basins. The non-federal sponsor is the Brazos River Harbor Navigation District.

ADDRESSES: U.S. Army Corps of Engineers, Galveston District, P.O. Box 1229, Galveston, TX 77553–1229.

FOR FURTHER INFORMATION CONTACT: Mr. Mike Bragg, Project Manager—Project Management Branch, (409) 766–3979; or Mr. George Dabney, Environmental Lead—Planning and Environmental Branch, (409) 766–6345.

SUPPLEMENTARY INFORMATION: The existing navigation project, completed in 1996, is approximately 8.6 miles in length. The project's primary reaches and basins include a 47-foot deep, 400-foot wide entrance channel; a 45-foot deep, 400-foot wide main channel; 45-foot deep turning basins (with 750, 1,000 and 1,200-foot diameters); and a 36-foot deep, 750-foot diameter Brazos Harbor Turning Basin. The existing project encompasses numerous industrial and shipping facilities, located in or adjacent to the Port of Freeport, TX. The non-federal sponsor, the Brazos River Harbor Navigation District, seeks to increase navigation safety and efficiency, and to enhance its competitiveness by improving the existing project to attract larger, deeper draft vessels including LNG tankers, crude carriers and container ships.

To explore the feasibility of proposed project improvements, the non-federal sponsor has partnered with the U.S. Army Corps of Engineers, Galveston District, to conduct a feasibility study for determining optimum depths and widths necessary to safely accommodate current and projected navigation needs. Section 216 of the Flood Control Act of 1970, Public Law 91–611, authorizes the proposed deepening and widening improvements of the existing navigation project.

Project alternatives under evaluation include maintaining primary channel reaches at their existing dimensions (No Action Alternative), or, deepening and widening reaches to either 60 x 540 feet or 55 x 600 feet respectively. The remaining project reaches and basins will be deepened, widened or expanded to compatible dimensions.

The scoping process for public input will involve Federal, State, and local agencies, along with other interested parties and entities. Coordination with natural resources and environmental agencies will be conducted under the Fish and Wildlife Coordination Act, Endangered Species Act, Clear Water Act, Clean Air Act, National Historic Preservation Act, Magnuson-Stevens Fishery Conservation and Management Act, and the Coastal Zone Management Act. Public scoping meetings will also be held to discuss environmental issues associated with proposed channel improvements.

Issues to be considered during the public review and input process include: water and sediment quality, air and noise quality, hazardous, toxic and radiological waste, dredged material disposal, economics, threatened and endangered species, wetlands, historic properties, aesthetics, recreation, cumulative impacts, impact mitigation for natural resources, and other issues affecting public health and welfare. Any person or organization wishing to provide information on issues or concerns should contact the Galveston District Corps of Engineers at (see **ADDRESSES**).

It is estimated the DEIS will be available for public review and comment in April 2008.

Richard Medina,

Chief, Planning and Environmental Branch.

[FR Doc. 07–3817 Filed 8–2–07; 8:45 am]

BILLING CODE 3710–52–M

DEPARTMENT OF DEFENSE

Department of the Navy

Public Hearings for the Draft Environmental Impact Statement/ Overseas Environmental Impact Statement for the Hawaii Range Complex, HI

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: Pursuant to section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969 and regulations implemented by the Council on Environmental Quality (40 CFR parts 1500–1508), and Presidential Executive Order 12114, the Department of the Navy (Navy) has prepared and filed with the U.S. Environmental Protection Agency a Draft Environmental Impact Statement (EIS)/Overseas EIS on July 19, 2007, to evaluate the potential environmental effects of conducting current and emerging Navy Pacific Fleet training and defense-related research, development, test, and evaluation (RDT&E) operations within the Hawaii Range Complex (HRC) and to upgrade or modernize range complex capabilities (including hardware and infrastructure). A Notice of Intent for this DEIS/OEIS was published in the **Federal Register**, 71 FR 51188, on August 29, 2006.

The Draft EIS/OEIS was distributed to Federal, State, and Local agencies, elected officials, as well as other interested individuals and organizations on July 20, 2007. On July 27, 2007, Navy issued a revision to the Draft EIS/OEIS that was filed with the U.S. Environmental Protection Agency on July 19, 2007. Errata sheets and a corrected Draft EIS/OEIS were distributed to all Federal, State, and local agencies, elected officials, and other interested individuals and organizations on Navy's distribution list. To allow for the full 45-day review of the Draft EIS/OEIS, the public comment period has been extended from September 10, 2007 to September 17, 2007.

The Navy will conduct four public hearings to receive oral and written comments on the Draft EIS/OEIS. Federal agencies, state agencies, and local agencies and interested individuals are invited to be present or represented at the public hearings. This notice announces the dates and locations of the public hearings for this Draft EIS/OEIS.

Dates and Addresses: An open house session will precede the scheduled public hearing at each of the locations listed below and will allow individuals

Exhibit B-3. Notice of Public Hearings, Draft EIS/OEIS, August 3, 2007

to review the information presented in the Draft EIS/OEIS. Navy representatives will be available during the open house sessions to clarify information related to the Draft EIS/OEIS. In addition, the National Marine Fisheries Service (NMFS), which is participating as a cooperating agency in the development of the EIS, will be represented at the public hearings. All meetings will start with an open house from 5 p.m. to 6 p.m. Presentations and public comment will be held from 6 p.m. to 9 p.m. Public hearings will be held on the following dates and at the following locations: August 21, 2007, at Kauai War Memorial Convention Hall, 4191 Hardy Street, Lihue, Hawaii; August 23, 2007, at McKinley High School, 1039 South King Street, Honolulu, Hawaii; August 27, 2007, at Baldwin High School, 1650 Kaahumanu Avenue, Wailuku, Hawaii; August 29, 2007, at Waiakea High School, 155 West Kawili Street, Hilo, Hawaii.

FOR FURTHER INFORMATION CONTACT: Public Affairs Officer, *Pacific Missile Range Facility Attention:* HRC EIS/OEIS, P.O. Box 128, Kekaha, Kauai, Hawaii 96752–0128. Voice mail 1–866–767–3347 or facsimile 808–335–4520.

SUPPLEMENTARY INFORMATION: The HRC consists of open ocean areas (outside 12 nautical miles (nm)), offshore areas (within 12 nm from land), and onshore areas geographically situated on and around the Hawaiian Islands. The complex covers 235,000 square nm around the main Hawaiian Islands chain and a 2.1 million square nm Temporary Operating Area (TOA) of sea and airspace. The study area is a complex consisting of instrumented ocean areas, airspace, ocean surface operation areas, targets, and land range facilities.

Navy proposes to support and conduct current and emerging training and RDT&E operations in the HRC and to upgrade or modernize range complex capabilities to enhance and sustain Navy training and defense-related testing. This would be accomplished by increasing training operations and implementing necessary force structure changes; supporting three transient Strike Group training exercises at the same time and an additional aircraft carrier during Rim of the Pacific Exercises; operating a Portable Undersea Tracking Range; constructing and operating an Acoustic Test Facility; enhancing RDT&E and training operations at the Pacific Missile Range Facility (PMRF); and using the TOA as required.

The Draft EIS/OEIS evaluates the potential environmental impacts of three alternatives, including two action alternatives (Alternatives 1 and 2) and the No-action Alternative. The No-action Alternative stands as no change from current levels of training usage. Alternatives 1 and 2 analyze an increased tempo and frequency of training exercises in the HRC. Alternative 2 is the Navy's preferred alternative.

No significant adverse impacts are identified for any resource area in any geographic location within the HRC that cannot be mitigated, with the exception of exposure of marine mammals to underwater sound. NMFS has received an application from the Navy for a Marine Mammal Protection Act Letter of Authorization (LOA) and governing regulations to authorize incidental take of marine mammals that may result from the implementation of the activities analyzed in the Draft EIS/OEIS. NMFS is participating as a cooperating agency in the development of this Draft EIS/OEIS. NMFS staff will be present at the scheduled open house and public hearings and available to discuss both the MMPA incidental take authorization process and NMFS' participation in the development of the EIS.

The Draft EIS/OEIS was distributed to Federal, State, and local agencies, elected officials, as well as other interested individuals and organizations on July 20, 2007. On July 27, 2007, Navy issued a revision to the Draft EIS/OEIS that was filed with the U.S. Environmental Protection Agency on July 19, 2007. Errata sheets and a corrected Draft EIS/OEIS were distributed to all Federal, State, and local agencies, elected officials, and other interested individuals and organizations on Navy's distribution list. To allow for the full 45-day review of the Draft EIS/OEIS, the public comment period has been extended from September 10, 2007 to September 17, 2007.

Copies of the Draft EIS/OEIS are available for public review at the following libraries: Kahului Public Library, 90 School Street, Kahului, Maui, Hawaii 96732; Wailuku Public Library, 251 High Street, Wailuku, Maui Hawaii 96793; Hilo Public Library, 300 Waianuenue Avenue, Hilo, Hawaii, HI 96720; Hawaii State Library, Hawaii and Pacific Section Document Unit, 478 South King Street, Honolulu, Oahu, Hawaii 96813–2994; Lihue Public Library, 4344 Hardy Street, Lihue, Kauai, Hawaii 96766; Waimea Public Library, P.O. Box 397, Waimea, Kauai Hawaii 96766; and Princeville Public Library, 4343 Emmalani Drive, Princeville, Kauai, Hawaii 96722. The Draft EIS/OEIS is also available for electronic public viewing at *http://www.govsupport.us/hrc.* Single copies of the Draft EIS/OEIS and the Executive Summary will be made available upon request by contacting Public Affairs Officer, Pacific Missile Range Facility, P.O. Box 128, Kekaha, Kauai, Hawaii 96752–0128, *Attention:* HRC EIS/OEIS, voice mail 1–866–767–3347 or facsimile 808–335–4520.

Federal, State, and local agencies and interested parties are invited to be present or represented at the public hearing. Written comments can also be submitted during the open house sessions preceding the public hearings. Oral statements will be heard and transcribed by a stenographer; however, to ensure the accuracy of the record, all statements should be submitted in writing. All statements, both oral and written, will become part of the public record on the Draft EIS/OEIS and will be responded to in the Final EIS/OEIS. Equal weight will be given to both oral and written statements.

In the interest of available time, and to ensure all who wish to give an oral statement have the opportunity to do so, each speaker's comments will be limited to three (3) minutes. If a long statement is to be presented, it should be summarized at the public hearing and the full text submitted in writing at the hearing, mailed to Public Affairs Officer, Pacific Missile Range Facility, P.O. Box 128, Kekaha, Kauai, Hawaii 96752–0128, ATTN: HRC EIS/OEIS, facsimile 808–335–4520; or submitted via e-mail to *deis_hrc@govsupport.us* or via the project Web site at *http://www.govsupport.us/hrc.*

All written comments must be postmarked or received by September 17, 2007, to ensure they become part of the official record. All comments will be responded to in the Final EIS/OEIS.

Dated: July 30, 2007.

M.C. Holley,

Lieutenant Commander, Office of the Judge Advocate General, U.S. Navy, Administrative Law Division, Alternate Federal Register Liaison Officer.

[FR Doc. E7–15127 Filed 8–2–07; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Availability of Finding

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: Pursuant to Executive Order (EO) 12114, Environmental Effects Abroad of Major Federal Actions, the

Exhibit B-3. Notice of Public Hearings, Draft EIS/OEIS, August 3, 2007 (Continued)

Speed or Course Alteration – If a marine mammal is detected outside the EZ but is likely to enter it based on relative movement of the vessel and the animal, then if safety and scientific objectives allow, the vessel speed and/or direct course will be adjusted to minimize the likelihood of the animal entering the EZ. Major course and speed adjustments are often impractical when towing long seismic streamers and large source arrays, but are possible in this case because only one GI gun and a short (300–m, 984–ft) streamer will be used. If the animal appears likely to enter the EZ, further mitigative actions will be taken, i.e. either further course alterations or shut down of the airgun.

Shut-down Procedures – If a marine mammal is within or about to enter the EZ for the single GI gun, it will be shut down immediately. Following a shut down, GI gun activity will not resume until the marine mammal is outside the EZ for the full array. The animal will be considered to have cleared the EZ if it: (1) visually observed to have left the EZ; (2) has not been seen within the EZ for 15 minutes in the case of small odontocetes and pinnipeds; or (3) has not been seen within the EZ for 30 minutes in the case of mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, and beaked whales.

Minimize Approach to Slopes and Submarine Canyons – Although sensitivity of beaked whales to airguns is not known, they appear to be sensitive to other sound sources (mid-frequency sonar; see section IV of SIO's application). Beaked whales tend to concentrate in continental slope areas and in areas where there are submarine canyons. Avoidance of airgun operations over or near submarine canyons has become a standard mitigation measure, but there are none within or near the study area. Four of the 16 OBS locations are on the continental slope, but the GI gun is low volume (45 in^3), and it will operate only a short time (approximately 2 hours) at each location.

Reporting

A report will be submitted to NMFS within 90 days after the end of the cruise. The report will describe the operations that were conducted and the marine mammals that were detected near the operations. The report will be submitted to NMFS, providing full documentation of methods, results, and interpretation pertaining to all monitoring. The 90–day report will summarize the dates and locations of seismic operations, all marine mammal sightings (dates, times, locations, activities, associated seismic survey activities), and estimates of the amount and nature of potential "take" of marine mammals by harassment or in other ways.

ESA

Under section 7 of the ESA, the NSF has begun informal consultation on this proposed seismic survey. NMFS will also consult informally on the issuance of an IHA under section 101(a)(5)(D) of the MMPA for this activity. Consultation will be concluded prior to a determination on the issuance of the IHA.

National Environmental Policy Act (NEPA)

NSF prepared an Environmental Assessment of a Planned Low-Energy Marine Seismic Survey by the Scripps Institution of Oceanography in the Northeast Pacific Ocean, September 2007. NMFS will either adopt NSF's EA or conduct a separate NEPA analysis, as necessary, prior to making a determination on the issuance of the IHA.

Preliminary Determinations

NMFS has preliminarily determined that the impact of conducting the seismic survey in the northeast Pacific Ocean may result, at worst, in a temporary modification in behavior (Level B Harassment) of small numbers of eight species of marine mammals. Further, this activity is expected to result in a negligible impact on the affected species or stocks. The provision requiring that the activity not have an unmitigable adverse impact on the availability of the affected species or stock for subsistence uses does not apply for this proposed action.

For reasons stated previously in this document, this determination is supported by: (1) the likelihood that, given sufficient notice through relatively slow ship speed, marine mammals are expected to move away from a noise source that is annoying prior to its becoming potentially injurious; (2) the fact that marine mammals would have to be closer than either 35 m (115 ft) in intermediate depths or 23 m (75.5 ft) in deep water from the vessel to be exposed to levels of sound (180 dB) believed to have even a minimal chance of causing TTS; and (3) the likelihood that marine mammal detection ability by trained observers is high at that short distance from the vessel. As a result, no take by injury or death is anticipated and the potential for temporary or permanent hearing impairment is very low and will be avoided through the incorporation of the proposed mitigation measures.

While the number of potential incidental harassment takes will depend on the distribution and abundance of marine mammals in the vicinity of the survey activity, the number of potential harassment takings is estimated to be small, less than a few percent of any of the estimated population sizes, and has been mitigated to the lowest level practicable through incorporation of the measures mentioned previously in this document.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to SIO for conducting a low-energy seismic survey in the Pacific Ocean during September, 2007, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated.

Dated: July 26, 2007.

James H. Lecky,

Director, Office of Protected Resources, National Marine Fisheries Service.

[FR Doc. E7–14883 Filed 7–31–07; 8:45 am]

BILLING CODE 3510–22–S

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

[I.D. 050107N]

Taking and Importing Marine Mammals; Increasing Usage and Enhancing Capability of the U.S. Navy's Hawaii Range Complex

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; receipt of application for letter of authorization; request for comments and information.

SUMMARY: NMFS has received a request from the U.S. Navy (Navy) for authorization for the take of marine mammals incidental to the training events conducted within the Hawaii Range Complex (HRC) for the period of July 2008 through July 2013. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is announcing our receipt of the Navy's request for the development and implementation of regulations governing the incidental taking of marine mammals and inviting information, suggestions, and comments on the Navy's application and request.

DATES: Comments and information must be received no later than August 31, 2007.

Exhibit B-4. Notice of Receipt of Application for Letter of Authorization, August 1, 2007

ADDRESSES: Comments on the application should be addressed to Michael Payne, Chief, Permits, Conservation and Education Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910–3225. The mailbox address for providing email comments is *PR1.050107N@noaa.gov*. NMFS is not responsible for e-mail comments sent to addresses other than the one provided here. Comments sent via e-mail, including all attachments, must not exceed a 10–megabyte file size.

FOR FURTHER INFORMATION CONTACT: Jolie Harrison, Office of Protected Resources, NMFS, (301) 713–2289, ext. 166.

SUPPLEMENTARY INFORMATION:

Availability

A copy of the Navy's application may be obtained by writing to the address specified above

(See ADDRESSES), telephoning the contact listed above (see **FOR FURTHER INFORMATION CONTACT**), or visiting the internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm*. The Navy's Draft Environmental Impact Statement (DEIS) for the Hawaii Range Complex was made available to the public on July 27th, 2007, and may be viewed at *http://www.govsupport.us/hrc*. Because NMFS is participating as a cooperating agency in the development of the Navy's DEIS for the Hawaii Range Complex, NMFS staff will be present at the associated public meetings and prepared to discuss NMFS' participation in the development of the EIS as well as the MMPA process for the issuance of incidental take authorizations. The dates and times of the public meetings may be viewed at: *http://www.govsupport.us/hrc*.

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce (Secretary) to allow, upon request, the incidental, but not intentional taking of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) if certain findings are made and regulations are issued or, if the taking is limited to harassment, notice of a proposed authorization is provided to the public for review.

Authorization for incidental takings may be granted if NMFS finds that the taking will have no more than a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses, and that the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such taking are set forth.

NMFS has defined "negligible impact" in 50 CFR 216.103 as:

an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.

With respect to military readiness activities, the MMPA defines "harassment" as:

(i) any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A Harassment]; or (ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B Harassment].

Summary of Request

On June 25, 2007, NMFS received an application from the Navy requesting authorization for the take of 26 species of marine mammals incidental to upcoming Navy training activities to be conducted within the HRC, which covers 235,000 nm^2 around the Main Hawaiian Islands (see page 17 of the application), over the course of 5 years. These training activities are classified as military readiness activities. The Navy states that these training activities may expose some of the marine mammals present within the HRC to sound from hull-mounted mid-frequency active tactical sonar or to underwater detonations. The Navy requests authorization to take 26 species of marine mammals by Level B Harassment. Further, the Navy requests authorization to take 20 individual marine mammals per year by serious injury or mortality (2 each of the following: bottlenose dolphin, Kogia spp., melon-headed whale, pantropical spotted dolphin, pygmy killer whale, short-finned pilot whale, striped dolphin, and Cuvier's, Longman's, and Blainesville's beaked whale).

Specified Activities

The Navy has prepared a Draft Environmental Impact Statement analyzing the effects on the human environment of implementing their preferred alternative (among other alternatives), which includes conducting current and emerging training and research, development, test, and evaluation (RDT&E) operations in the HRC. The HRC complex consists of targets and instrumented areas, airspace, surface operational areas (OPAREAS), and land range facilities. The activities described in the EIS include current and future proposed Navy training and RDT&E operations within Navy-controlled OPAREAs, airspace, and ranges, and Navy-funded range capabilities enhancements (including infrastructure improvement).

In the application submitted to NMFS, the Navy requests authorization for take of marine mammals incidental to conducting a subset of the activities analyzed in the EIS. Table 1–1 in the application lists the categories of Navy training operations and RDT&E operations and indicates those that the Navy believes: (1) could potentially result in harassment of marine mammals through exposure to underwater detonations; (2) could potentially result in harassment of marine mammals through exposure to tactical mid-frequency sonar; and, (3) do not have the potential to harass marine mammals. The Navy is requesting authorization for take incidental to the following categories of Navy training operations: (1) Naval Surface Fire Support Exercises, (2) Surface-to-Surface Gunnery Exercises, (3) Surface-to-Surface Missile Exercises, (4) Air-to-Surface Missile Exercises, (5) Bombing Exercises, (6) Sink Exercises, (7) Mine Neutralization, (8) Anti-submarine Warfare (ASW) Tracking Exercises, (9) ASW Torpedo Exercises, and (10) Major Integrated ASW Training Exercises (such as RIMPAC, USWEX, and Multiple Strike Group Exercises).

Information Solicited

Interested persons may submit information, suggestions, and comments concerning the Navy's request (see **ADDRESSES**). All information, suggestions, and comments related to the Navy's HRC request and NMFS' potential development and implementation of regulations governing the incidental taking of marine mammals by the Navy in the HRC will be considered by NMFS in developing, if appropriate, the most effective regulations governing the issuance of letters of authorization.

Dated: July 26, 2007.

James H. Lecky,

Director, Office of Protected Resources, National Marine Fisheries Service.

[FR Doc. E7–14891 Filed 7–31–07; 8:45 am]

BILLING CODE 3510–22–S

Exhibit B-4. Notice of Receipt of Application for Letter of Authorization, August 1, 2007 (Continued)

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generator unit at a site adjacent to the existing Nelson Dewey Generating Station (NED) Units 1 and 2 on the Mississippi River at River Mile 607.7. In addition to the new power generating unit, the following associated facilities would be constructed and operated: A new lateral collector well to supply cooling water; additional barge unloading capacity including three additional barge moorings in the Mississippi River, a new barge unloading tower foundation, and a temporary equipment barge unloading ramp; a new storm water detention pond and pipe outfall structure; 1.7-mile-long off-site parallel industrial railroad tracks, including a sheet pile retaining wall, adjacent to the existing BNSF railroad mainline tracks; new railroad bridges over two creeks for the off-site parallel industrial railroad tracks; and two new coal pile runoff ponds to replace the existing coal pile runoff pond adjacent to the railroad tracks.

The project would require the discharge of dredged or fill material into the Mississippi River and two creeks that are tributaries to the Mississippi River. The Mississippi River is a navigable water of the U.S. The discharge of dredged or fill material into waters of the U.S. requires a permit issued by the Corps under Section 404 of the Clean Water Act. Construction work conducted below the ordinary high water mark of a navigable water of the U.S. requires a permit issued by the Corps under Section 10 of the Rivers and Harbors Act. The final environmental impact statement will be used as a basis for the permit decision and to ensure compliance with the National Environmental Policy Act (NEPA).

ADDRESSES: Questions concerning the Draft Environmental Impact Statement (DEIS) can be addressed to Mr. Jon K. Ahlness, Regulatory Branch by letter at U.S. Army Corps of Engineers, 190 Fifth Street East, Suite 401, St. Paul, MN 55101–1638, by telephone or by e-mail at *jon.k.ahlness@usace.army.mil*.

FOR FURTHER INFORMATION CONTACT: Mr. Jon K. Ahlness, (651) 290–5381.

SUPPLEMENTARY INFORMATION: The Corps and the Public Service Commission of Wisconsin (PSCW) will jointly prepare the federal/state DEIS. The Corps is the lead federal agency and the PSCW is the lead state agency. The Wisconsin Department of Natural Resources (WDNR) is participating in the preparation of the DEIS. The Corps and the PSCW will jointly conduct two public scoping meetings to identify issues that will be addressed in the DEIS. The first public scoping meeting will be held at the Cassville Elementary School Gym, 412 Crawford St., Cassville, Wisconsin on January 30, 2008 from 6:30 p.m. to 9 p.m. The second public scoping meeting will be held at the City of Portage Municipal Building Community Room, 115 West Pleasant St., Portage, Wisconsin, on February 11, 2008 from 6:30 p.m. to 9 p.m.

We anticipate that the DEIS will be made available to the public in April of 2008. The DEIS will assess impacts of the proposed action and reasonable alternatives, identify and evaluate mitigation alternatives, and discuss potential environmental monitoring. Significant issues and resources to be identified in the DEIS will be determined through coordination with responsible federal, state, and local agencies; the general public; interested private organizations and parties; and affected Native American Tribes. Anyone who has an interest in participating in the development of the DEIS is invited to contact the St. Paul District, Corps of Engineers. Significant issues that will be addressed in the DEIS include:

1. Fish, wildlife, and ecologically sensitive resources.

2. Water resources, including: Surface water hydrology; groundwater hydrology; and waters of the U.S., including wetlands.

3. Water quality, including: Surface water runoff; and storm water management.

4. Air quality, including: Mercury emissions; and carbon dioxide emissions.

5. Cumulative impacts, including: Wildlife habitat loss; water quality; and air quality.

Additional issues of interest may be identified through the public scoping process.

Our environmental review will be conducted to meet the requirements of the National Environmental Policy Act of 1969, National Historic Preservation Act of 1966, Endangered Species Act of 1973, Section 404 of the Clean Water Act, and other applicable laws and regulations.

Dated: January 10, 2008.

Jon L. Christensen,

Colonel, Corps of Engineers District Engineer.

[FR Doc. E8–819 Filed 1–16–08; 8:45 am]

BILLING CODE 3710–CY–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Intent To Prepare a Supplement to the Hawaii Range Complex Draft Environmental Impact Statement/Overseas Environmental Impact Statement (SDEIS/OEIS) for a Proposal To Enhance Training, Testing, and Operational Capability Within the Hawaii Range Complex (HRC)

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: The Department of the Navy (DON) announces its intent to prepare a Supplement to the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (SDEIS/OEIS) for the Hawaii Range Complex (HRC). This SDEIS/OEIS will be focused on the methodology used to analyze potential marine mammal behavioral effects related to mid-frequency active sonar exposure. In addition, DON may make adjustments to the alternatives.

SUPPLEMENTARY INFORMATION: On August 29, 2006, pursuant to section 102(2)(c) of the National Environmental Policy Act of 1969 as implemented by the Council on Environmental Quality regulations (40 CFR parts 1500–1508), and Executive Order 12114 (Environmental Effects Abroad of Major Federal Actions), the DON announced its intent to prepare an EIS/OEIS for the HRC and invited the public to comment on the scope of the EIS/OEIS (71 FR 51188). A DEIS/OEIS was subsequently released on July 27, 2007, (72 FR 41324), which evaluated the potential environmental effects of increasing usage and enhancing the capabilities of the HRC to achieve and maintain Fleet readiness and to conduct current, emerging, and future training and research, development, test, and evaluation (RDT&E) activities. As described in the DEIS/OEIS at section 4.1.2.4.9, a dose function approach was used to evaluate potential behavioral harassment of marine mammals incidental to the use of mid-frequency active sonar during Navy training and testing within the HRC. Since the release of the DEIS/OEIS in July 2007, the DON, in cooperation with NMFS, has further refined the dose function approach. Given the nature of these refinements, the Navy has decided to prepare a SDEIS/OEIS to provide opportunity for public review of the methodology. In addition, DON may make adjustments to the alternatives.

Exhibit B-5. Notice of Intent, Supplement to the Draft EIS/OEIS, January 17, 2008

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All public comments previously received during the July through September 2007 DEIS/OEIS public review period on the dose function approach and the marine mammals effects analysis are still valid and will be considered in the SDEIS/OEIS and Final EIS/OEIS for this action. Previously submitted comments need not be resubmitted. A notice of availability of the SDEIS/OEIS and dates of the public hearings will be published in the **Federal Register** at a later date. No decision will be made to implement any alternative in the HRC until the EIS/OEIS process is completed and a Record of Decision is signed by the DON.

FOR FURTHER INFORMATION CONTACT: Public Affairs Officer, Pacific Missile Range Facility, *Attention:* HRC EIS/OEIS, P.O. Box 128, Kekaha, Kauai, Hawaii 96752–0128. Voice mail 1–866–767–3347 or facsimile at 808–335–4520.

Dated: January 14, 2008.

T.M. Cruz,

Lieutenant, Office of the Judge Advocate General, U.S. Navy, Federal Register Liaison Officer.

[FR Doc. E8–796 Filed 1–16–08; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF ENERGY

Environmental Management Site-Specific Advisory Board, Oak Ridge Reservation

AGENCY: Department of Energy.

ACTION: Notice of Open Meeting.

SUMMARY: This notice announces a meeting of the Environmental Management Site-Specific Advisory Board (EM SSAB), Oak Ridge Reservation. The Federal Advisory Committee Act (Pub. L. No. 92–463, 86 Stat. 770) requires that public notice of this meeting be announced in the **Federal Register**.

DATES: Wednesday, February 13, 2008, 6 p.m.

ADDRESSES: DOE Information Center, 475 Oak Ridge Turnpike, Oak Ridge, Tennessee.

FOR FURTHER INFORMATION CONTACT: Pat Halsey, Federal Coordinator, Department of Energy Oak Ridge Operations Office, P.O. Box 2001, EM–90, Oak Ridge, TN 37831. Phone (865) 576–4025; Fax (865) 576–2347 or e-mail: *halseypj@oro.doe.gov* or check the Web site at *http://www.oakridge.doe.gov/em/ssab.*

SUPPLEMENTARY INFORMATION:

Purpose of the Board: The purpose of the Board is to make recommendations to DOE in the areas of environmental restoration, waste management, and related activities.

Tentative Agenda: The presentation topic will be "EM Budget and Prioritization Review."

Public Participation: The meeting is open to the public. Written statements may be filed with the Board either before or after the meeting. Individuals who wish to make oral statements pertaining to the agenda item should contact Pat Halsey at the address or telephone number listed above. Requests must be received five days prior to the meeting and reasonable provision will be made to include the presentation in the agenda. The Deputy Designated Federal Officer is empowered to conduct the meeting in a fashion that will facilitate the orderly conduct of business. Individuals wishing to make public comment will be provided a maximum of five minutes to present their comments.

Minutes: Minutes will be available by writing or calling Pat Halsey at the address and phone number listed above. Minutes will also be available at the following Web site *http://www.oakridge.doe.gov/em/ssab/minutes.htm.*

Issued at Washington, DC on January 14, 2008.

Rachel Samuel,

Deputy Committee Management Officer.

[FR Doc. E8–811 Filed 1–16–08; 8:45 am]

BILLING CODE 6450–01–P

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[Docket No. EL08–32–000]

Central Minnesota Municipal Power Agency, Midwest Municipal Transmission Group; Notice of Filing

January 9, 2008.

Take notice that on December 31, 2007, the Central Minnesota Municipal Power Agency and the Midwest Municipal Transmission Group tendered for filing a Petition for Declaratory Order and Request for Waivers.

Any person desiring to intervene or to protest this filing must file in accordance with Rules 211 and 214 of the Commission's Rules of Practice and Procedure (18 CFR 385.211, 385.214). Protests will be considered by the Commission in determining the appropriate action to be taken, but will not serve to make protestants parties to the proceeding. Any person wishing to become a party must file a notice of intervention or motion to intervene, as appropriate. Such notices, motions, or protests must be filed on or before the comment date. On or before the comment date, it is not necessary to serve motions to intervene or protests on persons other than the Applicant.

The Commission encourages electronic submission of protests and interventions in lieu of paper using the "eFiling" link at *http://www.ferc.gov.* Persons unable to file electronically should submit an original and 14 copies of the protest or intervention to the Federal Energy Regulatory Commission, 888 First Street, NE., Washington, DC 20426.

This filing is accessible on-line at *http://www.ferc.gov,* using the "eLibrary" link and is available for review in the Commission's Public Reference Room in Washington, DC. There is an "eSubscription" link on the Web site that enables subscribers to receive e-mail notification when a document is added to a subscribed docket(s). For assistance with any FERC Online service, please e-mail *FERCOnlineSupport@ferc.gov,* or call (866) 208–3676 (toll free). For TTY, call (202) 502–8659.

Comment Date: 5 p.m. Eastern Time on January 30, 2008.

Kimberly D. Bose,

Secretary.

[FR Doc. E8–716 Filed 1–16–08; 8:45 am]

BILLING CODE 6717–01–P

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[Docket No. ER08–148–000]

Central Power & Lime, Inc.; Notice of Issuance of Order

January 9, 2008.

Central Power & Lime, Inc. (Central Power) filed an application for market-based rate authority, with an accompanying rate schedule. The proposed market-based rate schedule provides for the sale of energy, capacity and ancillary services at market-based rates. Central Power also requested waivers of various Commission regulations. In particular, Central Power requested that the Commission grant blanket approval under 18 CFR part 34 of all future issuances of securities and assumptions of liability by Central Power.

On December 19, 2007, pursuant to delegated authority, the Director, Division of Tariffs and Market

Exhibit B-5. Notice of Intent, Supplement to the Draft EIS/OEIS, January 17, 2008 (Continued)

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the National Primary Drinking Water Regulations in 40 CFR part 142.

Dated: December 21, 2007.

J.I. Palmer, Jr.,

Regional Administrator, Region 4.

[FR Doc. E8–3342 Filed 2–21–08; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[Docket# EPA–RO4–SFUND–2008–0098; FRL–8531–7]

Ecusta Mill Site Pisgah Forest, Transylvania County, NC; Notice of Settlement

AGENCY: Environmental Protection Agency.

ACTION: Notice of settlement.

SUMMARY: Under sections 104, 106, 107 and 122(h)(1) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the United States Environmental Protection Agency has entered into an Agreement and Order on Consent for Removal Action by Bona Fide Prospective Purchaser concerning the Ecusta Mill Site located in Pisgah Forest, Transylvania County, North Carolina.

DATES: The Agency will consider public comments on the settlement until March 24, 2008. The Agency will consider all comments received and may modify or withdraw its consent to the settlement if comments received disclose facts or considerations which indicate that the settlement is inappropriate, improper, or inadequate.

ADDRESSES: Copies of the settlement are available from Ms. Paula V. Batchelor. Submit your comments, identified by Docket ID No. EPA–RO4–SFUND–2008–0098 or Site name Ecusta Mill Superfund Site by one of the following methods:

• *http://www.regulations.gov:* Follow the on-line instructions for submitting comments.

• *E-mail: Batchelor.Paula@epa.gov.*

• *Fax:* 404/562–8842/Attn Paula V. Batchelor.

Mail: Ms. Paula V. Batchelor, U.S. EPA Region 4, SD–SEIMB, 61 Forsyth Street, SW., Atlanta, Georgia 30303. "In addition, please mail a copy of your comments on the information collection provisions to the Office of Information and Regulatory Affairs, Office of Management and Budget (OMB), Attn: Desk Officer for EPA, 725 17th St., NW., Washington, DC 20503."

Instructions: Direct your comments to Docket ID No. EPA–R04–SFUND–2008–0098. EPA's policy is that all comments received will be included in the public docket without change and may be made available online at *http://www.regulations.gov*, including any personal information provided, unless the comment includes information claimed to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Do not submit information that you consider to be CBI or otherwise protected through *http://www.regulations.gov* or e-mail. The *http://www.regulations.gov* Web site is an "anonymous access" system, which means EPA will not know your identity or contact information unless you provide it in the body of your comment. If you send an e-mail comment directly to EPA without going through *http://www.regulations.gov* your e-mail address will be automatically captured and included as part of the comment that is placed in the public docket and made available on the Internet. If you submit an electronic comment, EPA recommends that you include your name and other contact information in the body of your comment and with any disk or CD–ROM you submit. If EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, EPA may not be able to consider your comment. Electronic files should avoid the use of special characters, any form of encryption, and be free of any defects or viruses. For additional information about EPA's public docket visit the EPA Docket Center homepage at *http://www.epa.gov/epahome/dockets.htm.*

Docket: All documents in the docket are listed in the *http://www.regulations.gov* index. Although listed in the index, some information is not publicly available, e.g., CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, will be publicly available only in hard copy. Publicly available docket materials are available either electronically in *http://www.regulations.gov* or in hard copy at the U.S. EPA Region 4 office located at 61 Forsyth Street, SW., Atlanta, Georgia 30303. Regional office is open from 7 a.m. until 6:30 p.m. Monday through Friday, excluding legal holidays.

Written comments may be submitted to Ms. Batchelor within 30 calendar days of the date of this publication.

FOR FURTHER INFORMATION CONTACT: Paula V. Batchelor at 404/562–8887.

Dated: February 1, 2008.

De'Lyntoneus Moore,

Acting Chief, Superfund Enforcement & Information Management Branch, Superfund Division.

[FR Doc. E8–3337 Filed 2–21–08; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[ER–FRL–6696–2]

Environmental Impacts Statements; Notice of Availability

Responsible Agency: Office of Federal Activities, General Information (202) 564–7167 or *http://www.epa.gov/compliance/neap/*. Weekly receipt of Environmental Impact Statements Filed 02/11/2008 Through 02/15/2008 Pursuant to 40 CFR 1506.9.

EIS No. 20080057, Draft EIS, AFS, MT, Young Doge Project, Proposed Timber Harvest and Associate Activities, Prescribed Burning, Road and Recreation Management, Kootenai National Forest, Rexford Ranger District, Lincoln County, MT, Comment Period Ends: 04/07/2008, Contact: Pat Price 406–296–2536.

EIS No. 20080058, Final EIS, BOP, AL, Aliceville, Alabama Area, Proposed Federal Correctional Complex, To Address the Growing Federal Inmate Population, Pickens County, AL, Wait Period Ends: 03/24/2008, Contact: Pamela J. Chandler 202–514–6470.

EIS No. 20080059, Draft EIS, AFS, UT, Uinta National Forest Oil and Gas Leasing, Implementation, Identify National Forest Systems Land with Federal Mineral Rights, Wasatch, Utah, Juab, Tooele, and Sanpete Counties, UT, Comment Period Ends: 05/22/2008, Contact: Kim Martin 801–342–5100.

EIS No. 20080060, Draft EIS, AFS, SD, Upper Spring Creek Project, Proposes to Implement Multiple Resource Management Actions, Mystic Ranger District, Black Hills National Forest, Pennington County, SD, Comment Period Ends: 04/07/2008, Contact: Katie Van Alstyne 605–343–1567.

EIS No. 20080061, Final EIS, AFS, OR, Thorn Fire Salvage Recovery Project, Salvaging Dead and Dying Timber, Shake Table Fire Complex, Malheur National Forest, Grant County, OR, Wait Period Ends: 03/24/2008, Contact: Carole Holly 541–575–5300.

EIS No. 20080062, Final EIS, USA, 00, Permanent Home Stationing of the 2/25th Stryker Brigade Combat Team (SBCT), To Address a Full Range of Alternatives for Permanently Stationing the 2/25th SBCT, Hawaii and Honolulu

Exhibit B-6. Notice of Availability, Supplement to the Draft EIS/OEIS, February 22, 2008

Counties, HI; Anchorage and Southeast Fairbanks Boroughs, AK; El Paso, Pueblo, and Fremont Counties, CO, Wait Period Ends: 03/24/2008, Contact: Michael Ackerman 410–436–2522.

EIS No. 20080063, Draft Supplement, USN, HI, Hawaii Range Complex (HRC) Project, Additional Information, To Support and Maintain Navy Pacific Fleet Training, and Research, Development, Test, and Evaluation (RDT&E) Operations, Kauai, Honolulu, Maui and Hawaii Counties, HI, Comment Period Ends: 04/07/2008, Contact: Tom Clements 866–767–3347.

EIS No. 20080064, Final EIS, BIA, NY, Oneida Nation of New York Conveyance of Lands into Trust, Proposes to Transfer 17,370 Acre of Fee Land into Federal Trust Status, Oneida, Madison and New York Counties, NY , Wait Period Ends: 03/24/2008, Contact: Kurt G. Chandler 615–564–6832.

Amended Notices

EIS No. 20080021, Draft EIS, SFW, AK, Yukon Flats National Wildlife Refuge Project, Proposed Federal and Public Land Exchange, Right-of-Way Grant, Anchorage, AK, Comment Period Ends: 03/25/2008, Contact: Cyndie Wolfe 907–786–3463.

Revision of FR Notice Published 01/25/2008: Extending Comment Period from 03/11/2008 to 03/25/2008.

EIS No. 20080051, Final EIS, AFS, MT, Beaverhead-Deerlodge National Forest Draft Revised Land and Resource Management Plan, Implementation, Beaverhead, Butte-Silver Bow, Deerlodge, Granite, Jefferson, Madison Counties, MT, Comment Period Ends: 03/31/2008, Contact: Leaf Magnuson 406–683–3950.

Revision to FR Notice Published 02/15/2008: Change the Wait Period Ends from 03/17/2008 to Comment Period Ends 03/31/2008.

Dated: February 19, 2008.

Ken Mittelholtz,

Environmental Protection Specialist, Office of Federal Activities.

[FR Doc. E8–3423 Filed 2–21–08; 8:45 am]

BILLING CODE 6560–50–P

FARM CREDIT ADMINISTRATION

[BM–14–FEB–08–02]

Consideration and Referral of Supervisory Strategies and Enforcement Actions

AGENCY: Farm Credit Administration.

ACTION: Policy statement.

SUMMARY: The Farm Credit Administration (FCA or Agency) Board recently adopted a policy statement that identifies conditions that warrant referrals to the Agency's Regulatory Enforcement Committee (REC) to consider appropriate supervisory strategies and recommend to the FCA Board the use of the enforcement authorities conferred on the Agency under part C, title V of the Farm Credit Act of 1971, as amended, or other statutes.

DATES: *Effective Date:* February 14, 2008.

FOR FURTHER INFORMATION CONTACT: Roger Paulsen, Office of Examination, Farm Credit Administration, McLean, VA 22102–5090, (703) 883–4265, TTY (703) 883–4483,

or

Jane Virga, Senior Counsel, Office of General Counsel, Farm Credit Administration, McLean, VA 22102–5090, (703) 883–4020, TTY (703) 883–4020.

SUPPLEMENTARY INFORMATION: The FCA Board adopted a policy statement identifying conditions that require referrals to the Agency's Regulatory Enforcement Committee. The policy statement, in its entirety, follows:

Consideration and Referral of Supervisory Strategies and Enforcement Actions

FCA–PS–79 [BM–14–FEB–08–02]

Effective Date: February 14, 2008.

Effect on Previous Action: None.

Source of Authority: Sections 5.19, 5.25–5.35 of the Farm Credit Act of 1971, as amended.

The FCA Board Hereby Adopts the Following Policy Statement:

The Farm Credit Administration (FCA or Agency) Board provides for the regulation and examination of Farm Credit System (System or FCS) institutions, which includes the Federal Agricultural Mortgage Corporation (Farmer Mac), in accordance with the Farm Credit Act of 1971, as amended (the "Act"). This policy addresses conditions that warrant referrals to the Agency's Regulatory Enforcement Committee (REC) to consider appropriate supervisory strategies and recommend to the FCA Board the use of the enforcement authorities conferred on the Agency under Part C, Title V of the Act or other statutes. Enforcement actions include formal agreements, orders to cease and desist, temporary orders to cease and desist, civil money penalties, suspensions or removals of directors or officers, and conditions imposed in writing to address unsafe or unsound practices or violations of law, rule or regulation (Enforcement Document). Taking these actions, in an appropriate and timely manner, is critical to maintaining shareholder, investor, and public confidence in the financial strength and future viability of the System.

This policy provides only internal FCA guidance. It is not intended to create any rights, substantive or procedural, enforceable at law or in any administrative proceeding.

Composition of the REC

The Chairman of the FCA Board will designate the office directors of the Office of Examination, Office of General Counsel, and Office of Regulatory Policy, or the directors of successor offices, as voting members of the REC. A representative from the Farm Credit System Insurance Corporation will be invited to participate in REC activities as a non-voting member. The Chairman of the FCA Board will also designate one of the voting REC members as Chairman of the REC.

Due to the statutory independence of the Office of Secondary Market Oversight (OSMO), there will be different REC membership when considering issues related to Farmer Mac.

Referrals to the REC

Recommended supervisory strategies or enforcement actions concerning an FCS institution or person will be referred to the REC when any of the conditions exist, as specified below, or when a specified condition does not exist, but consideration of an enforcement action or review by the REC is appropriate. The REC will review the proposed actions and draft enforcement documents and assess the recommendations for pursuing any such actions. The REC may revise the recommendations and will document its concurrence or nonconcurrence with the supervisory strategy or enforcement action.

Conditions Warranting Referral to the REC

Any one of the following conditions requires a referral to the REC for its consideration of supervisory strategies or enforcement actions.

1. A "4" or "5" composite FIRS rating is assigned to an FCS institution;

2. The institution or person is deemed unable or unwilling to address a material: (a) Unsafe or unsound condition or practice; or (b) violation or ongoing violation of law or regulation;

3. The institution or person is about to engage in a material unsafe or unsound practice or is about to commit a willful or material violation of law or

Exhibit B-6. Notice of Availability, Supplement to the Draft EIS/OEIS, February 22, 2008 (Continued)

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primary or secondary education. Council members appointed by the Secretary of Defense, who are not federal officers or employees, shall serve as Special Government Employees under the authority of 5 U.S.C. 3109. Council members shall be appointed on an annual basis by the Secretary of Defense. In addition, the Secretary of Defense and the Secretary of Education or their designated representative shall serve as the Council's co-chair.

Individuals appointed to the Council from professional employee organizations shall be individuals designated by those organizations. Council members and consultants, if required, shall be entitled to compensation at the daily equivalent of the rate specified at the time of such service for level IV of the Executive Services under 5 U.S.C. 5315. Council members shall be entitled to compensation for travel and per diem for official travel.

The Council shall be authorized to establish subcommittees, as necessary and consistent with its mission, and these subcommittees or working groups shall operate under the provisions of the Federal Advisory Committee Act of 1972, the Government in the Sunshine Act of 1976, and other appropriate federal regulations.

Such subcommittees or workgroups shall not work independently of the chartered Council, and shall report all their recommendations and advice to the Council for full deliberation and discussion. Subcommittees or workgroups have no authority to make decisions on behalf of the chartered Council nor can they report directly to the Department of Defense or any federal officers or employees who are not Council members.

SUPPLEMENTARY INFORMATION: The Council shall meet at the call of the Council's Designated Federal Officer, in consultation with the Council's chairperson. The Designated Federal Officer, pursuant to DoD policy, shall be a full-time or permanent part-time DoD employee, and shall be appointed in accordance with established DoD policies and procedures. The Designated Federal Officer or duly appointed Alternate Designated Federal Officer shall attend all committee meetings and subcommittee meetings.

Pursuant to 41 CFR 102–3.105(j) and 102–3.140, the public or interested organizations may submit written statements to the Advisory Council on Dependents' Education membership about the Council's mission and functions. Written statements may be submitted at any time or in response to the stated agenda of planned meeting of the Advisory Council on Dependents' Education.

All written statements shall be submitted to the Designated Federal Officer for the Advisory Council on Dependents' Education, and this individual will ensure that the written statements are provided to the membership for their consideration. Contact information for the Advisory Council on Dependents' Education's Designated Federal Officer can be obtained from the GSA's FACA Database—*https://www.fido.gov/facadatabase/public.asp.*

The Designated Federal Officer, pursuant to 41 CFR 102–3.150, will announce planned meetings of the Advisory Council on Dependents' Education. The Designated Federal Officer, at that time, may provide additional guidance on the submission of written statements that are in response to the stated agenda for the planned meeting in question.

FOR FURTHER INFORMATION CONTACT: Jim Freeman, Deputy Committee Management Officer for the Department of Defense, 703–601–2554, extension 128.

Dated: February 19, 2008.

L.M. Bynum,

Alternate OSD Federal Register Liaison Officer, Department of Defense.

[FR Doc. E8–3485 Filed 2–25–08; 8:45 am]

BILLING CODE 5001–06–P

DEPARTMENT OF DEFENSE

Department of the Navy

Notice of Public Meetings for the Supplement to the Draft Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) for a Proposal To Enhance Training, Testing, and Operational Capability Within the Hawaii Range Complex (HRC)

AGENCY: Department of the Navy, DoD.

ACTION: Notice.

SUMMARY: Pursuant to section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969 and regulations implemented by the Council on Environmental Quality (40 CFR Parts 1500–1508), and Presidential Executive Order 12114, the Department of the Navy (Navy) prepared and filed with the U.S. Environmental Protection Agency on February 15, 2008, a Supplement to the Draft EIS/OEIS for a Proposal to Enhance Training, Testing, and Operational Capability within the HRC. The Supplement to the Draft EIS/OEIS evaluates the potential for behavioral harassment of marine mammals incidental to the use of mid-frequency active sonar during Navy training and testing within the HRC. The methodology used in the Supplement is a modification of the methodology previously used in the Draft EIS/OEIS. The Supplement to the Draft EIS/OEIS also addresses a change in the number of sonar hours for each of the alternatives and the potential effects of an additional alternative. A Notice of Intent for the Supplement to the Draft EIS/OEIS was published in the **Federal Register** on January 17, 2008 (73 FR 3242).

The Navy will conduct four public meetings to received oral and written comments on the Supplement to the Draft EIS/OEIS. Federal agencies, State agencies, and interested individuals are invited to be present or represented at the public meetings. This notice announces the dates and locations of public meetings for the Supplement to the Draft EIS/OEIS.

Dates and Addresses: Information sessions and receipt of public comments will be held at each of the locations listed below between 5 p.m. to 9 p.m. The information sessions will allow individuals to review the Supplement to the Draft EIS/OEIS in an open house format. Navy and NMFS representatives will be available during the information sessions to clarify information related to the Supplement to the Draft EIS/OEIS. Oral comments from the public will also be taken during the session. Public meetings will be held on the following dates and at the following locations in Hawaii:

1. March 13, 2008 at the Kauai Community College Cafeteria, 3–1901 Kaumualii Highway, Lihue, Kauai;
2. March 14, 2008 at Maui Waena Intermediate School 795 Onehee Avenue, Kahului, Maui;
3. March 17, 2008 at Disabled American Veterans Hall 2685 North Nimitz Highway, Honolulu, Oahu;
4. March 18, 2008, Hilo Hawaiian Hotel, 71 Banyan Drive, Hilo, Hawaii.

FOR FURTHER INFORMATION CONTACT: Public Affairs Officer, Pacific Missile Range Facility, P.O. Box 128, Kekaha, Kauai, Hawaii, 96752–0128, ATTN: HRC EIS/OEIS, voice mail 1–866–767–3347, facsimile 808–335–4520.

SUPPLEMENTARY INFORMATION: The Navy previously conducted public hearings on the Draft EIS/OEIS in August 2007 following publication of the Notice of Availability in the **Federal Register** on July 27, 2007 (72 FR 41324). Since the publication of the Draft EIS/OEIS, Navy, in coordination with NMFS, has

Exhibit B-7. Notice of Public Meetings for the Supplement to the Draft EIS/OEIS, February 26, 2008

conducted a re-evaluation of the analysis concerning the analytical methodology used in the July 2007 document to assess the potential for behavioral harassment of marine mammals incidental to the use of mid-frequency active sonar during Navy training and testing. Modifications to this analytical methodology have led Navy to determine that the preparation of a Supplement to the Draft EIS/OEIS is appropriate. Besides the modifications to the analytical methodology, the Supplement to the Draft EIS/OEIS incorporates changes in sonar hours for each alternative. The Supplement also includes the evaluation of the potential effects of a new alternative. Alternative 3 (which is also identified as the Navy's preferred alternative) includes all of the training and testing activities identified for Alternative 2, but with reduced mid-frequency sonar hours (the same number of sonar hours identified for the No-action Alternative).

The Proposed Action assessed in the Supplement to the Draft EIS/OEIS is unchanged from the Draft EIS/OEIS and involves increasing the usage and enhancing the capabilities of the HRC with the purpose of achieving and maintaining Fleet readiness and to conduct current, emerging, and future training and research, development, test, and evaluation (RDT&E) operations. This action is consistent with U.S. Code Title 10, section 5062.

The Supplement to the Draft EIS/OEIS has been distributed to various Federal, State, and local agencies, as well as other interested individuals and organizations. Additionally, copies of the Supplement to the Draft EIS/OEIS have been distributed to the following libraries in Hawaii for public review: Kahului Public Library, 90 School Street, Kahului, Maui, Hawaii 96732; Wailuku Public Library, 251 High Street, Wailuku, Maui, Hawaii 96793; Hilo Public Library, 300 Waianuenue Avenue, Hilo, Hawaii, Hawaii 96720; Hawaii State Library, Hawaii and Pacific Section Document Unit, 478 South King Street, Honolulu, Oahu, Hawaii 96813–2994; Lihue Public Library, 4344 Hardy Street, Lihue, Kauai, Hawaii 96766; Waimea Public Library, P.O. Box 397, Waimea, Kauai, Hawaii 96766; Princeville Public Library, 4343 Emmalani Drive, Princeville, Kauai, Hawaii 96722.

An electronic copy of both the Supplement and the Draft EIS/OEIS are also available for public viewing at: *http://www.govsupport.us/hrc*. Single copies of the Supplement to the Draft EIS/OEIS are available upon written request by contacting Public Affairs Officer, Pacific Missile Range Facility, P.O. Box 128, Kekaha, Kauai, Hawaii, 96752–0128, ATTN: HRC EIS/OEIS, voice mail 1–866–767–3347, facsimile 808–335–4520.

Federal, State, and local agencies and interested parties are invited to be present or represented at the public meetings. Written comments can also be submitted during these meetings. Oral statements will either recorded or be heard and transcribed by a stenographer. All statements, both oral and written, will become part of the public record on the Supplement to the Draft EIS/OEIS and will be addressed in the Final EIS/OEIS. Equal weight will be given to both oral and written statements.

In the interest of available time, and to ensure all who wish to give an oral statement at the public meetings have the opportunity to do so, each speaker's comments will be limited to three (3) minutes. If a long statement is to be presented, it should be summarized at the public meeting and the full text submitted in writing either at the meeting or mailed to Public Affairs Officer, Pacific Missile Range Facility, P.O. Box 128, Kekaha, Kauai, Hawaii, 96752–0128, ATTN: HRC EIS/OEIS, faxed to 808–335–4520, or submitted via e-mail to *deis_hrc@govsupport.us*.

All written comments must be post marked or received by April 7, 2008, to ensure they become part of the official record. All comments will be addressed in the Final EIS/OEIS.

Dated: February 20, 2008.

T.M. Cruz,

Lieutenant, Office of the Judge Advocate General, U.S. Navy, Federal Register Liaison Officer.

[FR Doc. E8–3633 Filed 2–25–08; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF DEFENSE

Department of the Navy

Privacy Act of 1974; System of Records

AGENCY: Department of the Navy, DoD.

ACTION: Notice to delete two Systems of Records.

SUMMARY: The Department of the Navy is deleting two system of records in its existing inventory of record systems subject to the Privacy Act of 1974 (5 U.S.C. 552a), as amended.

DATES: This proposed action will be effective without further notice on March 27, 2008 unless comments are received which result in a contrary determination.

ADDRESSES: Send comments to the Department of the Navy, PA/FOIA Policy Branch, Chief of Naval Operations (DNS–36), 2000 Navy Pentagon, Washington, DC 20350–2000.

FOR FURTHER INFORMATION CONTACT: Mrs. Doris Lama at (202) 685–6545.

SUPPLEMENTARY INFORMATION: The Department of the Navy systems of records notices subject to the Privacy Act of 1974 (5 U.S.C. 552a), as amended, have been published in the **Federal Register** and are available from the address above.

The Department of the Navy proposes to delete two system of records notices from its inventory of record systems subject to the Privacy Act of 1974 (5 U.S.C. 552a), as amended. The proposed deletion is not within the purview of subsection (r) of the Privacy Act of 1974 (5 U.S.C. 552a), as amended, which requires the submission of new or altered systems reports.

Dated: February 19, 2008.

L.M. Bynum,

Alternate, OSD Federal Register Liaison Officer, Department of Defense.

N11101–2

SYSTEM NAME:

Family Housing Requirements Survey Records System (June 8, 1999, 64 FR 30501).

REASON:

Program discontinued and all records have been destroyed.

N11103–01

SYSTEM NAME:

Housing Referral Services Record System (February 22, 1993, 58 FR 10817).

REASON:

Program discontinued and all records have been destroyed.

[FR Doc. E8–3600 Filed 2–25–08; 8:45 am]

BILLING CODE 5001–06–P

DEPARTMENT OF EDUCATION

The Federal Student Aid Programs Under Title IV of the Higher Education Act of 1965, as Amended

AGENCY: Department of Education.

ACTION: Notice inviting letters of application for participation in the Quality Assurance Program.

SUMMARY: The Secretary of Education invites institutions of higher education that may wish to participate in the Quality Assurance Program, under

Exhibit B-7. Notice of Public Meetings for the Supplement to the Draft EIS/OEIS, February 26, 2008 (Continued)

Appendix C
Resource Descriptions Including Laws and Regulations Considered

APPENDIX C RESOURCE DESCRIPTIONS INCLUDING LAWS AND REGULATIONS CONSIDERED

This appendix provides a general description of each resource and addresses the Federal, State, and local environmental review programs that do, or may, apply to the No-action Alternative, Alternative 1, Alternative 2, and Alternative 3. Project facilities and activities will be implemented in accordance with applicable Federal laws and regulations and with State and local laws, regulations, programs, plans, and policies as applicable.

This Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS) has been prepared and provided for public review in accordance with the Council on Environmental Quality regulations implementing the National Environmental Policy Act (NEPA) (40 Code of Federal Regulations [CFR] Part 1500-1508).

C.1 Air Quality

The Federal **Clean Air Act** (CAA) (42 United States Code [U.S.C.] 7401) requires the adoption of national ambient air quality standards (NAAQS) to protect the public health, safety, and welfare from known or anticipated effects of air pollution. Six air pollutants have been identified by U.S. Environmental Protection Agency (USEPA) as being a nationwide concern: carbon monoxide; ozone; nitrogen dioxide; particulate matter equal to or less than 10 microns in size (PM-10) and fine particulate matter equal to or less than 2.5 microns in size (PM-2.5); sulfur dioxide; and lead. USEPA has established NAAQS for these pollutants, which are collectively referred to as criteria pollutants, as shown in Table C-1. Air quality in Hawaii is defined by the State ambient air quality standards (AAQS). Table C-1 compares the NAAQS and the Hawaii AAQS.

According to USEPA guidelines, an area with air quality equal to or better than the NAAQS is designated as being in attainment; areas with worse air quality are classified as nonattainment areas. A nonattainment designation, for a particular pollutant, is given to a region if the primary NAAQS for that criteria pollutant is exceeded at any point in the region for more than 3 days during a 3-year period. An air basin may be designated as unclassified when there is insufficient data for USEPA to determine attainment status.

Clean Air Act Conformity and Applicability

The CAA contains the legislation that mandates the General Conformity Rule to ensure that Federal actions in designated nonattainment and maintenance areas do not interfere with a State's timely attainment of the NAAQS. The General Conformity Rule divides the air conformity process into two distinct areas: applicability analysis and conformity determination. The applicability analysis process requires Federal agencies to determine if their proposed action(s) would increase emissions of criteria pollutants above preset threshold levels (40 CFR 51.853). These threshold levels vary depending on severity of the nonattainment and geographic location. Because no areas of Hawaii are classified as nonattainment or maintenance areas, conformity analysis procedures do not apply to Navy actions in Hawaii.

Table C-1. Federal and State Ambient Air Quality Standards

Pollutant	Averaging Time	Hawaii State Standard	National Primary Standard	National Secondary Standard
Carbon Monoxide	8-hour	5 mg/m³ (4.5 ppm)	10 mg/m³ (9 ppm)	None
	1-Hour	10 mg/m³ (9 ppm)	40 mg/m³ (35 ppm)	None
Nitrogen Dioxide	Annual (1)	70 mg/m³ (0.037 ppm)	100 µg/m³ (0.053 ppm)	Same as Primary
Ozone	8-hour (2)	None	157 µg/m³ (0.075 ppm) (1)	Same as Primary
	1-Hour	157 µg/m³	235 µg/m³ (0.12 ppm) (7)	Same as Primary
Lead	Quarterly (1)	1.5 mg/m³	1.5 µg/m³	Same as Primary
PM-2.5	Annual (3)	None	15 µg/m³	Same as Primary
	24-hour (4)	None	65 µg/m³	Same as Primary
PM-10	Annual (arithmetic mean)	50 mg/m³	Revoked (8)	
	24-hour (5)	150 mg/m³	150 µg/m³	Same as Primary
Sulfur Dioxide (6)	Annual (1)	80 µg/m³ (0.03 ppm)	80 µg/m³ (0.03 ppm)	None
	24-hour	365 µg/m³ (0.14 ppm)	365 µg/m³ (0.14 ppm)	None
	3-hour	1,300 µg/m³ (0.5 ppm)	None	1,300 µg/m³ (0.5 ppm)
Hydrogen Sulfide	1-hour	35 µg/m³ (0.025 ppm)	None	None

Source: Hawaii Administrative Rules, Chapter 59; 40 CFR §50
Notes:
(1) Calculated as the arithmetic mean
(2) Calculated as the 3-year average of the fourth highest daily maximum 8-hour ozone concentration
(3) Calculated as the 3-year average of the arithmetic means
(4) Calculated as the 98th percentile of 24-hour PM-2.5 concentration in a year (averaged over 3 years) at the population oriented monitoring site with the highest measured values in the area (effective December 17, 2006).
(5) Calculated as the 99th percentile of 24-hour PM-10 concentrations in a year (averaged over 3 years).
(6) Measured as sulfur dioxide
(7) As of June 15, 2005 USEPA revoked the 1-hour ozone standard in all areas except the fourteen 8-hour ozone nonattainment Early Action Compact Areas
(8) USEPA revoked the annual PM-10 standard in 2006 (effective December 17, 2006)
mg/m³ = milligrams per cubic meter
µg/m³ = micrograms per cubic meter
PM-2.5 = fine particulate matter equal to or less than 2.5 microns in size
PM-10 = particulate matter equal to or less than 10 microns in size (also called respirable particulate and suspended particulate)
ppm = parts per million

De Minimis Emissions and Applicability Thresholds

De minimis emissions are total direct and indirect emissions of a criteria pollutant caused by a Federal action in a nonattainment or maintenance area at levels less than specified applicability thresholds. The six criteria pollutants are PM-10 and PM-2.5, sulfur dioxide, carbon monoxide, nitrogen oxides, 8-hour ozone, and lead. Ozone is measured by emissions of volatile organic compounds (VOC) and nitrogen oxides.

Federal regulations designate the State of Hawaii as an attainment area for all six criteria pollutants. Therefore, in Hawaii there are no applicable thresholds for air emissions (Table C-2).

Table C-2. General Conformity Applicability Thresholds for Nonattainment Areas

Criteria Pollutants	Tons Per Year
Ozone (VOC or Nitrogen Oxides)	
Serious Non-attainment Areas (NAAs)	50
Severe NAAs	25
Extreme NAAs	10
Other ozone NAAs outside an ozone transport region	100
Other ozone NAAs inside an ozone transport region	50 (VOC) 100 (nitrogen oxides)
VOC	**50**
Nitrogen Oxides	**100**
Carbon Monoxide—All NAAs and maintenance areas	100
Sulfur Dioxide or Nitrogen Oxides—All NAAs	100
PM-10	
Moderate NAAs and maintenance areas	100
Serious NAAs	70
PM-2.5 (direct PM-2.5 , Nitrogen Oxides, VOC, Sulfur Dioxide)	**100**
Lead—All NAAs	25

Source: 40 CFR §51.853
Notes:
PM-10 = particulate matter equal to or less than 10 microns in size
PM-2.5 = particulate matter equal to or less than 2.5 microns in size
VOC = Volatile organic compounds

Regionally Significant

The conformity regulation defines “regionally significant” emissions as the total direct and indirect emissions of a Federal action that represents 10 percent or more of an area's total emissions for a criteria pollutant. A general conformity determination would be required if emissions were regionally significant, even if they were *de minimis*. Ten percent of Kauai County’s annual air emission budget for each criteria pollutant would apply in the case of the construction at the Pacific Missile Range Facility (PMRF). However, because Hawaii is in attainment for all six criteria pollutants, regionally significant emissions are not applied.

Emissions Calculations

Although Hawaii is in attainment for all criteria pollutants under the CAA, applicability analysis is a useful tool to estimate and compare major Navy air emissions. The Air Conformity Applicability Model (ACAM) was developed by the Air Force to screen for compliance with the General Conformity Rule requirements (U.S. Air Force, 2005). The computer model estimates air pollutant emissions associated with proposed aircraft and personnel realignment, construction projects, and operation of various facilities. Emissions for each year are calculated separately. ACAM was used for the emissions estimates that follow.

Construction Emissions Estimates

Below is a description of the inputs used to complete the air emissions analysis for the construction of an 85,196 square-foot (ft^2), two-story, steel-framed Range Operations Control Building and a 4,198 ft^2 Dehumidified Warehouse at PMRF/Main Base. A 25,000 ft^2 building proposed as the Direct Energy Laser Facility is not included in the construction emissions calculations. Demolition of 13 buildings with a combined floor area of over 55,000 ft^2 could start in the second quarter of 2008. Site grading was assumed to be 3.03 acres. Construction starting in the third quarter of 2008 would require 2 years to complete. (Naval Facilities Engineering Command, 2004)

The full list of inputs and the detailed list of construction emissions are provided in the tables that follow. Post-construction air emissions (related to heating/cooling, added personal etc.) were not calculated for the Proposed Action because it was assumed that these sources would not vary significantly from the current activities at PMRF. In addition, because many emission factors for PM-2.5 have not been developed to-date, PM-10 emission factors are used as a conservative substitute.

VOC and PM-10 emissions will occur directly from the construction of facilities. Emission-causing activities that are included in this calculation include demolition of existing facilities, grading, and contraction activities including architectural coating, construction equipment, commuting emissions, and asphalt paving. It was assumed that there would not be enough asphalt paving to require analysis. These activities are described in more detail below and summarized in Table C-3:

- Demolition Emissions: The primary air pollutant from building demolition is PM-10. Demolition emissions are based on total volume of building being demolished and the number of days required for demolishing the buildings. The Proposed Action includes the demolition of Buildings 105, 106, 160, 161, 135, 136, 156, 157, 301, 305, 926, 964, and 967. These 13 buildings have a combined floor area of approximately 55,000 ft^2. Given the lack of project detail to-date, it was assumed that demolition could take 30 days, beginning in the second quarter of 2008.

- Grading Emissions: The primary air pollutant from grading is PM-10 from particles becoming airborne during grading, and nitrogen oxides, sulfur dioxide, PM-10, carbon monoxide, and VOCs from grading equipment. Grading emissions are based on the total number of days in a calendar year that will be required for grading and the total number of acres to be graded. Given the lack of project detail to-date, it was assumed that that grading will take 90 days and 3.03 acres would be graded, starting in the third quarter of 2008. Emissions are based on one storage pile on 0.2 acre per 10 acres graded, and three pieces of heavy equipment used 6 hours per day per 10 acres graded. No dust controls were assumed to be in place. All equipment is assumed to be diesel powered.

- Building Construction Emissions: Construction air emissions are spread out over 2 calendar years, starting in the third quarter of 2008. These activities are described in more detail below and summarized in Table C-3:

  - Asphalt Paving: The primary air pollutant from asphalt paving is VOCs. Asphalt paving emissions are based on the total land area to be paved spread over the number of days required for paving. It was assumed that the asphalt area being proposed for roads and parking was not significant enough to add to the model.

– Non-Residential Architectural Coatings: The primary air pollutant from paints, varnishes, primers, and other surface coatings is VOCs released through the evaporation of solvents. These emissions are based on gross square footage of facilities built. Project documentation estimates 89,394 gross square feet of facilities will be added at PMRF.

– Construction Equipment and Commuting Emissions: Emissions occurring from construction equipment and commuting include nitrogen oxides, sulfur dioxide, PM-10, carbon monoxide, and VOCs. There will be emissions from the exhaust gases of the following equipment:

  - Worker Trips (privately owned vehicles of the construction workers who commute to and from the site): The number of construction worker trips during construction is based on the square feet of construction and the length of construction (excluding grading). Total daily trips for the Warehouse and the Range Operations Control Building were calculated to be 73 trips per day for 2 years.
  - Stationary equipment: These emissions are based on gasoline powered equipment (e.g., generators, saws, etc.) used at the construction site and depend on the gross square feet to be constructed. Project documentation estimates 89,394 ft^2 of facilities will be added at PMRF/Main Base.
  - Mobile equipment: These emissions are based on forklifts, dump trucks, etc., used during construction. It is assumed that there are two pieces of diesel powered equipment per 10,000 ft^2; and the equipment is used 6 hours per day. Project documentation estimates 89,394 ft^2 of facilities will be added at PMRF/Main Base.

Table C-3. Proposed Construction Inputs into ACAM

Structure	Space (ft^2)	Yr/Qtr Built	Duration (days)
Warehouse	4,189	2008/3	185
Range Operations Control Building	85,196	2008/3	545
TOTAL Construction	**89,394**		**730**
TOTAL Asphalt Pavement	**1.0 acres**	**2008/3**	
TOTAL Graded	**3.03 acres**	**2008/3**	**90**
TOTAL Demolition	**55,000**	**2008/2**	**1-9 mo**

Table C-4 shows the estimated emission levels for proposed construction at PMRF/Main Base. None of the emissions generated by the construction of the new facilities would exceed the *de minimis* or “conformity threshold” found in Table C-2.

Table C-4. Proposed Construction Air Emissions Summary Information by Source

Year	Source Type	Carbon Monoxide (Tons)	Nitrogen Oxides (Tons)	Sulfur Dioxide (Tons)	VOC (Tons)	PM-10 (Tons)
2008	Demolition	0.00	0.00	0.00	0.00	0.11
2008	Construction—Grading Equipment	0.04	0.16	0.02	0.02	0.01
2008	Construction—Grading Ops.	0.00	0.00	0.00	0.00	4.64
2008	Construction—Mobile Equipment	2.63	6.27	0.77	0.57	0.51
2008	Construction—Non-Res. Arch. Ctgs.	0.00	0.00	0.00	0.10	0.00
2008	Construction—Stationary Equipment	17.82	0.46	0.02	0.67	0.01
2008	Construction—Workers Trips	0.60	0.03	0.00	0.04	0.01
	TOTAL FOR 2008	**21.09**	**6.92**	**0.81**	**1.39**	**5.28**
2009	Construction—Mobile Equip.	7.17	17.10	2.11	1.56	1.38
2009	Construction—Non-Res. Arch. Ctgs.	0.00	0.00	0.00	0.17	0.00
2009	Construction—Stationary Equipment	48.64	1.26	0.06	1.82	0.04
2009	Construction—Workers Trips	1.72	0.10	0.00	0.10	0.01
	TOTAL FOR 2009	**57.53**	**18.46**	**2.18**	**3.66**	**1.43**
2010	Construction—Mobile Equipment	1.13	2.70	0.33	0.25	0.22
2010	Construction—Non-Res. Arch. Ctgs.	0.00	0.00	0.00	0.03	0.00
2010	Construction—Stationary Equipment	7.67	0.20	0.01	0.29	0.01
2010	Construction—Workers Trips	0.27	0.01	0.00	0.01	0.00
	TOTAL FOR 2010	**9.07**	**2.91**	**0.34**	**0.57**	**0.23**

Notes:

PM-10 = particulate matter equal to or less than 10 microns in size
VOC = Volatile organic compounds

Aircraft Operations Emissions Estimates

Military aircraft flight operations (mostly helicopters) represent the major Navy emission sources among the actions proposed. Aircraft flying operations include both Landing and Takeoff (LTO) and Touch-and-Go (T/G) cycles. Emissions from engine exhaust occur for each operation during idle/taxi-out, takeoff, climb out, approach, and taxi/idle-in. Only those portions of the flying operation that take place below the atmospheric mixing height are considered (these are the only emissions presumed to affect ground level concentrations). Aerospace Ground Equipment includes such aircraft support equipment as air compressors, air conditioners (coolers), aircraft tug narrows, bomb lifts, cargo loaders, cargo leaders, fuel trucks, generators, ground heaters, hydraulic test stands, jacking manifolds and miscellaneous carts. Trim tests are engine tests performed with the engines on the aircraft. All engines on the aircraft are assumed to be tested the same number of times each year.

ACAM (U.S. Air Force, 2005) was used to calculate the air emissions. Air emissions were calculated for the following Proposed Actions. The activities described below are also summarized in Table C-5:

- Continued aircraft training and support at PMRF Airfield on Kauai. Operational records show that existing PMRF aircraft operations in fiscal year (FY) 2004 consisted of 13,395 aircraft operations (defined as a takeoff or landing of one aircraft) of which 8,129 were Navy activities. The C-26 "Metroliner" aircraft and UH-3H "Sea King" helicopter accounted for 67 percent of all Navy flights at PMRF. Transient Navy H-60, C-20, and NP-3D aircraft combined for the remaining 33 percent of Navy flights at PMRF. Given the limited number of Navy aircraft in ACAM, only the UH-3H and the C-26 were modeled, making up 2,602 and 2,926 flights respectively. In ACAM, the C-26 aircraft was modeled using the C-20A aircraft and the UH-3H helicopter was modeled using the CH-3A helicopter. The operations were divided between LTO and T/G as shown on Table C-4. (U.S. Department of the Navy, Engineering Field Activity Chesapeake, 2006)
- The proposed introduction of F/A-18 aircraft for Field Carrier Landing Practice (FCLP) conducted at PMRF Airfield on Kauai or at Marine Corps Base Hawaii Kaneohe Bay, Oahu (Alternative 1) starting in the first quarter of 2009. In ACAM, the F/A-18 fighter was substituted with the F/18 fighter. Twelve FCLP training events are planned with six to eight T/G landings in each event. Therefore, it is assumed that Alternative 1 has a total of 96 new T/G landings. No AGE or ground activities were included.
- The proposed increase of F/A-18 aircraft for FCLP at PMRF Airfield or at Marine Corps Base Hawaii on Oahu (Alternatives 2 and 3) starting in the first quarter of 2009. In ACAM, the F/A-18 fighter was substituted with the F/18 fighter. Sixteen FCLP training events are planned with 6 to 8 touch-and go landings in each event. Therefore, it is assumed that Alternatives 2 and 3 have a total of 128 new T/G landings. No AGE or ground activities were included.

The estimated annual aircraft emission levels, including aerospace ground support activities and engine testing are in Table C-6. None of the emissions generated by the aircraft would exceed the *de minimis* or "conformity threshold" found in Table C-1. Since estimated emission levels for the Proposed Action Alternative would be *de minimis* and would not be regionally significant, no further analysis is needed.

Table C-5. Proposed Aircraft Inputs into ACAM

AIRCRAFT				OPERATIONS						TIME SPENT IN OPERATION MODE (MIN)				
Aircraft Modeled	Aircraft Used by Navy	Engine	# of Engines	Annual LTO	Annual T/G	Run-up (per engine)	Annual Run-up	Annual Trim Test	Trim Test	Taxi/Idle Out	Takeoff	Climb	Approach	Taxi/ Idle In
PMRF Barking Sands Airfield (all Proposed Alternatives)														
CH-3E	UH-3H	T58-GE-5	2	768	1,066	1	60	24	25	8.00	0.00	6.50	6.50	7.00
C-20A	C-26	F113-RR-100	2	460	2,006	1	60	24	45	6.50	0.50	0.00	1.60	6.50
PMRF Airfield, Kauai or Marine Corps Base Hawaii Kaneohe Bay, Oahu (Alternative 1)														
F-18	F/A-18	F404-GE-400	2	0	96	0	90	0	60	6.50	0.50	0.50	1.60	6.50
PMRF Barking Sands Airfield, Kauai or Marine Corps Base Hawaii Kaneohe Bay, Oahu (Alternatives 2 and 3)														
F-18	F/A-18	F404-GE-400	2	0	128	0	90	0	60	6.50	0.50	0.50	1.60	6.50

Notes:
LTO = Landings and takeoffs
PMRF = Pacific Missile Range Facility
T/G = Touch-and-go landings

Table C-6. Proposed Aircraft Air Emissions Summary Information by Source

Proposed Action	Year	Source Type	Carbon Monoxide (tons)	Nitrogen Oxides (tons)	Sulfur Dioxide (tons)	VOC (tons)	PM-10 (tons)
PMRF Airfield Baseline	2007	Aerospace Ground Equipment	1.25	7.24	0.64	0.40	0.28
PMRF Airfield Baseline	2007	Aircraft Flying Operations—After Burn	1.39	2.63	0.12	0.01	0.00
PMRF Airfield Baseline	2007	Aircraft Flying Operations—Approach	0.38	1.04	0.15	0.03	0.00
PMRF Airfield Baseline	2007	Aircraft Flying Operations—Idle	7.90	0.42	0.13	2.60	0.04
PMRF Airfield Baseline	2007	Aircraft Flying Operations—Military	1.61	1.56	0.19	0.50	0.44
PMRF Airfield Baseline	2007	Aircraft Ground Activities (Trim Checks)—After Burn	0.08	0.14	0.01	0.00	0.00
PMRF Airfield Baseline	2007	Aircraft Ground Activities (Trim Checks)—Approach	0.05	0.13	0.02	0.00	0.00
PMRF Airfield Baseline	2007	Aircraft Ground Activities (Trim Checks)—Idle	0.17	0.01	0.00	0.04	0.00
PMRF Airfield Baseline	2007	Aircraft Ground Activities (Trim Checks)—Intermediate	0.01	0.01	0.00	0.00	0.00
PMRF Airfield Baseline	2007	Aircraft Ground Activities (Trim Checks)—Military	0.05	0.56	0.03	0.01	0.01
PMRF Airfield Baseline	2007	Aircraft Engine Test Cells—After Burn	0.00	0.01	0.00	0.00	0.00
PMRF Airfield Baseline	2007	Aircraft Engine Test Cells—Approach	0.00	0.01	0.00	0.00	0.00
PMRF Airfield Baseline	2007	Aircraft Engine Test Cells—Idle	0.01	0.00	0.00	0.00	0.00
PMRF Airfield Baseline	2007	Aircraft Engine Test Cells—Intermediate	0.00	0.00	0.00	0.00	0.00
PMRF Airfield Baseline	2007	Aircraft Engine Test Cells—Military	0.00	0.03	0.00	0.00	0.00
Total for 2007 and beyond			**12.92**	**13.79**	**1.30**	**3.60**	**0.78**
FCLP Alt 1	2009	Aircraft Flying Operations—Approach	0.03	0.06	0.01	0.01	0.01
FCLP Alt 1	2009	Aircraft Flying Operations—Idle	0.00	0.00	0.00	0.00	0.00
FCLP Alt 1	2009	Aircraft Flying Operations—Intermediate	0.01	0.08	0.01	0.00	0.01
FCLP Alt 1	2009	Aircraft Flying Operations—Military	0.01	0.14	0.01	0.00	0.01
Total for 2009 and beyond			**0.04**	**0.28**	**0.02**	**0.01**	**0.03**
FCLP Alt 2	2009	Aircraft Flying Operations—Approach	0.03	0.08	0.01	0.01	0.02
FCLP Alt 2	2009	Aircraft Flying Operations—Idle	0.00	0.00	0.00	0.00	0.00
FCLP Alt 2	2009	Aircraft Flying Operations—Intermediate	0.01	0.11	0.01	0.00	0.01
FCLP Alt 2	2009	Aircraft Flying Operations—Military	0.01	0.18	0.01	0.00	0.01
Total for 2009 and beyond			**0.05**	**0.37**	**0.03**	**0.01**	**0.04**

Notes: FCLP = Field Carrier Landing Practice
PMRF = Pacific Missile Range Facility
PM-10 = Particulate matter equal to or less than 10 microns in size
VOC = Volatile organic compounds

C.2 Airspace

Airspace, or that space which lies above a nation and comes under its jurisdiction, is generally viewed as being unlimited. However, it is a finite resource that can be defined vertically and horizontally, as well as temporally, when describing its use for aviation purposes.

Under Public Law 85-725, **Federal Aviation Act** of 1958, the Federal Aviation Administration (FAA) is charged with the safe and efficient use of our nation's airspace, and has established certain criteria for and limits to its use. The method used to provide this service is the National Airspace System. This system is "…a common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information and manpower and material."

Areas beyond the territorial limit are defined as international airspace. Therefore, the procedures of the International Civil Aviation Organization (ICAO) outlined in ICAO Document 4444, *Rules of the Air and Air Traffic Services*, are followed (International Civil Aviation Organization, 1996; 1997). ICAO Document 4444 is the equivalent air traffic control manual to FAA Handbook 7110.65, *Air Traffic Control*. The ICAO is a specialized agency of the United Nations whose objective is to develop the principles and techniques of international air navigation and to foster planning and development of international civil air transport.

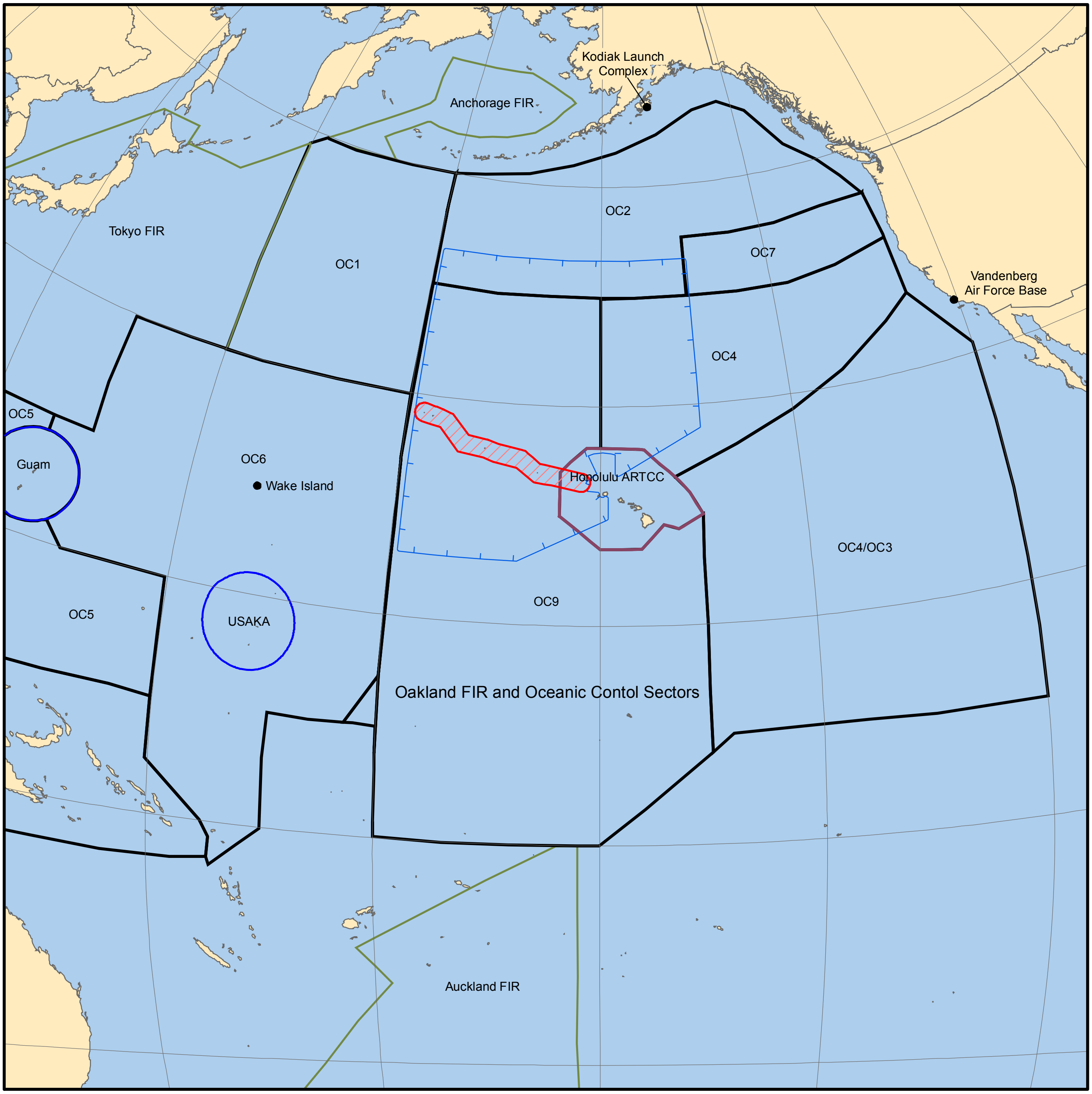
The FAA acts as the U.S. agent for aeronautical information to the ICAO, and air traffic in the Central Pacific is managed by the Oakland Air Route Traffic Control Center (ARTCC) within several Oceanic Control Sectors, the boundaries of which are shown in Figure C-1. The Honolulu Combined Radar Approach Control manages the Radar Control Area that surrounds the Hawaiian Islands.

Types of Airspace

Controlled and Uncontrolled Airspace

As part of the National Airspace System, controlled and uncontrolled airspace is divided into six classes, depending on location, use, and degree of control. Pilots are also subject to certain qualification requirements, operating rules, and equipment requirements. Figure C-2 depicts the six classes of non-military airspace. A brief description of each class follows:

- The Open Ocean Area does not include Class A airspace, which includes airspace overlying the waters within 12 nautical miles (nm) of the coast.
- Class B airspace is generally that airspace surrounding the nation's busiest airports in terms of Instrument Flight Rules (IFR) operations or passengers boarding an aircraft. An air traffic control clearance is required for all aircraft to operate in the area, and all aircraft that are so cleared receive separation services within the airspace.
- Class C airspace is generally that airspace surrounding those airports that have an operational control tower, are serviced by a radar approach control, and that have a certain number of IFR operations or passenger boardings.



EXPLANATION

- Temporary Operating Area (TOA)
- Radar Control Area
- Flight Information Region (FIR)
- Papahānaumokuākea Marine National Monument
- Oakland FIR and Oceanic Control (OC) Sector
- Honolulu Air Route Traffic Control Center Area
- Land

Note:
USAKA = U.S. Army Kwajalein Atoll
ARTCC = Air Route Traffic Control Center

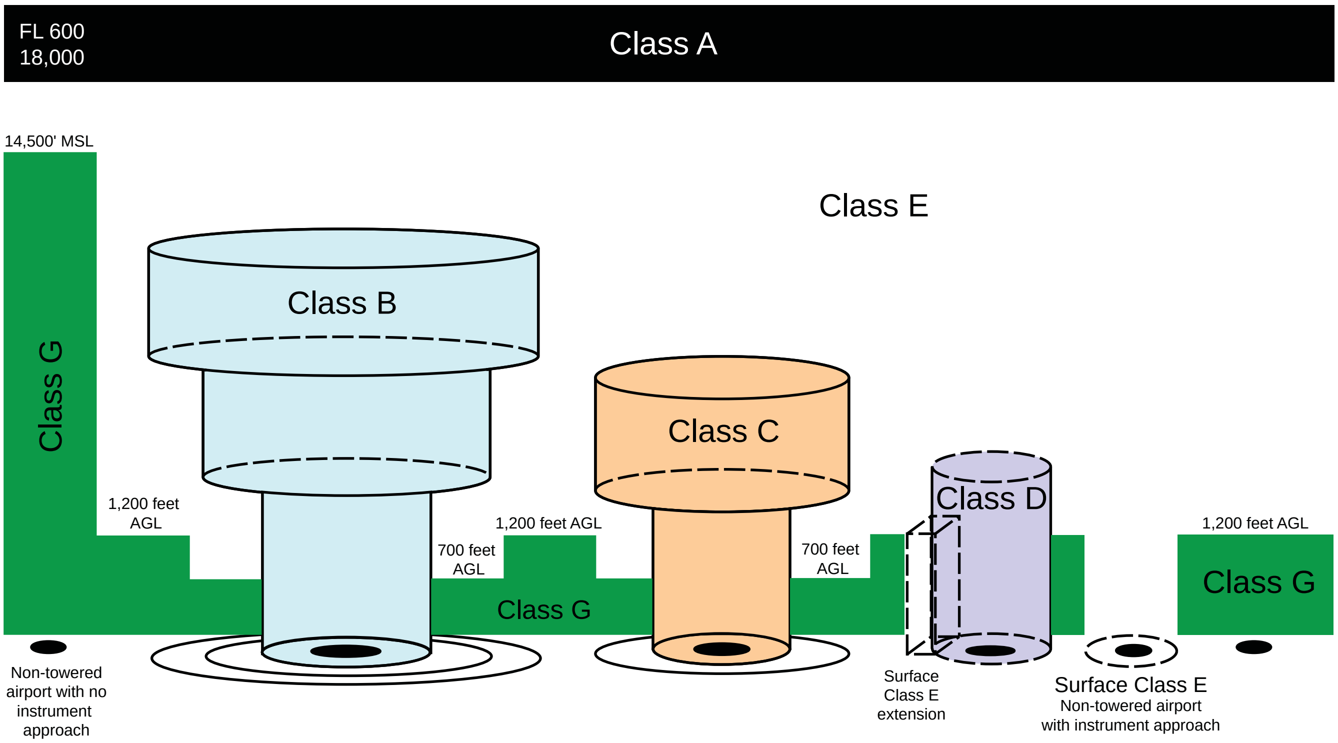
NORTH

0 300 600 1,200 Nautical Miles

Airspace Managed by Oakland and Honolulu Air Route Traffic Control Centers

Pacific Ocean

Figure C-1



Source: Federal Aviation Administration, 2002

EXPLANATION
AGL = Above Ground Level
FL = Flight Level
MSL = Above Mean Sea Level

The Six Classes of Non-Military Airspace

Figure C-2

- Class D airspace is generally that airspace surrounding those airports that have an operational control tower.
- Class E airspace is controlled airspace that is not Class A, Class B, Class C, or Class D airspace. Uncontrolled airspace, or Class G airspace, has no specific definition but generally refers to airspace not otherwise designated and operations below 1,200 ft above ground level. No air traffic control service to either IFR or Visual Flight Rules (VFR) aircraft is provided other than possible traffic advisories when the air traffic control workload permits and radio communications can be established.

Special Use Airspace

Complementing the classes of controlled and uncontrolled airspace are several types of special use airspace used by the military to meet its particular needs. Special use airspace consists of that airspace where activities must be confined because of their nature, or where limitations are imposed on aircraft operations that are not a part of these activities, or both. Except for controlled firing areas, special use airspace areas are depicted on aeronautical charts, IFR or visual charts, and include hours of operation, altitudes, and the controlling agency. Only the special use airspace found in the region of influence is described. For the open ocean area this includes Warning Areas, which are airspace that may contain hazards to non-participating aircraft in international airspace. Warning Areas are established beyond the 3-nm limit. Although the activities conducted within Warning Areas may be as hazardous as those in Restricted Areas, Warning Areas cannot be legally designated as Restricted Areas because they are over international waters (Aviation Supplies and Academics, Inc. 1996). For areas over and surrounding land and offshore areas this includes:

- Restricted Areas contain airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Activities within these areas must be confined, because of their nature, or limitations imposed upon aircraft operations that are not a part of these activities, or both. Restricted Areas denote the existence of unusual, often invisible, hazards to aircraft such as artillery firing, aerial gunnery, or guided missiles. Restricted Areas are published in the Federal Register and constitute Federal Aviation Regulation (FAR) Part 73.
- Warning Areas are airspace that may contain hazards to non-participating aircraft in international airspace. Warning Areas are established beyond the 3-nm limit. Although the activities conducted within Warning Areas may be as hazardous as those in Restricted Areas, Warning Areas cannot be legally designated as Restricted Areas because they are over international waters (Aviation Supplies and Academics, Inc., 1996). By Presidential Proclamation No. 5928, dated 27 December 1988, the U.S. territorial limit was extended from 3 to 12 nm. Special FAR 53 establishes certain regulatory warning areas within the new (3- to 12-nm) territorial airspace to allow continuation of military activities.

Other Airspace Areas

Other types of airspace include airport advisory areas, temporary flight restrictions areas, flight limitations and prohibitions areas, published VFR routes, and terminal radar service areas (National Aeronautical Charting Office, 2007).

Special Airspace Use Procedures

Other types of airspace, and special airspace use procedures used by the military to meet its particular needs, include air traffic control assigned airspace and altitude reservation (ALTRV) procedures. Both of these types of airspace are described below:

- Air Traffic Control Assigned Airspace (ATCAA), or airspace of defined vertical and lateral limits, is assigned by air traffic control to provide air traffic segregation between specified activities being conducted within the assigned airspace and other IFR air traffic. ATCAAs are usually established in conjunction with Military Operations Areas, and serve as an extension of Military Operations Area airspace to the higher altitudes required. These airspace areas support high altitude activities such as intercepts, certain flight test activities, and air refueling activities.
- ALTRV procedures are used as authorized by the Central Altitude Reservation Function, an air traffic service facility, or appropriate ARTCC, under certain circumstances, for airspace utilization under prescribed conditions. An ALTRV receives special handling from FAA facilities. According to FAA Handbook 7610.4H, Chapter 3, ALTRVs are classified as either moving or stationary, with the latter normally defining the fixed airspace area to be occupied as well as the specific altitude(s) and time period(s) the area will be in use. ALTRVs may encompass certain rocket and missile activities and other special activities as may be authorized by FAA approval procedures.

C.3 Biological Resources

Native or naturalized vegetation, wildlife, and the habitats in which they occur are collectively referred to as biological resources. Existing information on plant and animal species and habitat types in the vicinity of the proposed sites was reviewed, with special emphasis on the presence of any species listed as threatened or endangered by Federal or State agencies, to assess their sensitivity to the effects of the No-action Alternative, Alternative 1, Alternative 2, or Alternative 3.

OPNAVINST 5090.1B, Chapter 19, and the **Exercise RIMPAC Operations Order** advise commanding officers of requirements regarding the protection of Hawaii from the immigration of additional alien or invasive species.

- Wash downs: Surface ships shall routinely wash down anchors, chains, and appendages with seawater when retrieving them to prevent on board collection of sediment, mud and silt. When possible, following anchor retrieval, surface ships shall wash down chain lockers outside 12 nm from land to flush out sediment, mud, or silt.

  All equipment and unmanned vehicles to be placed in the ocean are to be clean and free of residual materials from prior use to avoid introduction of new species. For ships arriving from foreign ports, hulls of ships' small boats are to be cleaned of any marine growth (algae, barnacles, crustaceans, etc.) before placing them into ocean or harbor waters.

  Amphibious vessels launching and recovering amphibious vehicles shall ensure those vehicles, including their treads, are washed down after completion of operations. Ships shall dispose of wash water before entering 12 nm of the next operating area.

- Agricultural inspections: Inspection records may be provided upon arrival in Hawaii to Federal or State of Hawaii Department of Agriculture inspectors. Federal (U.S.) Department of Agriculture officials may inspect vessels pier side. State of Hawaii Department of Agriculture inspectors may be invited by the commanding officer to board U.S. flag vessels to assist with inspection of food stores, plants, and animals to ensure compliance with State animal quarantine laws.

  Foreign garbage is any food or food-related product, including containers, wrappers, plates, napkins, etc., from a foreign flag vessel or from a U.S. vessel for the first 24 hours after any U.S. Department of Agriculture boarding agents determine that all foreign stores have been expended. Foreign garbage is double-bagged in plastic bags, tied, and disposed in marked green dumpsters, separate from non-foreign garbage. The U.S. Department of Agriculture monitors foreign garbage dumpsters closely. Brown dumpsters are for non-foreign garbage.

- Brown tree snakes: No snakes are known to inhabit Hawaii. Commanding officers of all vessels and aircraft shall, prior to arrival in Hawaii, ensure that all stores originating from Australia and Guam are inspected for the brown tree snake. This inspection may be accomplished during on-loading of such stores or while underway. If any snake is sighted aboard a ship or aircraft entering Hawaii, the snake is to be restrained, contained, or killed and the snake retained until entry into Hawaii. Naval Station Pearl Harbor Security (911) is to be contacted, advised, and will take control of the snake for appropriate reporting to State Agriculture authorities.

- Ballast water: If it is necessary for a surface ship to load ballast water in an area that is either potentially polluted or within 3 nm from shore, the ship shall pump the ballast water out when outside 12 nm from shore and twice fill the tank(s) with clean sea water and pump prior to the next entry within 12 nm from shore. Surface ships will effect a ballast exchange twice in clean water, even if ballast water was pumped out before exiting the polluted waters or 3 nm limit, since residual water remaining in a tank after emptying it may still contain unwanted organisms that could be transferred during the next ballasting evolution. Ballast water exchange is not required during local operations or when reentering within 12 nm in the same locale as the ballast water was initially loaded.

The **Endangered Species Act** of 1973 (ESA) (16 U.S.C. 1531-1544, 87 Stat. 884, as amended) requires the U.S. Fish and Wildlife Service (USFWS) to identify plant and animal species that are threatened or endangered since "…various species of fish, wildlife, and plants in the United States have been rendered extinct as a consequence of economic growth and development untempered by adequate concern and conservation; other species of fish, wildlife, and plants have been so depleted in numbers that they are in danger of or threatened with extinction; these species of fish, wildlife, and plants are of aesthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people; the United States has pledged itself as a sovereign state in the international community to conserve to the extent practicable the various species of fish or wildlife and plants facing extinction…" Federal agencies are required to assess the effect of any project on threatened and endangered species under Section 7 of the ESA.

The **Migratory Bird Treaty Act** (16 U.S.C. 703-712) protects many species of migratory birds. Specifically, the act prohibits the pursuit, hunting, taking, capture, possession, or killing of such species or their nests and eggs. On December 2, 2003, the President signed the 2003 National Defense Authorization Act. The Act provides that the Secretary of the Interior shall exercise his/her authority under the Migratory Bird Treaty Act to prescribe regulations to exempt the Armed Forces from the incidental taking of migratory birds during military readiness activities authorized by the Secretary of Defense.

Congress defined military readiness activities as all training and activities of the Armed Forces that relate to combat and the adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use. Routine installation operation, industrial activities, and construction or demolition of facilities used for these purposes are not considered military readiness activities. Migratory bird conservation relative to non-military readiness activities is addressed in a Memorandum of Understanding (signed 31 July 2006) developed in accordance with Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds* (10 January 2001).

The final rule authorizing the Department of Defense to take migratory birds during military readiness activities (50 CFR Part 21) was published in the Federal Register on 28 February 2007. The rule states that the Armed Forces must confer and cooperate with the USFWS on the development and implementation of conservation measures to minimize or mitigate adverse effects of a military readiness activity if it determines that such activity may have a significant adverse effect on a population of a migratory bird species.

An activity will be determined to have a significant adverse effect when it is found within a reasonable period of time to diminish the capacity of a population of a migratory bird species to maintain genetic diversity, to reproduce, and to function effectively in its native ecosystem.

The **Marine Mammal Protection Act** (16 U.S.C. 1361, et seq.) gives the USFWS and National Marine Fisheries Service (NMFS) co-authority and outlines prohibitions for the taking of marine mammals. A take means to attempt as well as to actually harass, hunt, capture, or kill any marine mammal. Subject to certain exceptions, the Act establishes a moratorium on the taking and importation of marine mammals. Exceptions to the taking prohibition allow USFWS and NMFS to authorize the incidental taking of small numbers of marine mammals in certain instances.

The **Magnuson-Stevens Fishery Conservation and Management Act** (Public Law 94-265) (16 U.S.C. 1801-1882, April 13, 1976, as amended) requires that Federal agencies consult with NMFS on activities that could harm Essential Fish Habitat (EFH) areas. EFH refers to "those waters and substrate (sediment, hard bottom) necessary to fish for spawning, breeding, feeding or growth to maturity."

Executive Order (EO) 13089 Coral Reef Protection (63 FR 32701) and subsequent guidance documents from the Department of Defense (DoD) and the Navy were issued in 1998 "to preserve and protect the biodiversity, health, heritage, and social and economic value of U.S. coral reef ecosystems and the marine environment." It is DoD policy to protect the U.S. and International coral reefs and to avoid impacting coral reefs to the maximum extent possible. No concise definition of coral reefs has been promulgated, with regard to regulatory compliance of EO 13089. In general, coral reefs consist of tropical reef building Scleractinian and Hydrozoan corals, as well as calcified Octocorals in the families Tubiporidae and Helioporidae, non-calcified

Octocorals (soft corals) and Gorgonian corals, all growing in the 0 to 300 feet (ft) depth range. Deep water (300 to 3,000 ft depth range) precious corals and other deep water coral communities will only be considered in the case of a Sinking Exercise, where a vessel might ultimately land on a deep water coral community.

The **National Marine Sanctuaries Act** (NMSA) 16 U.S.C. § 1431 et seq. authorizes the Secretary of Commerce to designate as National Marine Sanctuaries areas of the marine environment that possess conservation, recreational, ecological, historical, research, and educational, or aesthetic resources and qualities of national significance, and to provide a comprehensive management and protection of these areas. To protect the area designated, any Federal action that is likely to destroy, cause the loss of, or injure a sanctuary resource must consult with the Secretary of Commerce prior to commencement of the action and adhere to reasonable and prudent alternatives set by the Secretary of Commerce. To the extent practicable, consultation may be consolidated with other consultation efforts under other Federal laws, such as the Endangered Species Act.

The NMSA allows the Secretary to issue regulations for each sanctuary designated and the system as a whole that, among other things, specify the types of activities that can and cannot occur within the sanctuary. The Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS) was signed into law in November 1992. The Final EIS/Management Plan was released in March 1997, and the final rule was published in November 1999. Activities allowed within the Sanctuary are all classes of military activities, internal or external to the Sanctuary, that are being or have been conducted before the effective date of the regulations, as identified in the Final EIS/Management Plan. The sanctuary includes specific areas from the coast of the Hawaiian Islands seaward to the 100-fathom isobath.

Under the HIHWNMS regulations, military activities are allowed within the sanctuary and are not subject to vessel/aircraft approach distances, discharge of materials prohibitions within the sanctuary, and consultation requirements if they are “classes of military activities, internal and external to the Sanctuary, that are being or have been conducted before the effective date of these regulations, as identified in the Final Environmental Impact Statement/Management Plan.” If the military activity is proposed after the official date of the regulations, then the activity is also an allowable activity but subject to prohibited activities provision under §922.184 (i.e., vessel/aircraft approach to humpback whale provisions, discharge of materials, etc.) unless the military activities are not likely to destroy, cause the loss of, or injure any sanctuary resource. Finally, any military activity that is subsequently modified in a way that causes the activity to be “likely to destroy, cause the loss of, or injure a Sanctuary resource in a manner significantly greater than was considered in previous consultation” is treated as a new military activity for which consultation may be necessary.

Exhibit C-1 is Appendix F of the 1997 HIHWNMS Final EIS/Management Plan. Exhibit C-2 is the “Report on Military Activities in Hawaiian Waters” provided by the Navy to the Department of Commerce. Exhibit C-3 is Navy/NOAA Memorandum of Understanding Concerning Military Activities and the HIHWNMS.

Appendix F

LIST OF MILITARY ACTIVITIES IN HAWAII

This compilation of classes of military activities conducted in Hawaiian waters has been divided into "near-shore" and "open ocean" categories. Near-shore operations are those which are conducted within the 100-fathom isobath proposed for inclusion in the sanctuary. Open ocean operations are those additional types of operations which are normally (but not always) conducted outside the 100-fathom isobath. These operations have been included because they are at times conducted near or inside the 100-fathom isobath. Theses classes of military activities near Hawaii are conducted by all the military services of the United States and, during combined operations, by military units from cooperating foreign nations or the State of Hawaii Department of Defense/National Guard.

I. SURFACE OPERATIONS

A. Near shore operations include, but are not limited to:

1. Pierside training and maintenance.
2. Dry-docking operations at Pearl Harbor.
3. Harbor movements by ships, submarines, boats and auxiliary craft.
4. Anchoring
5. Transit operations between harbors and operating areas (OPAREAS).
6. Salvage and towing operations.
7. Anti-submarine warfare (ASW) operations involving the use of sonar and expendable bathythermographs. Recoverable torpedoes are sometime used.
8. Amphibious warfare operations including the blasting of amphibious ships and the movement to the beach of landing craft, landing craft air cushion (LCAC), amphibious assault vehicles (AAV), ship's boats, special United States Marine Corps (USMC) "Boston Whaler" or "Zodiac" type special operations craft, and helicopters. Can involve the landings and take off of Harrier jets from a variety of amphibious ships.
9. Anti-surface warfare operations against ships and small boats
10. Special operations training involving swimmers and small boats
11. Explosive Ordnance Disposal (EOD) operations and training involving the use of explosives for demolition.
12. Mine warfare and mine counter-measure (MCM) operations involving the use of sonar, towed mine sweeping devices, the implantation of drill moored and bottom mines, and the firing of machine guns and small arms at floating targets.
13. Equipment and personnel drops from fixed wing and helicopter aircraft associated with re-supply, insertion, search and rescue and training.

B. Open ocean operations include, but are not limited to:

1. Transit operations between OPAREAs
2. Engineering, navigation, seamanship, and general warfare-related training exercises.
3. Towing operations.
4. Anti-submarine warfare operations involving the use of sonar, expendable bathythermographs , towed arrays and training torpedoes.
5. Amphibious warfare operations involving the blasting of ships over the horizon launch, recovery, and movements of LCAC and USMC/Seal special operations craft and low-flying helicopter and Harrier jet operations.
6. Anti-surface warfare operations involving high-speed maneuvering, the actual firing of guns and missiles at targets, calibration firing of guns and the launching of self-protective chaff.

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7. Anti-air warfare operations involving the actual firing of guns and missiles at target craft and the launching of self -protective chaff and flares.
8. Replenishment operations to vessels underway involving the transfer of both supplies and fuel via wire and transfer of supplies by low-flying helicopters.
9. Supersonic flight above 5,000 feet and outside 25 miles from land.

II. SUBSURFACE OPERATIONS

A. Near-shore operations including, but are not limited to:

1. Transit operations to and from ports and OPAREAs.
2. Post maintenance shallow water divers.
3. Shallow water ASW and anti-ship operations, which include the expenditure of non-recoverable sonobuoys and smoke markers.
4. Torpedo exercises using retrievable non-explosive torpedoes.
5. Mine warfare training during which submarines traverse through a field of bottom-moored practice mines, using active sonar to detect and avoid mines.
6. ASW target services for ships and aircraft, which include the expenditure of non-recoverable sonobuoys and smoke markers and use of sonar and towed arrays.
7. Special operations involving swimmers operating from submerged submarines and supported by small boats.
8. Mine warfare training which includes the launching of recoverable exercise (inert) mines.

B. Open ocean operations including, but not limited to:

1. Transit operations at a variety of depths
2. Deep water dives and surfacing
3. Deep water ASW and anti-submarine/ship warfare operations involving the use of sonar, expendable bathythermographs, towed arrays, and training torpedoes.

III. AIR OPERATIONS

A. Near-shore operations including, but not limited to:

1. Landing and takeoffs by helicopters, fixed-wing aircraft and target drones from shore bases
2. Landings, takeoff and training flights at altitudes above 50 feet by helicopters from ships.
3. Training flights and transfers of personnel and equipment by helicopters and fixed-wing aircraft at altitudes above 50 feet. Low flying tactical helicopter and fixed-wing aircraft training flights (single and multi-ship, day, night unaided and Night Vision Goggle (NVG) training) often involve terrain-following and Nap Of the Earth (NOE) flight over or near the island and shorelines, as well as, flight in published FAA transitions below controlled airspace and flight traffic patters over water.
4. Air assaults by helicopters from amphibious ships at altitudes above 50 feet.
5. ASW operations from patrol (P-3) aircraft and helicopters, against actual submarines or mobile target at altitudes from 50 to 16,000 feet. Inert mines and missiles, non-retrievable sonobuoys and smoke markers and retrievable torpedoes are discharged into the water, Helicopters may use dipping sonar.
6. Bombing and missile firing exercises by fixed-wing aircraft of attack helicopters using surface target or Kaula rock.
7. Insertion/extraction of special forces/USMC Force Reconnaissance (RECON) troops from helicopters and fixed-wing aircraft into the water.

B. Open ocean operations including:

1. Aircraft carrier air operations.

Exhibit C-1. Appendix F of the 1997 Hawaiian Islands Humpback Whale National Marine Sanctuary Final EIS/Management Plan (Continued)

2. Air combat maneuvering.
3. Live missile firings by aircraft versus target drones.
4. Live bombing, gunnery, and missile firings versus surface targets.
5. Low flying tactical helicopter and fixed-wing aircraft flights (single and multi-ship day, night unaided and NVG) transiting between island training areas at altitudes between 200 and 500 feet.
6. Emergency fuel dumping above 5,000 feet.
7. Air to air warfare operations involving the actual firing of guns and missiles at target craft and the launching of self-protective chaff and flares.
8. Supersonic flight above 5,000 feet and outside 25 miles of land.

OPERATIONS BY LOCATION

I. AREAS WITHIN ORIGINAL SANCTUARY BOUNDARIES:

A. PENGUIN BANK. Located southeast of Oahu, and southwest of Molokai, in the Kaiwi Channel. This is the areas of primary concern within the original sanctuary boundaries. Submarines conduct post-overhaul shallow- water dives in the vicinity of Penguin Bank. The area is also used for shallow-water ASW operations.

1. All Submarines completing any major repair work are required to conduct initial submerged testing in shallow water. The loss of USS THRESHER on sea trials generated the requirement to conduct initial submerged testing in shallow water to ensure that if the submarine has a casualty during the testing, and sinks to the ocean floor, the crew can be rescued. It is necessary to conduct initial testing close to shipyards facilities in case an unscheduled return to port is required for repairs. Penguin Bank is the only shallow water areas in Hawaiian water suitable for these required test.

2. Shallow-water ASW exercises involving surface ships and submarine, using low power active sonar transmissions, are conducted in the area to take advantage of the unique characteristics of shallow water. These exercise last from two to five days and result in the use of sonobuoys, smoke floats, expendable bathythermographs, and submarine-launched exercise (inert) torpedoes. This training cannot be conducted in deep water.

3. Submarines conduct mine warfare training at Penguin Bank. These exercises involve the submarines and small craft. The submarines practice implanting inert mine shapes, which are later recovered by small craft. This training cannot be conducted in deep water.

B. KAHOOLAWE. Operational training no longer conducted on Kaho'olawe. Helicopter operations occur regularly to and from the Navy bases camp for logistic purposes in support of the impending unexplored ordnance clean up. In addition helicopter flights will occur throughout the island for required aeromedical evacuation purposes. Landing craft are occasionally used to introduce or remove supplies and heavy equipment. Construction a pier is planned. The waters surrounding the island are not suitable for use by the public due to the presence of undetermined amounts of unexplored ordnance.

C. MAUI, MOLOKAI AND LANAI. With increased emphasis on littoral warfare, and the need to conduct training in shallow water, the waters adjacent to Maui, Molokai, and Lanai are important training areas for Navy ship home ported in Pearl Harbor. The channel between, Maui, Lanai and Molokai is extensively used for the biennial RIM PAC exercise as an EOD/MCM exercise area as well as for shallow-water ASW. Port visits are frequently conducted in Lahaina, Maui. Salvage ship and diving operations are frequently conducted.

1. The areas inside the 100 fathom isobath surrounding Maui, Molokai, and Lanai, and specifically the channel between this island, is used for shallow water ASW operations. These operations include

Exhibit C-1. Appendix F of the 1997 Hawaiian Islands Humpback Whale National Marine Sanctuary Final EIS/Management Plan (Continued)

using low-power active sonar transmissions, sonobuoys, smoke floats, expendable bathythermographs, and exercise (inert) torpedoes.

2. This channel is also used for MCM training, including the use of bottom-moored practice (inert) mines, sonar, towed mine sweeping device and MCM surface ships.

3. The recent installation of the Hawaiian Area Tracking System (HATS) southeast of Lanai provides an excellent passive acoustic range for shallow water exercise torpedo firings. Exercise torpedo firings(non-explosive) are conducted with HATS range control utilizing a helicopter for range safety.

4. The waters surrounding Molokai are used by the Marines and the U.S. Army: USMC day/night helicopter operations focus predominantly in the area around Molokai, which is their only effective local night vision goggle (NVG) training area. These flights take place at altitudes above 50 feet. The U.S. Army also uses the Molokai training area (day, night unaided and NVG), and conducts flights in and around the shorelines of Maui and Molokai for low level training and for transit routes between Oahu and the major Army tactical training area on the island of Hawaii, Pohakuloa Training Area.

D. KAUAI. Few operations occur in the small area north of Kauai originally included in the sanctuary. Air operations sometime occur over this area, and transit operations sometime occur through it.

II. ADDITIONAL AREAS PROPOSED FOR INCLUSION:

A. KAUAI. A significant concern over the proposed inclusion of the remaining waters inside the 100- fathom isobaoth surrounding Kauai is the potential impact upon operations at the PMRF, located on Kauai. Operations below are subdivided by those occurring inside the 100-fathom isobath area proposed for inclusion, and those normally occurring outside it.

1. Operations inside the proposed sanctuary boundaries.

a. Airspace. The airspace above the 100-fathom isobath is frequently used by P-3 aircraft operating against actual submarines or mobile targets. Operations take place from 50 to 16,000 feet. Inert mines and missiles are discharged into the water. Other exercise material discharged includes non-retrievable smoke markers and sonbuoys, and retrievable torpedoes. Occasionally, due to equipment malfunction, retrievable torpedoes are lost at sea. Target drones are launched from PMRF through coastal airspace, Helicopter operations are conducted frequently in the near-shore area.

b. Surface. Amphibious exercises, involving landing craft, LCAC, and AMTRACs, are regularly conducted on the beaches at PMRF. Target recovery boasts pass through proposed sanctuary waters enroute to and from pick-ups. Missile and gun life firing exercises using air, subsurface and surface targets occur in area R-3101, a fully instrumented range which extends three nautical miles seaward from the western cost of Kauai, a portion of which is inside the 100-fathom isoboath. Area R-3101 also serves as an aerial target recovery area.

c. Subsurface. In addition to operations with P-3 aircraft, submarines conduct torpedo exercises using retrievable torpedoes, and mine warfare training. Submarine traverse through a field of bottom-moored mines, using active sonar to detect and avoid mines. During the course of these exercises, submarines discharge non-retrievable bathythermographs.

2. Operations adjacent to proposed sanctuary boundaries.

a. Airspace:

Exhibit C-1. Appendix F of the 1997 Hawaiian Islands Humpback Whale National Marine Sanctuary Final EIS/Management Plan (Continued)

(1) Warning Area W-186 Special use airspace over open ocean located westward to northeastward of Kauai, and commencing at the border of R-3101, three nautical miles west of Barking Sands. Airspace extends from the surface to 9000 feet. W-186 is used for live missile, bomb, rocket, gunnery and torpedo exercises.

(2) Warning Area W-188. Special use airspace over open ocean located westward to northeastward of Kauai, and commencing at the border of R-3101, three nautical miles west of Barking Sands. The airspace extends from the surface to unlimited altitude and encompasses an operating area of approximately 42,000 square miles. W-188 is used for missile, rocket, gunnery, and torpedo exercises in support of fleet training and PMRF activities. The M-2, M-3, and M-4 portions of W-188 are a fully instrumented missile firing range with command and control, surveillance, tracking and telemetry services and data reduction services provided by and located at PMRF.

b. Surface: The surface of areas W-186 and W-188 encompass 41,000 square nautical miles, and are subdivided into eight operating areas for surface ships. Air, surface and underwater exercises using conventional ordnance of all types are conducted.

c. Subsurface:

(1) Barking Sands Tactical Underwater Range (BARSTUR): This range provides 80 square nautical miles of underwater tracking coverage in M2 of W-188, commencing seven nautical miles west of Kauai. The rage extends from the ocean floor to the surface. BARSTUR is used to evaluate ASW and anti-surface (ASU) warfare exercises and tactics and to track torpedo firings and submarines. The underwater and shore-based instrumentation at BARSTUR provides the capability to conduct ASW and ASU warfare training in an instrumented environment, which permits evaluation of the effectiveness of the tactics employed and the performance of weapons systems.

(2) Barking Sands Underwater Ranges Expansion (BSURE): This range is adjacent to BARSTUR and underlies M-4 in W-188. The range expands the underwater tracking area to approximately 800 square nautical miles, and extends from the ocean floor to the surface, BSURE is used to evaluate ASW and ASU exercises and to track torpedo firing and submarines.

B. OAHU

1. Operations inside proposed sanctuary boundaries.

a. Airfields generally. Low level day/night helicopter operations are conducted in accordance with published Federal Aviation Administration (FAA) routes/procedures and Honolulu approach control instructions for the various controlled and uncontrolled military and civilian airfields an the island of Oahu and the outer islands. FAA transition routing and/or training requires flight in and around the shorelines of Oahu at or below 500 feet.

b. Pearl Harbor. Operations within and near Pearl Harbor are primarily limited to transit operations, anchorages, ammunition on/off loads, maintenance, dry-docking, and pierside training.

c. Bellows Air Force Station. USMC and Navy special forces frequently use beaches at Bellow and adjacent water for amphibious operations. These exercises involve landing craft, LCAC, AAV, submarines with associated swimmer delivery vehicles and support craft, and small boat landings, as well as low level overflights by helicopters. The AMTRACs transit Kailua and Waimanalo Bays enroute to Bellows.

Exhibit C-1. Appendix F of the 1997 Hawaiian Islands Humpback Whale National Marine Sanctuary Final EIS/Management Plan (Continued)

d. NAS Barbers Point. P-3 and other aircraft frequently overfly coastal water at low level on approach and takeoff. Helicopters and fixed wing aircraft overfly coastal waters at low level on approach and takeoff and during helicopter closed traffic operations south of the main runway.

e. Kaneohe Bay. Helicopters and fixed wing aircraft overfly coastal waters at low level on approach and take off. Small boats operate in the harbor.

f. Camp Smith Training Facility. Located in Ewa, just east of NAS Barbers point. Company-sized small boat raid exercises are conducted semiannually. These operations involve over the horizon launchings of small boats, which transit to and land on the beach.

g. Waianae Coast

(1) FORACS Range. Submarines conduct Fleet Operational Readiness Accuracy Check and Site (FORACS) operations off the Waianae coast to calibrate their sensors. These operations consist of slowly proceeding in a specified course and measuring sensor bearings to a sound source of known positions. The sound source is located within the 100-fathom isobath, as is a portion of the FORACS range.

(2) Dry-Deck Shelter (DDS) Operations. Submarines conduct dry-deck shelter operations in the leeward waters west of Oahu involving launching/retrieving of swimmers, swimmer delivery vehicles, and support craft from surfaced and submerged submarines.

(3) Pokai Bay. USMC parachute operations involving water landings are conducted on a quarterly basis at Pokai Bay, off Makua. These operations include personnel and small boat insertions, and include the dropping of non-recoverable smoke flares.

(4) Makua Valley Military Reservation. Army helicopter conduct frequent low level flights (200-500 feet) along the coast enroute from Wheeler AAF (from the north via Dillingham and Kaena Point or from the east via Kolekole Pass and NAVMAG Lualualel) and from NAS Barbers Point supporting air assault training and fire buckets operations. Makua Valley is inaccessible by air from the north, east and south due to the proximity of the Waianae mountains. It affords the only company level live fire training area on Oahu

h. Dillingham Airfield. Dillingham, the adjacent uncontrolled airspace on/off shore, and the published military helicopter training route are used extensively for night unaided and NVG training. Helicopters routinely overfly coastal water at low level during approach, takeoff, closed traffic operations, and air assault training at the Army training area abutting Dillingham.

i. A-311. Army helicopters frequently conduct day/night low level training flights between Wheeler AAF and the primary tactical training area on Oahu, alert area A-311. Adverse weather (low ceilings over the western edge of the Kahuku mountain range) often requires aircraft to divert, low level (200 to 500 feet) seaward of the North Shore enroute to A-311.

2. Operations adjacent to proposed sanctuary boundaries: The ocean areas and airspace north and south of the island of Oahu are divided onto a number of special operating areas in which live conventional ordnance firings are routinely conducted by surface ships and aircraft. Air tactics training is also routinely conducted at altitudes above 200 feet.

C. KAULA ROCK. An unattended/non instrumented target approximately 52 nautical miles southwest of Kauai. Kaula Rock is an island with an area of .7 by .5 nautical miles upon which inert ordnance may be expended on the first 1000 feet of the southeast tip. Air to ground training exercises expend inert conventional ordnance and night illumination devices. Oahu-based Army helicopters occasionally conduct

Exhibit C-1. Appendix F of the 1997 Hawaiian Islands Humpback Whale National Marine Sanctuary Final EIS/Management Plan (Continued)

aerial gunnery training at Kaula Rock (W-187/R-3107). Operations entail open ocean and near-shore, low level, tactical flight (200-500 feet) enroute, and the expenditure of inert air-to-ground missiles and rockets on site.

D. HAWAII (ISLAND). Few operations occur inside the 100-fathom isobath surrounding Hawaii. Army and USMC helicopter operations regularly occur over the island, primarily in support of military exercises at the Pohkuloa Training Area (PTA) in the center of the island between the volcanoes, and enroute to/from home bases on Oahu. Navy and Army landing craft frequently on/off load supplies and equipment at Kawaihae Bay (Kawaihae docks) in support of military training at PTA. Navy ships conduct periodic port visits at Hilo and Kona.

GLOSSARY

AAF .... Army airfield
AAV .... Amphibious assault vehicles
AMTRACs .... Amphibious-tracked landing vehicles
ASU .... Anti-surface
ASW .... Anti-submarine warfare
BARSTUR .... Barking Sands Tactical Underwater Range
BSURE .... Barking Sands Underwater Range Expansion
DDS .... Dry deck shelter
EOD .... Explosive ordnance disposal
FORACS .... Fleet Operational Readiness Accuracy Check and Site
LCAC .... Landing craft, air cushion
HATS .... Hawaiian area tracking system
MCM .... Mine counter-measure
NAS .... Naval air station
NAVMAG .... Naval Magazine
NVG .... Night vision goggles
P-3 .... Patrol aircraft
RECON .... Reconnaissance
RIMPAC .... Rim of the Pacific (Specific multi-national exercise)
OPAREAs .... Operating areas
PMRF .... Pacific Missile Range Facility, Barking Sands, Kauai
USMC .... United States Marine Corps

Exhibit C-1. Appendix F of the 1997 Hawaiian Islands Humpback Whale National Marine Sanctuary Final EIS/Management Plan (Continued)

GENERAL COUNSEL OF THE NAVY
WASHINGTON, D.C. 20350-1000

April 21, 1995

Terry Garcia, Esq.
General Counsel
National Oceanic and Atmospheric
Administration
Herbert Hoover Office Building
14th and Constitution Avenue, N.W.
Washington, D.C. 20230

Dear Mr. Garcia:

I am pleased to provide you with the Department of the Navy's response to NOAA's request for additional information on military activities in and around Hawaii. These materials supplement the information that we previously have provided, both in Washington and in earlier discussions and briefings that have taken place in Hawaii. We are confident that your staff's review of these materials will confirm that the military services are conducting their existing classes of military activities in Hawaii in a manner that is consistent with the humpback whale sanctuary as proposed. We should be able to conclude the remaining issues on the MOU and minor revisions in the regulations in short order once we have agreement about existing classes of military activities. If you or your staff have any further questions, please do not hesitate to call me. I look forward to fully resolving this matter as soon as possible.

Sincerely,

Steven S. Honigman

Exhibit C-2. Report on Military Activities in Hawaiian Waters

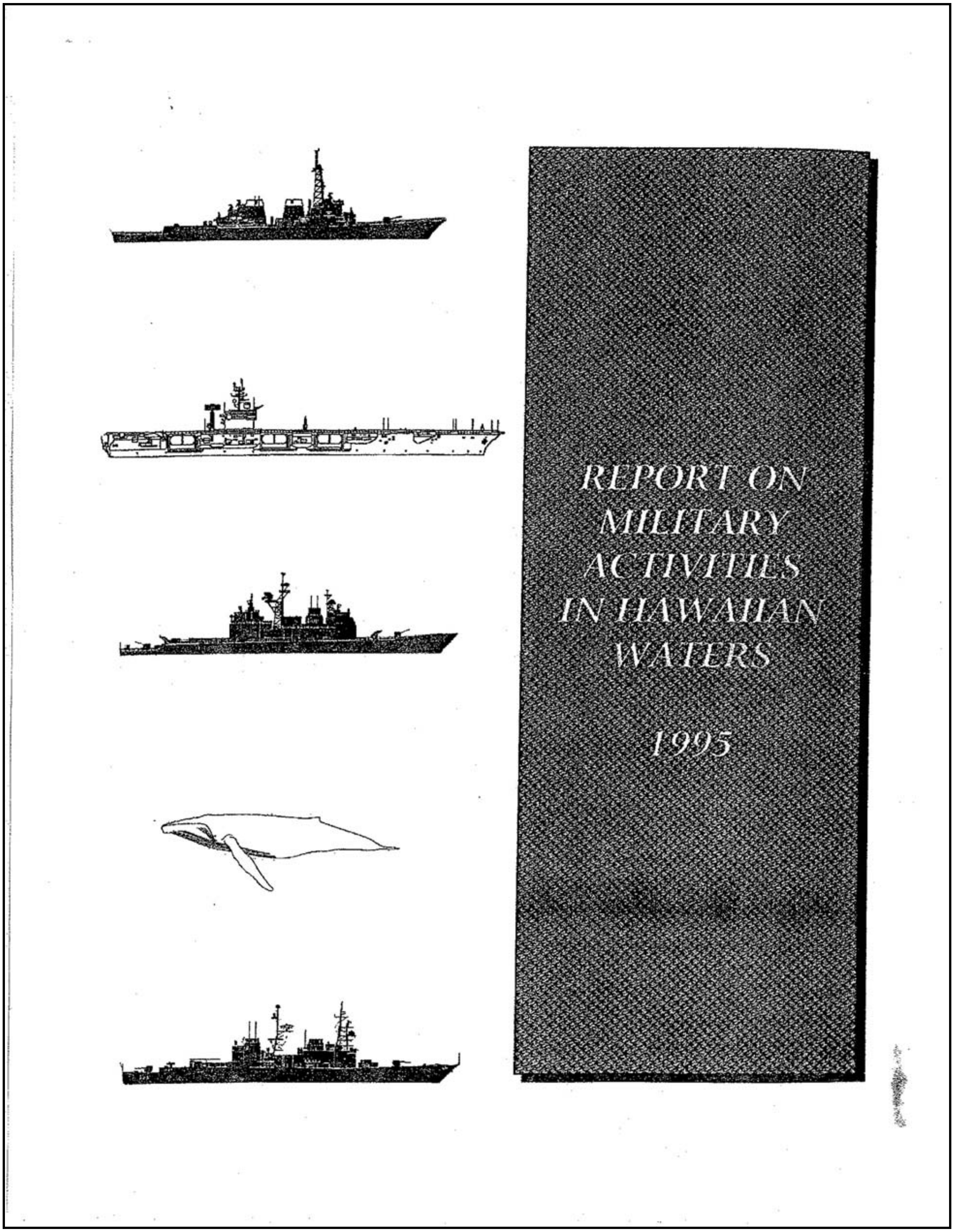

Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

Report on Military Activities in Hawaiian Waters

April 21, 1995

This information is provided at the request of NOAA to supplement the information on military activities currently undertaken in and around the Hawaiian Islands. It supplements the information on military activities previously provided either in writing or in a series of briefings and meetings between Department of the Navy and Department of Commerce officials in Hawaii and in Washington, D.C. beginning in early 1994 concerning establishment of the Hawaiian Islands Humpback Whale National Marine Sanctuary. As requested, for Categoy ! activities, a general description of potential effects on the humpback whale is provided. For Category II, a description of the activity, the location of the activity, the potential effects on the humpback whale and mitigative measures, are provided.

Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

GENERAL SUMMARY OF THE POTENTIAL EFFECTS TO SANCTUARY RESOURCES OF CATEGORY I AND II MILITARY ACTIVITIES

SURFACE OPERATIONS - CATEGORY I

1. Pierside Training and Maintenance (Inside 100 Fathom Isobath). Pierside training and maintenance have few potential effects on humpback whales and the risk of their occurring is virtually nonexistent. Most such training and maintenance is conducted at Pearl Harbor and humpback whales have not been sighted within the harbor.

a. This class of activities results in very few effects of any kind in the harbor. The activities conducted by the Navy are generally no different than those conducted at the Honolulu Shipyard and the commercial piers at Sand Point Island. Vessel discharges are restricted or piped to treatment systems ashore and nothing likely to harm a humpback whale is discharged. Vessel movements occur at very slow speeds with extra watches set. The presence of a humpback whale in the harbor would be quickly detected and protective action taken.

b. The potential for harm from a fuel spill also poses no real risk to humpback whales. When vessels are pierside, they have oil spill booms surrounding them to keep any minor spills from spreading or from being flushed from Pearl Harbor. Naval personnel complete prescribed training to qualify to transfer fuel internally or to participate in external fueling operations. Additionally, Navy directives require naval activities to have spill prevention and emergency response plans for ships and shoreside activities. Plans for shoreside activities meet state standards applied to private activities. Commander Naval Base Pearl Harbor has a permanently assigned Navy On Scene Coordinator (NOSC) whose responsibility is to immediately respond to and clean up any spills that exceed the capacity of the individual vessel. NOSCs train closely with the U.S. Coast Guard to ensure that they meet the requirements of the Oil Pollution Act of 1990 and that a rapid, successful response is achievable. Finally, Navy fuel is a lighter, more highly refined fuel than used by most commercial vessels and would either evaporate or dissipate quickly even if it were spilled. Thus it is unforeseeable that a quantity of oil sufficient to harm a humpback would be released.

c. Additionally, all activities on or about the piers are conducted in accordance with Navy safety instructions and OSHA, as applicable, ensuring the safe handling of petroleum products and potentially hazardous materials.

2. Dry Docking Operations at Pearl Harbor. Dry dock operations at Pearl Harbor will have no harmful effects on humpback whales, direct, indirect or cumulative.

a. No whales have been observed in Pearl Harbor, the only location of Navy drydocks. The use of the drydocks at the Pearl Harbor Naval Shipyard involves placing a vessel inside the drydock and pumping the water from inside the dock back into Pearl Harbor. When maintenance is completed, to avoid contamination/pollution, the dry-docks are cleared of foreign materials before the dock is reflooded.

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

b. The use of the floating drydock at SUBASE Pearl Harbor is very similar except that the drydock itself floats up to raise the vessel to be maintained out of the water. Foreign materials are cleared before the dock is sunk to refloat the vessel.

3. Harbor Movements by Ships, Submarines, Boats and Auxiliary Craft. Harbor movements at Pearl Harbor, MCAS Kaneohe and other Navy harbors will have no harmful effects on humpback whales, direct, indirect or cumulative.

a. No whales have been observed in Navy harbors in Hawaii. Movement of vessels in harbors is similar to that done by private and commercial vessels. The speed and maneuvering of vessels, however, is even more carefully controlled within the confines of the harbor since all traffic is under the control of the Navy.

b. For ships and submarines special watches are posted to ensure adequate lookouts are in position and the most experienced crews are maneuvering the vessels. Before qualifying as lookouts, individuals must receive special training regarding visual positioning reports and required reports to the maneuvering bridge to avoid collisions and other hazards to either the vessel or marine mammals. Boats and auxiliary vessels use trained coxswains and boatswain mates to ensure that only qualified individuals are permitted to maneuver these smaller craft.

4. Anchoring. Anchoring operations for Navy ships within the 100 fathom isobath will have no harmful effects on humpback whales, direct, indirect or cumulative. Despite having conducted anchoring in Hawaiian waters for many years, there have been no indications that such operations have had any effect on humpback whales.

a. With rare exception, naval vessels only anchor within designated anchorage areas. The only real potential risk to humpback whales is collision. Special "sea and anchor details" (watches) are posted to ensure additional lookouts are in position and the most experienced crews are maneuvering the ships. Before qualifying as lookouts, individuals must receive special training regarding visual positioning reports and required reports to the maneuvering bridge to avoid collisions and other hazards to either the vessel or marine mammals. During the actual anchoring, the vessels are operating at extremely slow speed to ensure accurate positioning during the evolution. Ships at anchor operate small boats and continue to operate ship's systems, but these pose few risks for humpback whales. There are no discharges from ships at anchor that pose any risk to humpback whales.

b. Additionally, commanding officers have been directed to avoid harming humpback whales and will take appropriate corrective action. Chief of Naval Operations Instructions, Operational Orders from the Third Fleet Commander and a handbook from Commander Naval Surface Group Middle Pacific (Hawaii area) reiterate the requirements of the Marine Mammal Protection Act (MMPA) not to harm, harass or threaten any marine mammal. The handbook goes further and provides guidance that reiterates the prohibitions in 50 CFR 222.31.

Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

5. Transit Operations Between Harbors and Operating Areas (Within the 100 Fathom Isobath). Transit operations between harbors and operating areas pose a very low risk of potentially harmful effects on humpback whales, direct, indirect or cumulative. Despite having conducted countless ship transits from harbor to operations areas for many years, there have been no indications that such operations have had any effect on humpback whales in Hawaiian waters.

a. There have been no collisions or observable effects on whales. There is, however, a remote possibility of collision with a whale. Special "sea and anchor details" (watches) are posted to ensure adequate lookouts are in position and the most experienced crews are maneuvering the ships until the ship reaches either the operating area or the open ocean. Before qualifying as lookouts, individuals must receive special training regarding visual positioning reports and required reports to the maneuvering bridge to avoid collisions and other hazards to either the vessel or marine mammals.

b. Commanding officers have been directed to ensure their operations do not harm humpback whales. Chief of Naval Operations Instructions, Operational Orders from the Third Fleet Commander and a handbook from Commander Naval Surface Group Middle Pacific (Hawaii area) reiterate the requirements of the Marine Mammal Protection Act (MMPA) not to harm, harass or threaten any marine mammal. The handbook goes further and provides guidance that reiterates the prohibitions in 50 CFR 222.31.

6. Special Operations Involving Swimmers and Small Boats. (Within the 100 Fathom Isobath). Special operation involving swimmers and small boats pose a very low risk of potentially harmful effects on humpback whales, direct, indirect or cumulative. Similar operations have been conducted in Hawaiian waters for many years without any indication that such operations have had any effect on humpback whales.

a. Special operations involve open water swimming/diving with drop off and retrieval by Zodiacs, Boston Whalers or other small boats specially configured for the mission. The boats either transit from shore, another ship, an aircraft or a submarine to the mission location. Typically the mission location is ashore but it may be another ship. Most special operation craft are capable of both very quiet, stealthy operation and high speed operation. High speed is used to attain position and for escape in case of detection, but since high speed increases the risk of detection, most operations are at low or moderate speeds.

b. Small boat coxswains and special operations forces are acutely aware of the environment around them and avoid objects like humpback whales, which pose a more severe hazard to them than they pose to the whales. Although most operations are at night, special operations forces are specially trained for night operations and the use of night vision devices.

c. Chief of Naval Operations Instructions, Operational Orders from the Third Fleet Commander and a handbook from Commander Naval Surface Group Middle Pacific (Hawaii area) reiterate the requirements of the Marine Mammal Protection Act

Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

(MMPA) not to harm, harass or threaten any marine mammal. The handbook goes further and provides guidance that reiterates the prohibitions in 50 CFR 222.31.

d. For these reasons, the possibility of a collision with a whale is remote. The small boats are highly maneuverable and able to avoid any interaction with whales while operating in and around the Hawaiian Islands. To the extent that humpback whales detect special operations craft, the effect would be very minor and transitory.

7. Salvage Operations and Towing (Within the 100 Fathom Isobath). Operations involving salvage operations and towing pose a very low risk of potentially harmful effects on humpback whales, direct, indirect or cumulative. Navy towing and salvage operations have been conducted in Hawaiian waters for many years without any apparent effect on humpback whales.

a. Towing operations are similar to those conducted by commercial towing companies between the islands, but are undertaken far less frequently and rarely involve long tows. The primary potential for harming humpback whales during towing and salvage operations is from collision between the towing ship or the tow and a humpback whale. The chances of that occurring are very slight. The Navy conducts relatively few towing operations in Hawaiian waters. Virtually all surface vessels are required to be capable of taking another vessel under tow, but this is a secondary mission for all but tugs and salvage ships and typically is practiced on a fairly infrequent basis. Even during such practice exercises, once the towing rig is in place and the tow is underway, the exercise is essentially complete and is broken off. Navy salvage ships and tugs may also conduct towing for exercise or operational reasons, but this also is relatively infrequent.

b. During towing, there is only a very slight chance of collision with a humpback whale. Towing takes place at slow speeds, usually under ten knots. Although towing ships have reduced maneuverability, the low speed should allow humpback whales, which are capable of swimming at 20 knots for short distances, adequate opportunity to avoid the ship and the tow. Navy salvage ships and tugs are diesel-powered and should be easily detectable by a whale.

c. For most ships, towing is an unusual event and the bridge watch and lookout positions will be manned by the most experienced crew members.

d. Salvage operations and exercises are directed at saving life or equipment, or clearing an area of damaged equipment. This could include refloating a damaged ship or clearing it from a channel. This can include such things as refloating a grounded ship, raising a submerged aircraft, removing the crew from a sunken submarine or fighting a fire aboard another ship. Many of these operations are conducted at anchor, minimizing the potential for collision. Some salvage operations may have to be practiced in shallow water. While salvage operations are being actively prosecuted, there may be lines, cables, extra anchors and floats deployed. Portable pumps may be put aboard a stricken vessel. During firefighting drills, saltwater and firefighting agents may be used and then discharged. Salvage operations and exercises are very carefully

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planned so that safety remains paramount. They are conducted in a careful, professional way because rarely are two exercises the same. If a humpback whale were to approach a salvage exercise, protective action as appropriate to the situation would be taken.

e. Additionally, commanding officers have been directed to avoid harming humpback whales and will take appropriate corrective action. Chief of Naval Operations Instructions, Operational Orders from the Third Fleet Commander and a handbook from Commander Naval Surface Group Middle Pacific (Hawaii area) reiterate the requirements of the Marine Mammal Protection Act (MMPA) not to harm, harass or threaten any marine mammal. The handbook goes further and provides guidance that reiterates the prohibitions in 50 CFR 222.31.

8. Transit Operations Between Operations Areas. (Outside 100 Fathom Isobath). The risk of harm to humpback whales during surface ship transits is very small. The greatest potential risk is that of collision. In the many years of Navy operations in Hawaiian waters, the Navy is unaware of any collision between a Navy ship and a humpback whale.

a. Depending on the angle of incidence, speed and depth, a collision with a ship could injure or kill a whale. The potential for such a collision with a Navy ship transiting between operations areas, however, is extremely remote for a number of reasons. First, surface ships conduct most operations at moderate speeds (ten to 15 knots) for reasons of fuel economy. Given the ability of humpbacks to attain speeds of twenty knots, whales are able to avoid collision. Second, the watch section for a surface ship, even during routine steaming, is robust compared with many commercial vessels. The Navy has specific training standards for both lookouts and bridge watchstanders. Personnel are specifically trained in the use of binoculars and specific techniques to maximize their ability to sight whales so that evasive action can be taken. Typically a surface ship will have three lookouts and two officers conducting visual searches. Additional lookouts are often posted in shallow water or proximity to the coast. Most Navy ships are also highly maneuverable and during most evolutions are able to maneuver, radically if necessary, to avoid collision.

b. A less serious potential effect involves disturbing or changing the behavior pattern of a humpback whale in a way that would harm a humpback whale. As addressed above, the lack of collisions between Navy ships and humpback whales may be due in part to the whales' decisions to detect and avoid surface ships - a reaction that does not harm the whale. Because Navy ships are not trying to approach or follow whales, these essentially random interactions are brief and unlikely to harm whales because of the small areas effected, the relatively short time frames involved and the relatively few surface ships at sea in the Hawaiian area at any one time - even during major exercises. During the last RIMPAC exercise, only one whale (of undetermined species) was even detected during the entire exercise.

c. Additionally, commanding officers have been directed to avoid harming humpback whales and will take appropriate corrective action. Chief of Naval Operations

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Instructions, Operational Orders from the Third Fleet Commander and a handbook from Commander Naval Surface Group Middle Pacific (Hawaii area) reiterate the requirements of the Marine Mammal Protection Act (MMPA) not to harm, harass or threaten any marine mammal. The handbook goes further and provides guidance that reiterates the prohibitions in 50 CFR 222.31.

9. Towing Operations. (Outside 100 Fathom Isobath). Towing operations outside the 100 fathom isobath are essentially similar to towing within the 100 fathom isobath. As with inshore towing, towing further to sea poses a very low risk of potentially harmful effects on humpback whales, direct, indirect or cumulative. Navy towing and salvage operations have been conducted in Hawaiian waters for many years without any apparent effect on humpback whales.

a. Towing operations are similar to that done by commercial towing companies between the islands, but are undertaken far less frequently and rarely involve long tows. The primary potential for harming humpback whales during towing and salvage operations is from collision between the towing ship or the tow and a humpback whale. The chances of that occurring are very slight. The Navy conducts relatively few towing operations in Hawaiian waters. Virtually all surface vessels are required to be capable of taking another vessel under tow, but this is a secondary mission for all but tugs and salvage ships and typically is practiced on a fairly infrequent basis. Even during such practice exercises, once the towing rig is in place and the tow is underway, the exercise is essentially complete and is broken off. Navy salvage ships and tugs may also conduct towing for exercise or operational reasons, but this also is relatively infrequent.

b. During towing, there is only a very slight chance of collision with a humpback whale. Towing takes place at slow speeds, usually under ten knots. Although towing ships have reduced maneuverability, the low speed should allow humpback whales, which are capable of swimming at 20 knots for short distances, adequate opportunity to avoid the ship and the tow. Navy salvage ships and tugs are diesel-powered and should be easily detectable by a whale.

c. For most ships, towing is an unusual event and the bridge watch and lookout positions will be manned by the most experienced crew members. Additionally, commanding officers have been directed to avoid harming humpback whales and will take appropriate corrective action. Chief of Naval Operations Instructions, Operational Orders from the Third Fleet Commander and a handbook from Commander Naval Surface Group Middle Pacific (Hawaii area) reiterate the requirements of the Marine Mammal Protection Act (MMPA) not to harm, harass or threaten any marine mammal. The handbook goes further and provides guidance that reiterates the prohibitions in 50 CFR 222.31.

<u>**SURFACE OPERATIONS - CATEGORY II**</u>

1. Engineering, Navigation, Seamanship and General Warfare-Related Training Exercises (Outside 100 Fathom Isobath).

Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

a. General. Surface ships routinely conduct a variety of training exercises virtually whenever they are underway to train crewmembers how to operate assigned equipment, to work together as a team, to train ships to work together and to hone individual skills. These general exercises are often referred to as type training. Surface ships also conduct general warfare-related exercises involving groups of ships, submarines and aircraft in a simulated combat environment to train and test command and control, tactics, strategy and equipment. General warfare-related training exercises include phases devoted to particular warfare areas like anti-surface warfare (ASUW), anti-air warfare (AAW), amphibious warfare and minewarfare.

b. Training Conducted.

i. Proficiency training. Most type training involves drills that are internal to one ship while it is conducting other tasks. Engineering drills involve exercising the ship's propulsion and auxiliary systems in a variety of configurations to train personnel in casualty control procedures and test equipment. Engineering drills can result in changes to ship's course and speed and some engineering tests require the ship to maintain a particular speed for a specific period of time. Ships also conduct damage control drills in which they simulate controlling the effects of fire, flooding and explosive damage that could be received in combat. These drills normally have no effect outside the ship. Navigation and seamanship involve drills on fixing the position of the ship, maneuvering (including formation steaming), launch and recovery of boats, communications and launch and recovery of helicopters and aircraft. These drills require the ship to maneuver at various courses and speeds and during man-overboard drills, to put smoke markers into the water.

ii. Transiting Battle Groups and Surface Action Groups. Battle groups transiting the Hawaiian Islands conduct training in engineering, seamanship and general warfare-related tasks in the course of normal steaming. The presence of other ships enhances the opportunity for maneuvering and communications exercises. Battle groups deploying from the eastern Pacific to the Far East, numbering four to seven ships, pass the Hawaiian Islands area three to four times each year and likely will conduct this training.

iii. RIMPAC and Major Exercises. Ships conduct training in engineering, seamanship and general warfare-related tasks during major exercises. The increased number of ships and the presence of foreign navies enhances the opportunity for some aspects of this type of training, including formation steaming, communications and launch and recovery of aircraft. One example of a major exercise is RIMPAC, the major exercise conducted in the Hawaiian area on a regular basis. RIMPAC is conducted every two years in the summer months. RIMPAC is a significant military and international event. For example, RIMPAC 1994 involved over 25,000 soldiers, sailors, coastguardsmen, airmen and marines. Over fifty ships, nine submarines and 200 aircraft from five nations participated. It is designed to improve coordination and interoperability of combined, joint and bilateral forces in maritime, theater and littoral operations. RIMPAC can last up to 14 days, although much of that time is spent at distances considerably remote (i.e., over 150 miles) to the Hawaiian Islands. The amount of time spent within 150 miles of the Hawaiian islands depends on the exercise scenario. Because of the recent emphasis on littoral warfare and the threat of submarines adapted to coastal operations, recent scenarios

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typically include amphibious operations and the ASW operations necessary to conduct them safely. During RIMPAC 1994, over 50 ships conducted engineering, seamanship and general warfare-related training virtually continuously during the exercise.

c. Location of Training. This training takes place virtually all around the Hawaiian Islands, although most type training occurs in the operations areas south of Pearl Harbor. Because of Hawaiian geography, most of this training occurs outside the proposed sanctuary boundaries and outside the 100 fathom isobath.

d. Potential Effects on Humpback Whales and Mitigation. There is almost no additional potential effects on humpback whales apart from the very low risk of collision with a ship. In the many years of Navy operations in Hawaiian waters, the Navy is unaware of any collision between a Navy ship and a humpback whale.

i. The most serious potential direct effect of surface ship operations, including training in engineering, seamanship and general warfare-related tasks, is collision of a ship and a whale. Depending on the angle of incidence, speed and depth, such a collision could injure or kill a whale. The potential for such a collision, however, is extremely remote for a number of reasons. First, surface ships conduct most operations at moderate speeds (ten to 15 knots) for reasons of fuel economy. Given the ability of humpbacks to attain speeds of twenty knots, whales are able to avoid collision. Second, the watch section for a surface ship, even during routine steaming, is robust compared with many commercial vessels. The Navy has specific training standards for both lookouts and bridge watch-standers that trains personnel in the use of binoculars and specific techniques to maximize their ability to sight whales so that evasive action can be taken. Typically a surface ship will have three lookouts and two officers conducting visual searches. Additional lookouts are often posted in shallow water or proximity to the coast. Most Navy ships are also highly maneuverable and during most evolutions are able to maneuver, radically if necessary, to avoid collision.

ii. A less serious potential effect involves disturbing or changing the behavior pattern of a humpback whale in a way that would harm a humpback whale. As addressed above, the lack of collisions between Navy ships and humpback whales may be due in part to the whales' decisions to detect and avoid surface ships - a reaction that does not harm the whale. Because Navy ships are not trying to approach or follow whales, these essentially random interactions are brief and unlikely to harm whales because of the small areas effected, the relatively short time frames involved and the relatively few surface ships at sea in the Hawaiian area at any one time - even during major exercises. During the last RIMPAC exercise, only one whale (of undetermined species) was even detected during the entire exercise.

2. Replenishment Operations Underway (Outside 100 Fathom Isobath).

a. General. To allow extended operations at sea, surface ships conduct underway replenishment. Fuel, food, weapons, and other supplies are transferred from logistic support ships to operating forces. Replenishment can be conducted as ships steam alongside or by means of vertical replenishment by helicopter. In normal replenishment

Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

alongside, the ships steam on parallel courses at the same speed and maintain a separation of 120 - 140 feet. This is a demanding evolution, requiring precise shiphandling and quick reaction in case of equipment casualties. Once in position, the ships pass lines and rig hoses or tensioned wires for transfer of fuel or palletized supplies. Personnel can also be exchanged by this means. In vertical replenishment, a helicopter is used to move pallets of cargo from the supply ship to the customer, usually by means of a sling underneath the helicopter. Both alongside and vertical replenishment can be conducted simultaneously and a supply ship can service two customers at once. While engaged in replenishment, the ships hold course and speed to facilitate station-keeping and have very reduced maneuverability. Replenishment is ordinarily conducted at between ten and fifteen knots. Underway replenishment involving the actual transfer of fuel is conducted at least 50 miles from land.

b. Training Conducted.

i. Proficiency Training. Because of the need for precise shiphandling and rapid handling of lines and rigging under considerable tension, surface ships practice underway replenishment on a regular basis, even when no actual supplies are exchanged.

ii. Transiting Battle Groups. Battle groups transiting the Hawaiian Islands may occasionally conduct underway replenishment within 150 miles of the Hawaiian Islands, but this would be rare.

iii. Major Exercises. Ships engaged in major exercises like RIMPAC routinely must conduct underway replenishment to complete the exercise. Destroyer-type ships refuel approximately every three days and conduct other replenishment every ten days. Even if not strictly required logistically, major exercises routinely include underway replenishment phases to allow training with ships of foreign navies. During RIMPAC 1994, over 50 ships conducted underway replenishment throughout the 14 days of the exercise.

c. Location of Training. This training takes place virtually all around the Hawaiian Islands, although most type training occurs in the operations areas south of Pearl Harbor. Because of the restricted maneuverability of ships during underway replenishment, these operations ordinarily take place in open water outside the 100 fathom isobath. Where fuel is transferred, the replenishment is at least 50 miles from land.

d. Potential Effects on Humpback Whales and Mitigation. There are almost no additional potential effects on humpback whales apart from the very low risk of collision with a ship. The overall risk of collision is described above on page 8.

i. The risk of collision with a humpback whale during underway replenishment is affected by several factors. The risk is somewhat increased because once alongside, the maneuverability of ships conducting underway replenishment is reduced. On the other hand, underway replenishment takes place at moderate speeds and steady courses, allowing a humpback whale to avoid collision. Lookouts are also increased during such evolutions because of the reduced maneuverability. Replenishment of fuel is also conducted 50 miles from land. Finally, the Navy has used active sonar at zero elevation

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and low power to alert a whale spotted ahead of a group of replenishing ships. The whale left the area. In the many years of Navy operations in Hawaiian waters, the Navy is unaware of any collision between a Navy ship and a humpback whale during underway replenishment.

ii. There is no real risk to the humpback whale from a fuel spill during underway replenishment. Equipment and procedures are designed to avoid any spill and in practice, spills are very rare. Even were spills do occur, Navy standard fuel is a fairly light petroleum product that quickly dissipates and evaporates.

iii. Helicopters involved in vertical replenishment shuttle between ships at low altitudes - under 200 feet. These flights, however, cover fairly short distances between ships that are underway. It is highly unlikely they would overfly an unalerted whale. Any effect would be very transitory.

3. Anti-Submarine Warfare (ASW) Operations (Within and Outside 100 Fathom Isobath).

a. General. Antisubmarine warfare remains one of the key roles for Navy surface forces, requiring constant crew training and equipment maintenance. Submarines pose some of the most pressing threats to the ability of Naval forces to carry out missions directed by the President anywhere in the world.

i. Surface ASW operations, while described separately here, are necessarily closely related to air and submarine ASW operations. Surface ASW ships, i.e., cruisers, destroyers and frigates, frequently carry embarked helicopters that work with the surface ship. Surface ships also work with medium and long range patrol aircraft in combined tactics to detect, track and attack submarines. ASW training by surface ships also involves submarines, usually as targets but also during coordinated surface/submarine ASW.

ii. Surface ships practice ASW by using a variety of sensors, but primarily active and passive sonars, to locate and track submarines or remotely controlled targets that simulate submarines. To optimize sonar performance, expendable bathythermographs (XBT) are deployed to measure water temperatures at various depths. XBTs are small canisters that are released from the ship and sink to the bottom, trailing a thin metal wire to transmit information on water conditions back to the ship. The information is used to predict sonar performance. XBTs are also used for environmental studies. Once the information is received (a few minutes), the wire is cut and sinks to the bottom. Once the submarine or target is tracked by passive or active sonar, the ship simulates or actually launches weapons to attack the target. Most surface ship sonars are hull-mounted, but some surface ships tow a long sonar passive array. Exercise weapons consist of ship-launched ASW torpedoes with inert warheads. Most exercise torpedoes are designed to be recovered upon completion of the exercise, either by the ship itself or a dedicated recovery craft.

iii. Surface ship ASW operations include a range of activities. Such operations include routine maintenance and basic operator training, single ship training with

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a target submarine under controlled conditions (the equivalent of a "scrimmage" in sports) and complex, free-ranging multi-ship exercises. In the Hawaiian area, surface ship ASW operations are conducted both inside and outside the 100 fathom isobath.

b. Training Conducted.

i. Proficiency Training. Basic proficiency training is conducted by individual ships or small groups of ships. Most proficiency training involves ships homeported in Pearl Harbor, although some proficiency training is also conducted by ships in transiting battle groups described below. Proficiency training is necessary to achieve satisfactory levels of equipment readiness, individual training and teamwork to allow more advanced training to take place and for ships to deploy to forward locations ready to perform their missions. Surface ships like cruisers, destroyers and frigates are engaged in ASW proficiency training in the Hawaiian Islands area year round. Surface ships stationed in Hawaii conduct approximately 20-25 days underway for training in local waters in each quarter, a significant portion of which is devoted to ASW training.

ii. Transiting Battle Groups. Battle groups deploying from the eastern Pacific to the Far East receive ASW training when they pass through the Hawaiian Islands area. Battle groups of four to seven ships pass through Hawaiian waters three to four times each year. Three to four of the ships will participate in ASW training while in Hawaiian waters, lasting several days.

iii. Major Exercises. Major exercises typically involve components from all the armed services and the armed forces of other nations. Major exercises can include over 50 ships and 10 submarines plus associated aviation units and Marine units. Many of the ships have an ASW mission and most exercise scenarios include at least some ASW training. Major exercises differ from proficiency training and more structured training in that they must emphasize significant free play where units are able to maneuver realistically over a broad area to achieve their mission, as would forces in the event of actual conflict. Major exercises are also used to evaluate the effectiveness of current tactics and to develop new tactics.

(1) RIMPAC. The extent and importance of RIMPAC has previously been explained on page 7. RIMPAC 1994 devoted considerable time and resources to anti-submarine warfare in light of the threat that submarines would pose to forces friendly to the United States in most foreseeable scenarios. RIMPAC 1994 involved 30 surface ships conducting ASW and nine submarines either conducting ASW or serving as opposing forces. A significant number of the aircraft involved were also devoted to ASW.

(2) Other Major Exercises. Other major exercises are conducted periodically with the armed forces of one or more nations. These have included exercises with the Japanese, Australian and Canadian navies and an exercise with the Russian Navy will take place this summer. ASW is typically included in such exercises, depending on the units involved.

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

c. Location of Training. Surface ships often energize their sonar to conduct basic ASW training and equipment maintenance while underway. More formal ASW training is conducted on the various ranges and restricted areas around the Hawaiian Islands. Apart from PMRF and major exercises, surface ships conduct ASW training on approximately 50 - 70 days per year in designated warning areas and ranges around Hawaii. Of those exercises, approximately ten percent occur within the 100 fathom isobath. Approximately five percent occur in warning areas a small portion of which fall within the sanctuary. Most exercises involving the launch of an exercise torpedo occur on the BARSTUR range under range control of PMRF, outside the 100 fathom isobath and well clear of the proposed sanctuary boundaries. Surface units conduct ASW training at PMRF approximately 35 - 45 days each year and were scheduled to expend approximately 35 - 45 lightweight ASW torpedoes over the same period. Transiting battle groups also conduct ASW training along their track, which typically lies at least 25 miles north of Kauai while westbound. Eastbound battle groups often make a port call at Pearl Harbor and ASW operations may be conducted enroute to Pearl Harbor or upon departure. Major fleet exercises are typically conducted over 50 miles from any island, but include portions close to land to simulate passage through straits or amphibious operations. ASW training during these phases must include shallow water operations, and is conducted at Penguin Banks, off PMRF or at the HATS range near Kahoo'lawe. For example, during RIMPAC 1994, although most ASW training occurred outside the 100 fathom isobath, thirty surface ships conducted ASW training in Auau Channel between Maui and Lanai and again in the channel between Kaula Rock and Niihau for two days.

d. Potential Effects on Humpback Whales and Mitigation. The potential for adverse effects on humpback whales from surface ASW operations is very remote because of a combination of the nature and intensity of the operations themselves, the equipment and mitigation procedures.

i. The most serious potential direct effect of surface ship ASW training on humpback whales is collision of a ship and a whale. Depending on the angle of incidence, speed and depth, such a collision could injure or kill a whale. The potential for such a collision, however, is extremely remote for a number of reasons. First, surface ship ASW operations are generally conducted at low to moderate speeds (five to fifteen knots) because speed quickly degrades sonar performance, whether active or passive. Given the ability of humpbacks to attain speeds of twenty knots, whales are able to avoid collision. Second, during ASW operations surface ships stress an aggressive posture by lookouts to an even greater extent than usual because of the importance of being able to detect periscopes and other visual indications of submarines. Typically a surface ASW ship will have three lookouts and two officers conducting visual searches that would detect surface whale activity and allow maneuvering to avoid collision. Additional lookouts are often posted in shallow water or proximity to the coast. Some ASW ships supplement lookouts equipped with binoculars with electrically-enhanced optics (essentially sophisticated television cameras) that permit search and identification beyond normal visual ranges. ASW-capable ships are also highly maneuverable and during most evolutions are able to maneuver, radically if necessary, to avoid collision. Third, while conducting active sonar searches, surface ASW ships should be readily detectable by humpbacks. Fourth, while conducting passive sonar searches, and to a lesser degree during active sonar searches,

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surface ships can detect the presence of vocalizing humpbacks, allowing them to alert lookouts and the bridge watch and increase the ability to avoid collisions. As a result of these factors, despite having conducted surface ASW ship operations in Hawaiian waters for years, the Navy is unaware of any collisions between a Navy surface ship and a humpback whale.

ii. A less serious potential effect involves disturbing or changing the behavior pattern of a humpback whale in a way that would harm a humpback whale. As addressed above, the lack of collisions between Navy ships and humpback whales may be due in part to the whales' decisions to detect and avoid surface ships - a reaction that does not harm the whale. Because Navy ships are not trying to approach or follow whales, these essentially random interactions are brief and unlikely to harm whales because of the small areas effected, the relatively short time frames involved and the relatively few surface ships at sea in the Hawaiian area at any one time - even during major exercises. During the last RIMPAC exercise, only one whale (of undetermined species) was even detected during the entire exercise.

iii. The use of active sonar during surface ship ASW operations also could be detected by humpback whales but is unlikely to harm them directly or indirectly. Cruisers and destroyers typically employ the SQS-53 sonar for active searching. The SQS-53 transmits at between 3 and 4 kilohertz.. Frigates typically employ the SQS-56 sonar for active searching. The SQS-56 transmits at between 6.5 and 8.5 kilohertz and are of short duration. Sonar signals are pulsed, not continuous. The strength of the signal is attenuated quickly as the range from the ship increases so that even using extremely conservative standards, divers are permitted to work submerged, even in confined harbors, as long as they are more than 600 yards from the SQS-53 sonar. The SQS-56 sonar is considerably less powerful. Lower power levels are often used in shallow water (under 100 fathoms). The sonar beam can be focused in different directions rather than being omnidirectional. The area where sound levels exceed other naturally-occurring sounds is relatively small, the duration is limited and the speed of advance allows avoidance. Active sonars, directed straight ahead at zero depression and low power, have been successfully used as a "horn" to alert whales to an approaching ship. Passive sonars, including towed arrays, pose no risk to humpback whales.

iv. The potential for any harm to humpbacks from exercise torpedoes used during surface ASW training is also remote. Exercise torpedoes are fired under very controlled circumstances that involve range clearance procedures to ensure that whales are not present. These involve at a minimum a detailed visual search of the range from the ship, supplemented by passive sonar information. They are frequently supplemented by air reconnaissance flown by helicopters when available to further ensure the range is clear. Torpedoes are not fired until the range is clear. Most torpedo firings occur at PMRF outside the 100 fathom isobath. PMRF strictly controls weapons firings and does not permit an exercise to proceed until the range is declared "clear" after consideration of inputs from ships' sensors, visual surveillance of the range from aircraft and range safety boats, radar data, acoustic information from a comprehensive system of sensors and surveillance from shore. The exercise can be modified as necessary to obtain a clear range or is canceled.

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

v. Even if humpback whales were on the range, the risk to them is very low. Torpedoes used by surface ships (or their embarked helicopters) do use active sonar to locate targets, but at frequencies that are even higher than surface ships and at less power. Exercise torpedoes are programmed to search within a fairly limited area for 6 - 8 minutes. After their fuel is expended, they are recovered. Exercise torpedoes carry only inert warheads and will not explode. Even though they are inert, exercise torpedoes are set to miss the target to avoid mechanical impacts. On rare occasions, less than one per year, torpedoes with explosive warheads (warshots) are fired for test and evaluation. Such test and evaluation exercises, are even more carefully controlled in order to ensure safety and obtain valid data. Given their tight control and the infrequent conduct of shots involving warshots, the risk to humpback whales is extraordinarily remote.

vi. In addition to the specific mitigation measures discussed above, a number of general mitigation measures help ensure that the risk of a harmful effect on humpbacks is extremely low. Since 1990, Commander Naval Surface Group, Middle Pacific (COMNAVSURFGRUMIDPAC), who is responsible for the operations of surface ships in the Hawaii area when they are not working directly for Commander Third Fleet, has published The Shipboard Environmental Coordinator's Guide to Environmental Compliance. That guide informs ships of the NMFS prohibition on approaching humpback whales. Also, all Navy ships calling on Hawaiian ports are advised of key natural resource issues, including precautions regarding whales, in the reply to their request for a berth. Because this anticipates the actual date of arrival by approximately two days, the ships are advised of humpback precautions well before they approach Hawaii. Commander, Third Fleet Operation Order 201 (COMTHIRDFLT OPORD 201), a basic reference for commands planning or conducting operations from just east of Guam to the West Coast of the United States, describes the sanctuary and the prohibition on taking marine mammals. This ensures that protection of the humpback whale is officially considered during the planning and conduct of operations, including surface ship ASW operations.

vii. Given the nature of ASW operations and the locations where they take place, even if there are minor direct effects, they are temporary, localized and unlikely to result in either indirect or cumulative effects.##

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

4. Amphibious Warfare Operations.

a. General. Amphibious warfare operations encompass activities or events that support power projection of naval forces in the littoral region. They include all activities necessary to conduct reconnaissance on a hostile beach, to insert troops, vehicles and necessary equipment and supplies over or onto a hostile beach and to support the landing force once it is ashore. Amphibious landings are recognized as one of the most complex of military operations because of the number of different units involved, the potential effect of natural conditions and the vulnerability (in war) of the landing force during its approach to the beach. Thus careful, intense training is required to maintain the ability to conduct these operations safely and effectively.

LCAC comes ashore

i. Amphibious operations necessarily include operations involving submarines, surface forces and air support. The potential effects of special operations involving swimmers and small boats, whether delivered by surface ships or submarine, are covered in the description of Category I activities at pages 3 and 32. Insertion of special forces or USMC Reconnaissance units from helicopters are covered in the Category II discussion of air activities at page 48. Amphibious operations also include extensive low level helicopter flights, which are principally discussed in the air operations section. This discussion focuses on the activities of the ships and associated aircraft involved with training to move forces ashore. Forces are transported ashore by means of Armored Amphibious Vehicles (AAV), Landing Craft Air Cushioned (LCAC) and small boats such as Zodiacs or Boston Whalers. Some Landing Craft Utility (LCU) or Lighter Amphibious Resupply Cargo (LARC) may also be used to move supplies to the beach. Attack helicopters or VSTOL aircraft like the AV-8B Harrier are launched from surface ships that make up the amphibious group to provide close air support for the troops on the beach and to provide additional security for the amphibious area of assault.

ii. Surface ships such as LHAs, LPDs, LHDs, LSTs and LSDs maneuver from the sea to a position three to five miles from the objective area and discharge the transport vehicles with personnel embarked. Most major surface amphibious ships have "well decks" that are normally dry but that can be flooded when the ship ballasts down. Well decks are flooded to make it easier to launch and recover the smaller amphibious craft that actually carry troops and equipment ashore. The ship pumps the water out of the ballast tanks to raise the well deck back out of the water. Landing craft are disembarked either while the

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

ship is at anchor or while it is underway at slow speed. LSTs may beach themselves to permit equipment to drive directly onto the shore.

iii. Once launched, the landing craft proceed to the beach. LCACs and AAVs may proceed beyond the beach. In addition helicopters are used to transfer personnel and supplies from ship to shore and for fire support. Minesweeping is conducted to clear channels to the beach for the assault craft using a variety of systems. Some minesweepers tow mechanical and electromagnetic sweeping gear that cuts moored mines loose or detonates influence mines. Others minesweepers tow sonar transducers or operate remotely operated vehicles to locate and neutralize mines. Marine mammal systems may also be deployed from small boats to locate mines. Helicopters involved in these movements often fly at 500 feet or below. Fixed wing aircraft, including conventional aircraft and the vertical takeoff AV-8B conduct both reconnaissance operations and close air support. Close air support involving simulated strafing and weapons delivery or actual delivery of inert weapons is frequently conducted below 1000 feet.[1]

b. Training Conducted

i. Proficiency Training. Training at Bellows Air Force Station includes basic proficiency training where Marine Corps units conduct amphibious training to qualify equipment operators and work on tactics. AAVs transit from MCAS Kaneohe and conduct mock assaults on the beach. They may also be accompanied by Zodiacs or Boston Whalers and by helicopters if available. These exercises are fairly basic and are structured to focus on a few tasks at a time. In these exercises, specific tasks such as proceeding through the channel or navigating the surf may be repeated as necessary to develop the required skill levels. If an amphibious ship is available in the area, it may be used to practice embarking or disembarking landing craft before or after they run to the beach. Such training goes on year round. Training for AAVs and Zodiacs each occurs twelve to fifteen times per year, and lasts from one to five days. Training with LCACs occurs several times each year, can occur in any season and lasts from one to five days.

ii. Transiting Amphibious Readiness Groups. Occasionally Amphibious Readiness Groups transiting near the Hawaiian Islands on their way to deployment in the Western Pacific conduct mock assaults either at Bellows or PMRF. Such assaults are conducted in a more comprehensive, realistic matter and involve the coordinated use of aircraft, minesweepers and other units required for an actual amphibious assault. These can occur up to several times per year, depending upon deployment schedules.

iii. RIMPAC. The overall scheme of RIMPAC has been discussed previously at page 7. RIMPAC 1994 included an amphibious segment involving six major amphibious ships. Approximately four landings were made over a four day period at PMRF, MCAS Kaneohe and Bellows. For each day, approximately six LCACs would make approximately ten round trips from ship to shore. Conventional landing craft such as LCUs and LARCs

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[1]The potential impacts of low altitude flights by helicopters or fixed wing aircraft are discussed at greater length starting at page 40.

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

would make approximately four round trips each day. Approximately 30 AAVs would make two round trips each day. Between 15 and 40 Zodiacs or similar small boats would make two round trips each day.

iv. Major Exercises. Major exercises besides RIMPAC may also include an amphibious segment involving a mock assault on the beach. Major exercises include approximately two to six major amphibious ships (not including the supporting gunfire support ships, escorts, supply ships and supporting carriers). For major exercises, dummy minefields using inert shapes may be placed in shallow water. The exercise is conducted generally described as discussed above. The aviation portion is conducted as discussed in the aviation portion of Category II at page 40.

c. Location of training. Amphibious operations are conducted principally at MCAS Kaneohe and Bellows Air Force Station, and occasionally at PMRF. PMRF amphibious operations mainly occur during RIMPAC and major excercises. None of these areas are designated for the sanctuary. AAVs may also enter the water at MCAS Kaneohe and transit to Bellows, generally remaining approximately 1000 yards from shore. In addition, when an amphibious ship is available, mock assaults using LCACs and AAVs launched from the ship also land at Bellows. When Amphibious Ready Groups (ARGs) transit the Hawaiian Islands, they also conduct mock assaults at Bellows or PMRF. Ship-launched assaults are also conducted at PMRF. Because of local geography, amphibious operations in these waters typically involve movement from ships located outside the 100 fathom isobath to the beach. Thus the approach phase and the initial launching of landing craft occurs near or outside the 100 fathom line, but the transit to the beach necessarily enters the 100 fathom contour.

d. Potential Effects on Humpback Whales and Mitigation. The potential that amphibious operations could have harmful effects on humpback whales is extremely small. Despite having conducted amphibious operations in the Hawaiian Islands for decades, the Navy is unaware of any harmful effects on humpback whales.

i. The most serious potential direct effect of amphibious warfare operations on humpback whales is collision of a ship or landing craft and a whale. Depending on the angle of incidence, speed and depth, such a collision could injure or kill a whale. The potential for such a collision, however, is extremely remote for a number of reasons. First, amphibious ships generally conduct operations at low speeds or at anchor. Given the ability of humpbacks to attain speeds of twenty knots, whales are able to avoid collision. The risk of collision between one of the landing craft and a humpback whale is also very slight. Landing craft shuttle back and forth from ship to shore over a relatively short distance so that the area of concern is fairly limited. Even within the area, AAVs, LCUs and LARCs are very limited in speed. AAVs have a top speed under six knots in water and even LCUs are limited to eleven knots.

ii. Some of the other landing and support craft are faster. LCACs are capable of much faster speeds, up to 40 knots, but their hovercraft design minimizes the risk to a humpback if a collision occurs because the LCAC actually rides four feet above the water. LCACs are also highly maneuverable and can avoid whales if sighted. Zodiacs, Boston

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

Whalers and similar small boats can travel at high speed, but given their planing hulls and small size, pose little risk to a humpback whale. Given the risk to the crew of such craft posed by a collision with objects much smaller than a humpback whale, they maintain a close lookout and can avoid whales if they enter the amphibious assault area.

iii. The amphibious area of assault is a very highly controlled area because of the surface and air traffic. The presence of whales would be quickly detected and crews alerted to the hazard.

iv. A less serious potential effect involves disturbing or changing the whale behavior pattern in a way that would harm a humpback whale. As addressed above, the lack of collisions between Navy ships and humpback whales may be due in part to the whales' decisions to detect and avoid amphibious operations. Such operations are localized to a fairly small area, involve large numbers of diesel and turbine-powered small craft that are not optimized for noise reduction and which therefore allow humpback whales to avoid the area. The areas where the operations are conducted are outside the areas designated for the sanctuary, have no known special significance to humpback whales and are in use for only short periods. Even if there is an avoidance reaction, it is transitory. Once the operations are complete, humpback whales can reoccupy even the small area occupied by the exercise. Thus there are no indirect or cumulative effects.

v. In addition to the specific mitigation measures discussed above, a number of general mitigation measures help ensure that the risk of a harmful effect on humpbacks is extremely low. Since 1990, Commander Naval Surface Group, Middle Pacific (COMNAVSURFGRUMIDPAC), who is responsible for the operations of surface ships in the Hawaii area when they are not working directly for Commander Third Fleet has published The Shipboard Environmental Coordinator's Guide to Environmental Compliance. That guide informs ships of the NMFS restrictions on approaching humpback whales.[2] Also, all Navy ships calling on Hawaiian ports are advised of key natural resource issues, including precautions regarding whales, in the reply to their request for a berth. Because this anticipates the actual date of arrival by approximately two days, the ships are advised of humpback precautions well before they approach Hawaii. Commander, Third Fleet Operation Order 201 (COMTHIRDFLT OPORD 201), a basic reference for commands planning or conducting operations from Guam to the West Coast of the United States, describes the sanctuary and the prohibition on taking marine mammals. This ensures that protection of the humpback whale is officially considered during the planning and conducting of operations, including amphibious warfare operations.

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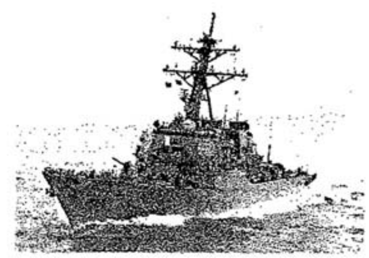
[2]The guide currently reflects approach distances before the recent amendments to the MMPA, but is in the process of being revised.

Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

5. Anti-Surface Warfare Operations (ASUW) (Within and Outside 100 Fathom Isobath).

a. General. Anti-Surface Warfare (ASUW) operations involve a variety of activities designed to allow surface ships to detect, track and destroy other surface vessels, including small boats. It involves equipment maintenance and calibration, ship maneuvering, deployment of countermeasures and firing guns and missiles against simulated targets. Guns used in ASUW range from small caliber machine guns firing solid projectiles up to 5 inch guns firing explosive projectiles. A variety of missiles may be used in an ASUW role, including missiles like Harpoon that is specifically designed for attacking ships. Missiles used for ASUW guide themselves to the target once launched. The simulated targets may be self-deployed inflatable targets, targets towed by other ships or remotely controlled target boats. Finally ships may activate electronic or mechanical equipment or deploy devices to decoy or deceive other surface ships or their weapons. One of those decoys used most frequently is chaff - metallic coated strips or particles that are dispersed in the air to decoy radar-guided missiles. During some exercises, ships will engage in evasive maneuvers at full speed (in excess of 30 knots) to enhance the effectiveness of decoys, avoid simulated incoming rounds and attain firing positions.



DDG-60, one of the Navy's newest destroyers, maneuvers at sea.

b. Training Conducted

i. Proficiency Training. Ships conduct basic drills to train the crew in the use and maintenance of their equipment. This starts at a basic level of familiarization with operation of equipment and proceeds through complex drills designed to train a crew to achieve combat readiness in a realistic environment. Gunnery and missile exercises are also conducted to calibrate, align and otherwise improve the performance of a weapons system. Most proficiency training is conducted in the vicinity of a ship's homeport. Approximately fifteen to eighteen ships are routinely homeported at Pearl Harbor. Three to six are deployed to the Western Pacific at any given time. In addition, surface ships from other nations periodically visit Pearl Harbor and frequently conduct ASUW training while in the area. Approximately five to ten foreign surface ships visit annually unrelated to a major exercise. Surface ships practice the detection and tracking portions of ASUW anytime they are at sea. Surface ships homeported in the Hawaii area typically spend approximately 20 to 25 days underway for training each quarter.

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

ii. Transiting Battle Groups. Transiting battle groups also conduct ASUW training along their track, which typically lies at least 25 miles north of Kauai while westbound. Eastbound battle groups often make a port call at Pearl Harbor and ASUW operations may be conducted enroute to Pearl Harbor or upon departure, depending upon the availability of services. Four to five ships visit Pearl Harbor every three months. Surface combatants deploying to the Middle East receive advanced ASUW training at PMRF and in the operations areas east of Hawaii three times a year.

iii. Major Exercises. Major exercises typically involve components from all the armed services and the armed forces of other nations. Major exercises can include over 50 ships and 10 submarines plus associated aviation units and Marine units. Virtually all surface ships have a ASUW mission and most exercise scenarios include at least some ASUW training. Major exercises differ from proficiency training and more structured training in that they must emphasize significant free play where units are able to maneuver realistically over a broad area to achieve there mission, as would forces in the event of actual conflict. Major exercises are also used to evaluate the effectiveness of current tactics and to develop new tactics. However even in major exercises, the conduct of actual gunnery or missile exercises is tightly controlled.

(1) RIMPAC. The general nature of RIMPAC has been previously described at page 7. RIMPAC typically includes portions devoted to ASUW. ASUW operations during RIMPAC can last the full length of the exercise (14 days). The ASUW portion includes detection phases where adversaries try to hide near or behind islands as well as gunnery and missile exercises. For example, during RIMPAC 1994, 38 surface ships conducted ASUW operations against mock surface adversaries ranging from cruisers to small boats.

(2) Other Major Exercises. Other major exercises also typically include a portion devoted to ASUW that makes use of the ranges, operations areas and target services available, particularly around Oahu and at PMRF.

c. Location of Training. Operations directed to tracking and detection of surface targets occur anytime a surface ship is at sea. Surface ships spend between twenty to twenty-five days at sea each quarter, but this tempo can increase depending on the international situation and funding.

i. Gunnery and missile exercises in the vicinity of the Hawaiian Islands must occur in one of the designated operating areas. Areas are assigned and the drills are conducted so that the fall of shot occurs within the assigned area. Surface gunnery, even involving small arms, very rarely occurs in an operation area that includes portions within the 100 fathom isobath. Where ship-towed targets are utilized, the time to tow the target to the operating area is a significant factor in selecting a suitable operating area. All training involving small arms, .50 caliber machine guns and the Phalanx Close-In Weapons System (CIWS) is conducted outside the proposed sanctuary boundaries, most frequently in Warning Area 191 or Warning Area 193, south of Pearl Harbor. These areas are all outside the 100 fathom isobath. Surface gunnery exercises using larger caliber guns are all conducted in operations areas outside the 100 fathom and outside areas proposed for the

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

sanctuary. Excluding exercises at PMRF, most exercises take place in Warning Areas 191 or 192, south of Pearl Harbor. Such surface gunnery exercises occur approximately thirty-five to fifty days each year.

ii. All ASUW gunnery or missile exercises involving remotely controlled target boats occurs in operation areas near PMRF. PMRF is used for such ASUW exercises between 20 to 25 times each year.

d. Potential Effects on Humpback Whales and Mitigation. Gunnery and missile exercises pose few additional risks to whales beyond ordinary ship operations, which are themselves very slight. The risk of harmful effects on humpback whales is remote because of the safety procedures utilized and the very limited area where the weapons used could harm a whale. The Navy has not observed any harmful effects on humpback whales from ASUW operations nor does it anticipate any indirect or cumulative effects.

i. Exercises where ordnance is expended occur in a very controlled environment where safety is paramount. No firing is permitted until after it is determined that the range is clear. In the operating areas near Oahu, the range is visually cleared from the ship, which itself is at an increased level of readiness. Many surface ships have electrically-enhanced optics (essentially sophisticated television cameras) that permit search and identification beyond normal visual ranges. Embarked helicopters are also frequently used to further examine the range to ensure that no other surface craft or whales are present. Each small arms group or each gun (for larger weapons) has a safety observer who ensures that the range is clear before and during the exercise and who can halt the exercise if whales are observed.

ii. The range safety precautions at PMRF are even more rigorous because of the extra sensors available. Exercises involving missiles or target boats are all conducted at PMRF. PMRF strictly controls weapons firings and does not permit an exercise to proceed until the range is declared "clear" after consideration of inputs from ships' sensors, visual surveillance of the range from aircraft and range safety boats, radar data, acoustic information from a comprehensive system of sensors and surveillance from shore. The exercise can be modified as necessary to obtain a clear range or is canceled.

iii. The ordnance used in most gunnery exercises poses a risk to a whale only if the whale were to breach precisely at the point of impact. Small arms, .50 caliber machine guns and the CIWS exclusively fire non-explosive ammunition. Although some grenade launchers fire an explosive round, they have a very limited range (several hundred yards). Thus exercises using these weapons are of little risk. Even larger weapons generally fire inert or non-fragmenting ordnance for training exercises. These rounds pose a risk only at the point of impact. Even on those occasions when regular ammunition is used, rounds up to 5 inches pose a risk to marine mammals only within a very small area because of their size and fuzing.

Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

iv. When missiles are used for ASUW exercises, they are usually fitted with telemetry warheads instead of explosive warheads.[3] Some missiles used for ASUW exercises are primarily designed for use against aircraft and carry relatively small explosive charges. Harpoon missiles do carry warheads of 360 pounds, but burst at or above the surface of the water and pose much less risk to a submerged whale than a similar explosive charge at a greater depth. The area where a whale would be harmed is relatively small and given the elaborate range safety measures and the small number of such weapons used (generally less than ten per year), the risk is extremely small.

v. The risk to humpback whales from target boats at PMRF is very small. The boats themselves are fairly small (approximately fifteen to thirty feet long). They are remotely controlled, highly maneuverable and can be maneuvered to avoid any humpback whales that are detected on the range.

vi. Finally, none of the decoys deployed from ships pose any threat to humpback whales.

6. Anti-Air Warfare (AAW) Operations (Outside the 100 Fathom Isobath).

a. General. Anti-Air Warfare (AAW) operations involve a variety of activities designed to allow surface ships to detect, track and either evade or destroy hostile aircraft or missiles. AAW involves equipment maintenance and calibration, ship maneuvering, deployment of countermeasures, firing guns and missiles against simulated targets and deploying decoys. Guns used in AAW range from .50 caliber machine guns firing solid projectiles through 5 inch guns firing explosive projectiles. A variety of missiles may be used for AAW, including the Standard missile and the Sea Sparrow. Missiles used for AAW guide themselves to the target once launched. Countermeasures, both electronic and mechanical, are also deployed to decoy incoming aircraft or missiles. The most common decoy is chaff - metallic coated strips or particles that are dispersed in the

USS BARRY fires a Standard missile

[3]Telemetry warheads transmit flight characteristics, target detection and fuzing information back to the ground so that the success of the flight can be assessed.

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

air to decoy radar-guided missiles. Flares may also be used. The simulated targets may be sleeves towed by aircraft, drones launched from shore or in very rare cases, starshells fired by a ship.

i. Subsonic target drones are essentially unmanned small aircraft propelled by turbojet engines. Supersonic target drones, which are rocket propelled, are also used. Once the range is clear and declared "green," the drone is launched towards the general vicinity of the ship. For launch, drones may use boosters. The boosters burn out quickly and are jettisoned within moments of launch. The drone will fly a selected missile profile. Depending upon the needed training, the drone's flight path can include high altitude (20,000 to 50,000 feet), low altitude (under 200 feet) or both.

ii. Upon acquiring the target drone, the ship will launch its surface to air missile (SAM). Most but not all SAMs used at PMRF have telemetry warheads and do not explode. Relatively few missiles actually hit a drone. If a missile does hit a drone, the pieces of both fall into the sea. In the rare event that a live warhead is used, the warhead will detonate in close proximity to the target and small pieces of both will fall into the sea. Most missiles that do not strike the target or detonate are destroyed by command and fall in small pieces to the sea. Missiles that are not ordered destroyed assume a ballistic profile and fall into the sea, either intact or in pieces if the sea surface triggers the proximity fuse.

iii. Subsonic target drones are flown by remote control back to the waters nearby PMRF. When the drone runs out of fuel, it is glided onto the water where it floats until a recovery vessel retrieves the drone for reuse. Supersonic drones are not retrievable or reusable. Supersonic drones are lost at sea at the end of their missile profile.

b. Training Conducted

i. Proficiency Training. Ships conduct basic drills to train the crew in the use and maintenance of their equipment. This starts at a basic level of familiarization with operation of equipment and proceeds through complex drills designed to train a crew to achieve combat readiness in a realistic environment. Gunnery and missile exercises are also conducted to calibrate, align and otherwise improve the performance of a weapons system. Most proficiency training is conducted in the vicinity of a ship's homeport. Approximately fifteen to eighteen ships are routinely homeported at Pearl Harbor. Three to six are deployed to the Western Pacific at any given time. In addition, surface ships from other nations periodically visit Pearl Harbor and frequently conduct AAW training while in the area. Approximately five to ten foreign surface ships visit annually unrelated to a major exercise. The extent to which surface ships practice AAW depends on their mission. Many ships have only a limited self-defense capability using CIWS, decoys or Sea Sparrow or other short range missiles. Most cruisers, destroyer and frigates, on the other hand, have larger caliber guns and longer range missiles and will emphasize AAW to a much greater degree.

ii. Transiting Battle Groups. Transiting battle groups also conduct AAW training along their track, which typically lies at least 25 miles north of Kauai while westbound. Eastbound battle groups often make a port call at Pearl Harbor and AAW

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

operations may be conducted enroute to Pearl Harbor or upon departure, depending upon the availability of services. Four to five ships visit Pearl Harbor every three months. Surface combatants deploying to the Middle East receive advanced AAW training at PMRF and in the operations areas east of Hawaii three times a year.

iii. Major Exercises. Major exercises typically involve components from all the armed services and the armed forces of other nations. Major exercises can include over 50 ships and 10 submarines plus associated aviation units and Marine units. Most surface ships have at least a self-defense AAW mission and most exercise scenarios include at least some AAW training. Major exercises differ from proficiency training and more structured training in that they must emphasize significant free play where units are able to maneuver realistically over a broad area to achieve there mission, as would forces in the event of actual conflict. Major exercises are also used to evaluate the effectiveness of current tactics and to develop new tactics. However even in major exercises, the conduct of actual gunnery or missile exercises is tightly controlled.

(1) RIMPAC. The general nature of RIMPAC has been previously described at page 7. RIMPAC typically includes portions devoted to AAW. AAW operations during RIMPAC can last the full length of the exercise (14 days). During RIMPAC 1994, 38 surface ships conducted AAW against aircraft from two carriers. Surface ships also engaged four surface-launched drones.

(2) Other Major Exercises. Other major exercises also typically include a portion devoted to AAW that makes use of the ranges, operations areas and target services available, particularly around Oahu and at PMRF.

c. Location of Training. Although the tracking and detection portion of basic AAW operations may be conducted at virtually any time, realistic training is limited by the availability of aircraft and target services. Surface ships spend between twenty to twenty-five days at sea each quarter, but this tempo can increase depending on the international situation and funding.

i. Gunnery and missile exercises in the vicinity of the Hawaiian Islands must occur in one of the designated operating areas. Areas are assigned and the drills are conducted so that the fall of shot occurs within the assigned area. All AAW gunnery is conducted outside areas proposed for the sanctuary and outside the 100 fathom isobath. Although Phalanx Close-In Weapons System CIWS test firing may occur in Operation Areas 196 and 191, most exercises occur further at sea. Surface ships utilize Operation Areas 192 and 193 approximately 12 - 20 times each year for AAW gunnery exercises.

ii. PMRF Barking Sands is one of only two locations in the entire Pacific and Middle East region that can provide realistic targets and target profiles to defend against real world threats from aircraft and missiles. All missile exercises and all gunnery exercises involving drones occur in operation areas near PMRF, usually operation areas 188 and 186. PMRF is used for such AAW exercises between 85 to 110 days each year. Include in these are approximately 35 to 40 days when drones are launched for AAW exercises. PMRF uses approximately 25 to 30 supersonic drones and 55 to 75 subsonic drones each year.

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

d. Potential Effects on Humpback Whales and Mitigation.

i. AAW exercises, even those involving gunnery and missiles, pose few additional risks to whales beyond ordinary ship operations, which are themselves very slight. The risk of harmful effects on humpback whales is remote because of the safety procedures utilized and the very limited area where the weapons used could harm a whale. The Navy has not observed any harmful effects on humpback whales from AAW operations nor does it anticipate any indirect or cumulative effects.

ii. Many of the AAW exercises conducted involve detection and tracking and do not involve the expenditure of weapons. These exercises are also used to test shipboard sensors and optimize their performance. The only potential for risk of harmful effects to humpback whales is from the drones or aircraft, which fly various profiles.

iii. Exercises where ordnance is expended occur in a very controlled environment where safety is paramount. No firing is permitted until after it is determined that the range is clear. In the operating areas near Oahu, the range is visually cleared from the ship, which itself is at an increased level of readiness. Many surface ships have electrically-enhanced optics (essentially sophisticated television cameras) that permit search and identification beyond normal visual ranges. Embarked helicopters are also frequently used to further examine the range to ensure that no other surface craft or whales are present. Each small arms group or each gun (for larger weapons) has a safety observer who ensures that the range is clear before and during the exercise and who can halt the exercise if whales are observed.

iv. The range safety precautions at PMRF are even more rigorous because of the extra sensors available. Exercises involving the use of drones or missiles are all conducted at PMRF. PMRF strictly controls weapons firings and does not permit an exercise to proceed until the range is declared "clear" after consideration of inputs from ships' sensors, visual surveillance of the range from aircraft and range safety boats, radar data, acoustic information from a comprehensive system of sensors and surveillance from shore. The exercise can be modified as necessary to obtain a clear range or is canceled.

v. The ordnance used in most AAW gunnery exercises poses a risk to a whale only if the whale were to breach precisely at the point of impact. Both .50 caliber machine guns and the CIWS exclusively fire non-explosive ammunition. Thus exercises using these weapons are of little risk. Even larger weapons generally fire inert or non-fragmenting ordnance for training exercises. These rounds pose a risk only at the point of impact. Even on those occasions when regular ammunition is used, rounds up to 5 inches pose a risk to marine mammals only within a very small area because of their size and fuzing. Even five inch rounds contain less than nine pounds of explosives. When missiles are used for AAW exercises, they are usually fitted with telemetry warheads instead of explosive warheads. Even when live warheads are used, the detonation is in the air, posing no risk to whales for most profiles and minimal risk even for very low altitude profiles because of the relatively small explosive charges involved. The only possible risk is in the area immediately beneath the point of detonation.

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

vi. The exacting range clearance procedures of PMRF makes it highly unlikely a whale could enter the range undetected. If, however, one did move onto the range, the effect of a drone passing overhead would be transitory. Given the frequency of drone launches there is no risk of cumulative impacts.

7. Explosive Ordnance Disposal (EOD) and Demolition Operations (Within 100 Fathom Isobath).

a. General. Navy Explosive Ordnance Disposal (EOD) teams conduct a variety of exercises to hone their ability to neutralize ordnance, including ordnance in the marine environment. This is necessary to safely dispose of unexploded ordnance and mines in a combat situation. It involves moving teams to the site of the ordnance by small boat and deploying divers into the water. Once the simulated ordnance is located, EOD teams set off relatively small charges to familiarize personnel with proper procedures and equipment. Although Underwater Demolition Teams (UDT) also use explosives to remove underwater obstacles, such operations occur in Hawaiian waters relatively infrequently.

b. Training Conducted

i. Proficiency Training. Although a variety of EOD training occurs in Hawaii, training involving the use of explosives is relatively rare. In one kind of training, a 20 pound explosive charge is placed on a buoy suspended three fathoms above the bottom in approximately 90 feet of water. A fuze is lit, the divers clear the area and the charge explodes approximately 30 minutes later. Approximately 20 - 30 such shots occur annually, distributed throughout the year. In another exercise, small charges (less than one-quarter pound explosive weight), are exploded to actuate cutters while attached to a quay wall at a depth of 1 fathom. Approximately 50 to 100 such shots occur annually, distributed throughout the year.

ii. Major Exercises. Major exercises often include phases that include explosive ordnance disposal. For example, RIMPAC 1994 included an event involving neutralization of a simulated piece of unexploded ordnance.

c. Location of Training. Although many aspects of EOD training can take place anywhere around the Hawaiian Islands, most training, and all explosive training, is conducted in relative proximity to the West Loch Branch of Naval Magazine Lualualei. An underwater range is located approximately one mile off the beach adjacent to the rifle range at Puulua. The underwater range is outside any area proposed for the sanctuary and well within the 100 fathom isobath.

d. Potential Effects on Humpback Whales and Mitigation. EOD operations pose very little risk of harm to humpback whales. The only training exercises that could pose any risk is the detonation of the 20 pound explosive packs. The precautions taken to ensure a clear range, the limited amount of explosives and the infrequency of the operations reduce this risk to an extremely low level. The range itself is in fairly shallow water. Before any explosive operation, the range is carefully screened visually to ensure that no humpback whales or other intruders are present. When the divers enter the water, they

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Exhibit C-2. Report on Military Activities in Hawaiian Waters (Continued)

MEMORANDUM OF UNDERSTANDING

CONCERNING MILITARY ACTIVITIES AND THE

HAWAIIAN ISLANDS HUMPBACK WHALE NATIONAL MARINE SANCTUARY

1. This memorandum of understanding between the Department of the Navy (DoN) and the National Oceanic and Atmospheric Administration (NOAA), acting on behalf of the Department of Commerce, (Parties) sets forth certain determinations and establishes supplementary procedures for dealing with military activities within or in the vicinity of the Hawaiian Islands Humpback Whale National Marine Sanctuary (Sanctuary). This memorandum is designed to address existing statutory requirements under the Hawaiian Islands National Marine Sanctuary Act, Pub.L. 102–587, §§ 2301–2307 (1992), the National Marine Sanctuaries Act, 16 U.S.C. 1431 et seq., (NMSA), 15 C.F.R. Part 922 and the final regulations for the Sanctuary when issued, and to facilitate implementation of the Sanctuary while protecting the ability of the Department of the Navy to meet its statutory obligations under 10 U.S.C. §§ 5062–63.

2. For several years the Parties have exchanged information on existing classes of military activities within or in the vicinity of the Sanctuary. The DoN has provided NOAA with a description of the classes of existing military activities presently being conducted, both internal and external to the Sanctuary, (Attachment A), which will be appended to the Final Environmental Impact Statement (FEIS) for the Sanctuary management plan. At NOAA's request, DoN has also provided NOAA with its evaluation of the potential that existing classes of military activities may destroy, cause the loss of, or injure any Sanctuary resources. (Attachment B). Pursuant to its responsibilities under the NMSA, NOAA has reviewed the information provided on existing classes of military activities and has determined that they are not likely to destroy, cause the loss of, or injure any Sanctuary resources within the Sanctuary.

3. If DoN learns that an existing military activity has destroyed, caused the loss of, or injured a humpback whale, the applicable DoN point of contact in paragraph 5 below will notify the NOAA point of contact identified in paragraph 5.iv. as soon as is reasonably possible.

4. By this agreement, NOAA and the DoN have completed the consultation required, if any, by NMSA § 304(d) on existing classes of military activities described in Attachments A and B. These existing classes of military activities, therefore, are not subject to further consultation under NMSA § 304(d), unless they are modified such that consultation is required under the final Sanctuary regulations.

5. The Parties agree to cooperate to make consultations as efficient as possible. To this end, they have designated the following principal points of contact for issues arising under this agreement:

i. For all Navy activities: Commander, Naval Base, Pearl Harbor, Hawaii.

Exhibit C-3. Navy/NOAA Memorandum of Understanding Concerning Military Activities and the Hawaiian Islands Humpback Whale National Marine Sanctuary

Memorandum of Understanding Re:
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ii. For all Marine Corps activities: Commander, Marine Forces Pacific.

iii. For NMSA § 304(d) consultations: Protected Species Program Manager, NMFS Southwest Region, Pacific Area Office, Honolulu, Hawaii.

iv. For Sanctuary management matters other than NMSA § 304(d) consultations: Hawaii Sanctuary Manager, Hawaii.

6. The Parties agree to take the steps necessary to expedite any consultation required under the final Sanctuary regulations, particularly those undertaken to address emergency conditions. Upon initiation of consultation by the DoN, the applicable principal points of contact will informally consult at the earliest practicable time, but in no circumstance later than ten working days, to establish a preliminary plan of action and milestones for completing the consultation in an efficient and timely manner, consistent with the requirements of NMSA § 304(d).

7. NOAA recognizes that some or all information regarding DoN activities may be classified in the interest of national security in accordance with applicable Executive Orders and Department of Defense directives. NOAA promptly will obtain cleared personnel and storage space to allow prompt completion of the NMSA § 304(d) consultation process.

8. The Parties agree that if the principal points of contact are unable to resolve differences on a consultation schedule, adoption of alternatives recommended by NOAA or other issues involving DoN military activities within or in the vicinity of the Sanctuary, either agency may seek additional consultation on the matter at a more senior level.

9. Each party understands that it must bear its own costs in connection with the implementation of NMSA § 304(d), applicable Sanctuary regulations and this memorandum.

10. This memorandum is effective upon signature. It may be amended by agreement of the Parties if the Parties determine an amendment is necessary to accomplish the objectives of this memorandum or to comply with applicable law or regulations. The Parties agree to review this memorandum at least every five years. The memorandum may be cancelled by either Party upon sixty days notice. Nothing in this agreement is intended to conflict with any applicable statutory or regulatory requirements. If any of the terms of this agreement are inconsistent with any statutory or regulatory requirements, then those portions of this agreement which are inconsistent shall be invalid; but the remaining provisions not affected by the inconsistency shall remain in full force and effect. Should either the NMSA or its implementing regulations be substantially altered, the Parties agree to revise this agreement as soon as possible to address the changed requirements.

Exhibit C-3. Navy/NOAA Memorandum of Understanding Concerning Military Activities and the Hawaiian Islands Humpback Whale National Marine Sanctuary (Continued)

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11. This is an interagency document designed to ensure expeditious, efficient cooperation among the Parties in the discharge of their responsibilities within the area of the Hawaiian Islands and does not create any independent right enforceable by any third party.

APPROVED

FOR THE DEPARTMENT OF COMMERCE:

Terry D. Garcia — DATE 10/10/95
NOAA General Counsel

Jeffrey R. Benoit — DATE 10/10/95
Director of the Office of Ocean and
Coastal Resources Management

FOR THE DEPARTMENT OF THE NAVY:

Steven S. Honigman — DATE 10/10/95
General Counsel

Attachments

Exhibit C-3. Navy/NOAA Memorandum of Understanding Concerning Military Activities and the Hawaiian Islands Humpback Whale National Marine Sanctuary (Continued)

C.4 Cultural Resources

Cultural resources include prehistoric and historic artifacts, archaeological sites (including underwater sites), historic buildings and structures, and traditional resources (such as Native American and Native Hawaiian religious sites). Cultural resources of particular concern include properties listed in or eligible for inclusion in the National Register of Historic Places (National Register). Section 106 of the **National Historic Preservation Act** (16 U.S.C. 470 et seq.) requires Federal agencies to take into consideration the effects of their actions on significant cultural properties. Implementing regulations (36 CFR 800) specify a process of consultation to assist in satisfying this requirement. To be considered significant, cultural resources must meet one or more of the criteria established by the National Park Service that would make that resource eligible for inclusion in the National Register. The term "eligible for inclusion in the National Register" includes all properties that meet the National Register listing criteria specified in Department of Interior regulations at 36 CFR 60.4. Resources not formally evaluated may also be considered potentially eligible and, as such, are afforded the same regulatory consideration as listed properties. Whether prehistoric, historic, or traditional, significant cultural resources are referred to as historic properties.

Numerous laws and regulations require that possible effects on important cultural resources be considered during the planning and execution of Federal undertakings. These laws and regulations stipulate a process of compliance, define the responsibilities of the Federal agency proposing the action, and prescribe the relationship among other involved agencies (e.g., State Historic Preservation Officer, the Advisory Council on Historic Preservation). In addition to the NEPA, the primary laws that pertain to the treatment of cultural resources during environmental analysis are the National Historic Preservation Act, especially Sections 106 and 110; the **Archaeological Resources Protection Act** of 1979 (16 U.S.C. 470aa-470mm), which prohibits the excavation or removal of items of archaeological interest from Federal lands without a permit; the **Antiquities Act** of 1906 (16 U.S.C. 431); and the **Native American Graves Protection and Repatriation Act** (25 U.S.C. 3001 et seq.), which requires that Federal agencies return "Native American cultural items" to the Federally recognized native groups with which they are associated, and specifies procedures to be followed if such items are discovered on Federal land.

C.5 Hazardous Materials and Waste

Hazardous Materials

The U.S. Department of Transportation defines a hazardous material as a substance or material that the Secretary of Transportation has determined is capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and that has been designated as hazardous under Section 5103 of the Federal hazardous materials transportation law (49 U.S.C. 5103). The term includes hazardous substances, hazardous wastes, marine pollutants, elevated temperature materials, materials designated as hazardous in the Hazardous Materials Table (see 49 CFR 172.101), and materials that meet the defining criteria for hazard classes and divisions (49 CFR 173).

Hazardous Wastes

Solid waste materials are defined in 40 CFR 261.2 as any discarded material (i.e., abandoned, recycled, or “inherently waste-like”) that is not specifically excluded from the regulatory definition. This waste can include materials that are solid, liquid, or gaseous (but contained). Hazardous waste is further defined as any solid waste not specifically excluded which contains specified concentrations of chemical constituents or has certain toxicity, ignitability, corrosivity, or reactivity characteristics.

Federal Regulations

The **Oil Pollution Act** of 1990 required oil storage facilities and vessels to submit to the Federal government plans detailing how they will respond to large discharges. In 2002, however, USEPA amended the Oil Pollution Prevention regulation. The Oil Pollution Prevention and Response; Non-Transportation-Related Onshore and Offshore Facilities; Final Rule (40 CFR 112) requires Spill Prevention, Control, and Countermeasure Plans and Facility Response Plans. These plans outline the requirements to plan for and respond to oil and hazardous substance releases. Chapter 10 (2003) of Chief of Naval Operations Instruction (OPNAVINST) 5090.1B also describes the Navy’s requirements for oil and hazardous substance spills.

The **Clean Water Act** (CWA) prohibits discharges of harmful quantities of hazardous substances into or upon U.S. waters out to 200 nm. Environmental compliance policies and procedures applicable to shipboard operations afloat are defined in OPNAVINST 5090.1B (2002), Chapter 19. These instructions reinforce the CWA discharge prohibition. The Navy’s Consolidated Hazardous Materials Reutilization and Inventory Management Program (CHRIMP) Manual also contains information to provide to the chain of command, afloat and ashore, to assist in developing and implementing hazardous materials management. Hazardous materials on Navy vessels afloat are procured, stored, used, and disposed in accordance with CHRIMP and related guidance.

In 1999, USEPA adopted a final rule intended to establish **Uniform National Discharge Standards** (UNDS) for 25 discharge sources on U.S. military vessels. The rule exempted 14 additional sources (40 CFR Part 1700). Pursuant to this legislation, State and local governments are prohibited from regulating the 14 discharges exempted from control, but may establish no-discharge zones for them. The UNDS legislation amended the CWA to exclude from the definition of “pollutant” a discharge incidental to the normal operation of a vessel of the Armed Forces.

The Environmental and Natural Resource Program Manual, **OPNAVINST 5090.1B** provides Navy policy, identifies key statutory and regulatory requirements, and assigns responsibility for Navy programs, including pollution prevention, clean up of waste disposal sites, and compliance with current laws and regulations for the protection of the environment and natural resources.

The **Nuclear Regulatory Commission** (Public Law [PL] 93-438, 42 U.S.C. 5801, et seq.) regulates radioactive materials, including depleted uranium; enforcement of this statute is conducted under 10 CFR 19, 20, 21, 30, and 40, Nuclear Regulatory Commission Standards for Protection Against Radiation. These health and safety standards were established as protection against ionizing radiation resulting from activities conducted under the licenses issued by the Nuclear Regulatory Commission. The handling, storage, transport, and disposal of radioactive materials; establishment of radiation protection programs; and record keeping are subject to Nuclear Regulatory Commission requirements.

"Pollution prevention," as defined by the **Pollution Prevention Act** of 1990 (PL 101-508, 42 U.S.C. 13101, et seq.) and EO 12856 (Federal Compliance with Right-to-Know Laws and Pollution Prevention Requirements, August 3, 1993), is "any practice which reduces the amount of a hazardous substance, pollutant or contaminant entering any waste stream or otherwise released to the environment (including fugitive emissions) prior to recycling, treatment or disposal; and any practice that reduces the hazards to public health and the environment associated with the release of such substances, pollutants or contaminants." The Pollution Prevention Act of 1990 requires USEPA to develop standards for measuring waste reduction, serve as an information clearinghouse, and provide matching grants to state agencies to promote pollution prevention. Facilities with more than 10 employees that manufacture, import, process, or otherwise use any chemical listed in and meeting threshold requirements of Emergency Planning and Community Right-to-Know Act must file a toxic chemical source reduction and recycling report.

The **Toxic Substances Control Act** of 1976 (PL 94-469, 15 U.S.C. 2601, et seq.) establishes that USEPA has the authority to require the testing of new and existing chemical substances entering the environment, and, subsequently, has the authority to regulate these substances. The Toxic Substances Control Act also regulates polychlorinated biphenyls.

The **Emergency Planning and Community Right-to-Know Act** of 1986 (EPCRA) as part of the SARA Title III establishes the emergency planning efforts at State and local levels and provides the public with potential chemical hazards information. There are two key concepts to understanding EPCRA: (1) EPCRA's intent to inform the public, and (2) a facility has four reporting requirements, defined in part by hazardous substance lists and exemptions, for emergency planning, emergency notification, community right-to-know, and toxic chemical release inventory.

The **Federal Insecticide, Fungicide, and Rodenticide Act** of 1972 regulates the labeling requirement and disposal practices of pesticide usage.

The **Hazardous Materials Transportation Act** of 1975 gives the U.S. Department of Transportation authority to regulate shipments of hazardous substances by air, highway, or rail. These regulations, found at 49 CFR 171–180, may govern any safety aspect of transporting hazardous materials, including packing, repacking, handling, labeling, marking, placarding, and routing (other than with respect to pipelines).

In 1997 USEPA, in consultation with the DoD, developed and published the "**Military Munitions Rule**: Hazardous Waste Identification and Management; Explosives Emergencies; Manifest Exemption for Transport of Hazardous Waste on Right-of-Ways on Contiguous Properties." The rule defines when conventional and chemical military munitions become solid wastes potentially subject to hazardous waste regulations, and establishes procedures and management standards for waste military munitions. This rule establishes the regulatory definition of solid waste as it applies to three specific categories of military munitions:

- Unused munitions;

- Munitions being used for their intended purpose; and
- Used or fired munitions.

Under the Military Munitions Rule, military munitions are not a solid waste for regulatory purposes:

- When a munition is being used for its intended purpose, which includes when a munition is being used for the training of military personnel; when a munition is being used for research, development, testing, and evaluation; and when a munition is destroyed during range clearance operations at active and inactive ranges; and
- When a munition that has not been used or discharged, including components thereof, is repaired, reused, recycled, reclaimed, disassembled, reconfigured, or otherwise subjected to materials recovery activities.

State Regulations

In 2001, Hawaii was authorized by USEPA to administer the **Resource Conservation and Recovery Act** under the Hawaii's Hazardous Waste Rules. These rules apply to hazardous waste generators; transporters; owners, and operators of treatment, storage, and disposal facilities; handlers of universal wastes; and handlers of used oil. Hawaii's Hazardous Waste Rules are modeled after the Federal hazardous waste rules. Hawaii's Department of Health is responsible for hazardous waste management. Title 11 of the Hawaii Administrative Rules (HAR) describes the requirements for hazardous waste management.

Hawaii's Hazardous Waste Law (Hawaii Revised Statutes [HRS] 342J) authorizes the Department of Health to regulate hazardous waste. Under the Hawaii Hazardous Waste Management Act (HRS Title 19, Health, Chapter 342J), the State hazardous waste management program provides technical assistance to generators of hazardous waste to ensure safe and proper handling. The hazardous waste management program promotes hazardous waste minimization, reduction, recycling, exchange, and treatment as the preferred methods of managing hazardous waste, with disposal used only as a last resort when all other hazardous waste management methods are ineffective or unavailable. The State program is coordinated with Hawaii's counties, taking into consideration the unique differences and needs of each county.

C.6 Health and Safety

Regulatory requirements related to the **Occupational Safety and Health Act** of 1970 have been codified in 29 CFR 1910, *General Industry Standards,* and 29 CFR 1926, *Construction Industry Standards.* The regulations contained in these sections specify equipment, performance, and administrative requirements necessary for compliance with Federal occupational safety and health standards, and apply to all occupational (workplace) situations in the United States. Requirements specified in these regulations are monitored and enforced by the Occupational Safety and Health Administration (OSHA), which is a part of the U.S. Department of Labor.

With respect to ongoing work activities, the primary driver is the requirements found in 29 CFR 1910, *Occupational Safety and Health Standards.* These regulations address such items as electrical and mechanical safety and work procedures, sanitation requirements, life safety requirements (fire and evacuation safety, emergency preparedness, etc.), design requirements for certain types of facility equipment (such as ladders and stair lifting devices), mandated training programs (employee Hazard Communication training, use of powered industrial equipment, etc.), and recordkeeping and program documentation requirements. For any construction or construction-related activities, additional requirements specified in 29 CFR 1926, *Safety and Health Regulations for Construction,* also apply.

OPNAVINST 5100.23G, Navy Safety and Occupational Health Program Manual, contains policy statements and outlines responsibilities for the implementation of the total safety and occupational health program for the Navy. The Navy's policy is to provide a safe and healthful working place for all personnel.

All work activities undertaken or managed by the U.S. Army Corps of Engineers, which can include many types of Federal construction projects, must comply with the requirements of EM 385-1-1, **U.S. Army Corps of Engineers Safety and Health Requirements Manual**. In many respects the requirements in this manual reflect those in 29 CFR 1910 and 1926, but also include Army Corps of Engineers-specific reporting and documentation requirements.

The **Range Commanders Council (RCC) Standard 321**, *Common Risk Criteria for National Test Ranges,* sets requirements for minimally-acceptable risk criteria to occupational and non-occupational personnel, test facilities, and non-military assets during range operations. Methodologies for determining risk are also set forth.

RCC 319-92, *Flight Termination System Commonality Standards* specifies performance requirements for flight termination systems used on various flying weapons systems.

Requirements pertaining to the safe shipping and transport handling of hazardous materials (which can include hazardous chemical materials, radioactive materials, and explosives) are found in the **Department of Transportation Hazardous Materials Regulations and Motor Carrier Safety Regulations** codified in 49 CFR 107, 171-180 and 390-397. These regulations specify all requirements that must be observed for shipment of hazardous materials over highways (truck shipment) or by air. Requirements include specific packaging requirements, material compatibility issues, requirements for permissible vehicle/shipment types, vehicle marking requirements, driver training and certification requirements, and notification requirements (as applicable).

Marine Terminals, 29 CFR 1917, applies to employment within a marine terminal (as defined in 29 CFR 1917.2) including the loading, unloading, movement or other handling of cargo, ship's stores, or gear within the terminal or into or out of any land carrier, holding or consolidation area, and any other activity within and associated with the overall operation and functions of the terminal, such as the use and routine maintenance of facilities and equipment. Cargo transfers accomplished with the use of shore-based material handling devices are also regulated.

Air Installation Compatible Use Zones and Aircraft Safety

The DoD established the Air Installation Compatible Use Zone (AICUZ) program in 1973 to plan for land use compatibility in areas surrounding military air installations. The purposes of the AICUZ program are to minimize public exposure to safety hazards associated with aircraft operations and to protect the operational capability of an air installation. In addition to noise, the AICUZ program includes analyses of airfield Accident Potential Zones (APZs) and height and obstruction criteria. An AICUZ study has not been prepared specifically for the Hawaii Range Complex (HRC).

Guidelines for establishing aviation safety zones around helicopter landing zones include clear zones and APZs. Infrequent helicopter operations require designation of a clear zone, but not APZs. The clear zone for VFR aircraft is the same as the takeoff safety zone. The takeoff safety zone constitutes the area under the approach/departure surface until that surface is 50 to 100 ft above the landing zone elevation. This zone is required to be free of obstructions.

Fleet Area Control and Surveillance Facility (FACSFAC) Pearl Harbor is responsible for area containment to preclude conflicts with other air traffic under FAA control. FACSFAC is not responsible for safe separation of aircraft operating under VFR in the Warning Areas. Commanding Officers will ensure that firing exercises and other hazardous operations have been approved and scheduled by the Scheduling Authority. In all Live Fire Exercises and those involving hazards to other units, final responsibility for ensuring the range is clear rests with the Commanding Officer of the firing unit.

Electromagnetic Radiation

Communications and electronic devices such as radar, electronic jammers, and other radio transmitters produce electromagnetic radiation (EMR). Equipment that produces an electromagnetic field has the potential to generate hazardous levels of EMR. An EMR hazard exists when transmitting equipment generates electromagnetic fields that induce currents or voltages great enough to trigger electro-explosive devices in ordnance, cause harmful effects on people or wildlife, or create sparks that can ignite flammable substances in the area. EMR can pose a health hazard to people or pose an explosive hazard to ordnance or fuels. Hazards are reduced or eliminated by establishing minimum distances from EMR emitters for people, ordnance, and fuels.

Explosive Safety Quantity Distance Arcs and Explosives

The types and amounts of explosives materials that may be stored in an area are determined by the quantity-distance requirements established by the DoD Explosives Safety Board. Explosive Safety Quantity-Distance (ESQD) arcs are defined by the Naval Sea Systems Command, and are used to establish the minimum safe distance between munitions storage areas and habitable structures. To ensure safety, personnel movements are restricted in areas surrounding a magazine or group of magazines. ESQD arcs have been developed for the Navy's munitions storage facilities at Naval Magazine Pearl Harbor.

Procedures for notification of underwater detonations are provided by Commander, Naval Surface Force, U.S. Pacific Fleet (COMNAVSURFPAC). Upon receipt of a "Request for Detonation of Underwater Ordnance" Commander, Naval Base Pearl Harbor determines whether the proposed detonation would constitute any danger, and replies to COMNAVSURFPAC by message stating concurrence or objection. Upon receipt of concurrence by appropriate Submarine Operating Authority and Naval Oceanographic Processing Facility, COMNAVSURFPAC grants permission via message to the requesting command to conduct underwater detonations. COMNAVSURFPAC simultaneously requests issuance of a local Notice to Mariners from the appropriate U.S. Coast Guard District (U.S. Department of the Navy, 2003b).

High-Velocity Air

High-velocity air is generated by hovercraft operations during amphibious training activities. The high-velocity air that exits the hovercraft creates potential hazards from foreign objects propelled due to the force of the air induction during hovercraft operation. Due to diffusion with existing air, as distance from the hovercraft increases, the velocity of the air decreases. While in operation, the hovercraft requires a 250-ft radius safety zone. Hovercraft such as the Landing Craft, Air Cushioned are most likely to generate high-velocity air near members of the public during Expeditionary Assault Exercises.

To a lesser extent than hovercraft operations, high-velocity air also is created near helicopters when they land or take off, or hover within about 50 ft of the water surface. Depending on the ground conditions, a 50- to 100-ft diameter safety zone is required when helicopters take off or land. Military personnel are trained in the correct procedures for approaching helicopters at landing zones, and these areas are generally restricted to military personnel, so the potential for high-velocity air from helicopters to affect public safety is very low.

Most of the naval training that takes place in the HRC occurs in international waters and airspace. Non-participating aircraft and surface vessels may be present. Notices to Airmen and Notice to Mariners are published to inform the public of training activities and exercises in the area that may pose a public safety hazard. In general, if non-participating aircraft or ships are present, hazardous operations are suspended until the range is clear.

C.7 Land Use

Land use is described as the human use of land resources for various purposes, including economic production, natural resources protection, or institutional uses. Land uses are frequently regulated by management plans, policies, ordinances, and regulations that determine the types of uses that are allowable or protect specially designated or environmentally sensitive uses. Potential issues typically stem from encroachment of one land use or activity on another or an incompatibility between adjacent land uses that leads to encroachment.

Any needed modifications to existing agreements or acquisition of any necessary real estate rights to accomplish HRC training would be performed by the Navy as required.

The **Federal Coastal Zone Management Act** of 1972 (as amended 16 U.S.C. 1451, et seq.,) excludes Federal lands from the coastal zone. However, Federal agencies that conduct activities directly affecting the zone must ensure that the activity is consistent with the State's Coastal Zone Management Program. The Hawaii Coastal Zone Management Program (HRS Chapter 205A), which is administered by the Department of Land and Natural Resources, regulates public and private uses in the coastal zone. The objectives and policies of the program consist of providing recreational resources; protecting historic and scenic resources and the coastal ecosystem; providing economic uses; reducing coastal hazards; and managing development in the coastal zone. The Hawaii Coastal Zone Management Program designates special management areas in the coastal zone which are subject to special controls on development. These areas extend inland from the shoreline and are established by the county planning commission or by the county council. The special management area is a designated area inland to the extent necessary to control shorelands, the uses of which have a direct and significant impact on the coastal waters.

C.8 Noise

Noise is defined as any sound that is undesirable because it interferes with communication, is intense enough to damage hearing, diminishes the quality of the environment, or is otherwise annoying. Response to noise varies by the type and characteristics of the noise source, distance between source and receptor, receptor sensitivity, and time of day. Noise may be intermittent or continuous, steady or impulsive, and may be generated by stationary sources or by transient sources. Noise receptors can include humans as well as terrestrial and marine animals. Of specific concern are potential noise effects on humans, marine mammals, birds, and fish. Each receptor has higher or lower sensitivities to sounds of varying characteristics.

Sound levels can be easily measured, but the variability in subjective and physical response to sound complicates the analysis of its impact on people. People judge the relative magnitude of sound sensation in subjective terms such as “loudness” or “noisiness.” Physically, sound pressure magnitude is measured and quantified in terms of a level scale in units of decibels (dB).

The human hearing system is not equally sensitive to sound at all frequencies. Because of this variability, a frequency-dependent adjustment called A-weighting has been devised so that sound may be measured in a manner similar to the way the human hearing system responds. The abbreviation for A-weighted sound level, dBA, is often used for expressing the units of the sound level quantities. Table C-7 lists typical A-weighted noise levels measured for various sources. When sound levels are read and recorded at distinct intervals over a period of time, they indicate the statistical distribution of the overall sound level in a community during the measurement period. The most common parameter derived from such measurements is the energy equivalent sound level (L_{eq}). L_{eq} is a single-number noise descriptor that represents the average sound level in a real environment where the actual noise level varies with time.

While the A-weighted scale is often used to quantify the sound level of an individual event, the degree of annoyance perceived by individuals depends on a number of factors. Some of the factors identified by noise researchers that affect our perception and cause us to categorize a sound as an annoyance or “noise” are magnitude of the event sound level in relation to the background (i.e., ambient) sound level, duration of the sound event, frequency of occurrence of events, and time of day at which events occur.

Several methods have been devised to relate noise exposure over time to community response. USEPA has developed the Day-Night Average Sound Level (L_{dn}) as the rating method to describe long-term annoyance from environmental noise. L_{dn} is similar to a 24-hour L_{eq} A-weighted, but with a 10 dB penalty for nighttime (10:00 p.m. to 7:00 a.m.) sound levels to account for the increased annoyance that is generally felt during normal sleep hours. The Air Force also uses L_{dn} for evaluating community noise impact.

Table C-7. Noise Levels of Common Sources

Source	Noise Level (in A-weighted decibels)	Comment
Air raid siren	120	At 50 feet (threshold of pain)
Rock concert	110	
Airplane, 747	102.5	At 1,000 feet
Jackhammer	96	At 10 feet
Power lawn mower	96	At 3 feet
Football game	88	Crowd size: 65,000
Freight train at full speed	88 to 85	At 30 feet
Portable hair dryer	86 to 77	At 1 feet
Vacuum cleaner	85 to 78	At 5 feet
Long range airplane	80 to 70	Inside
Conversation	60	
Typical suburban background	50	
Bird calls	44	
Quiet urban nighttime	42	
Quiet suburban nighttime	36	
Library	34	
Bedroom at night	30	

Source: Cowan, 1994

The Community Noise Equivalent Level (CNEL) has been adopted by the State of California for environmental noise monitoring purposes. CNEL is also similar to the A-weighted L_{eq}, but includes a penalty of 5 dB during evening hours (7:00 p.m. to 10:00 p.m.), while nighttime hours (10:00 p.m. to 7:00 a.m.) are penalized by 10 dB. For outdoor noise, the L_{dn} noise descriptor is usually 0.5 to 1 dB less than CNEL in a given environment.

CNEL and L_{dn} values can be useful in comparing noise environments and indicating the potential degree of adverse noise impact. However, averaging the noise event levels over a 24-hour period tends to obscure the periodically high noise levels of individual events and their possible adverse effects. In recognition of this limitation of the CNEL and L_{dn} metrics, USEPA uses single-event noise impact analyses for sources with a high noise level and short duration.

The maximum sound level (L_{max}) is a noise descriptor that can be used for high-noise sources of short duration, such as space vehicle launches. The L_{max} is the greatest sound level that occurs during a noise event. The term "peak" defines peak sound over an instantaneous time frame for a particular frequency.

Federal and State governments have established noise regulations and guidelines for the purpose of protecting citizens from potential hearing damage and various other adverse physiological, psychological, and social effects associated with noise. The Federal government preempts the State on control of noise emissions from aircraft, helicopters, railroads, and interstate highways.

The **Noise Control Act** (PL 92-574, 42 U.S.C. 4901, et seq.) directs all Federal agencies, to the fullest extent within their authority, to carry out programs within their control in a manner that promotes an environment free from noise that jeopardizes the health or welfare of any American. The act requires a Federal department or agency engaged in any activity resulting in the emission of noise to comply with Federal, State, interstate, and local requirements respecting control and abatement of environmental noise. OSHA has established noise limits for workers. For an 8-hour workday, people should not be exposed to a continuous noise level greater than 90 dBA. In addition, personnel should not be exposed to noise levels higher than 115 dBA for periods longer than 15 minutes. For the general public, USEPA recommends a 24-hour average noise level not to exceed 70 dBA. Table C-8 shows permissible noise exposures. The DoD Noise–Land Use Compatibility Guidelines state that sensitive land use, such as residential areas, are incompatible with annual L_{dn} greater than 65 dBA. Table C-9 shows land use zones for noise and accompanying day-night noise levels.

Table C-8. Permissible Noise Exposures*

Duration (hours per day)	Sound level (dBA) Slow Response
8	90
6	92
4	95
3	97
2	100
1 to 1.5	102
1	105
0.5	110
0.25 or less	115

Source: 29 CFR 1910.95, Table G-16
*Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level

Table C-9. Definition of Land Use Zones for Noise

Noise Zone	Compatibility with Noise Sensitive Land Uses	Percent of Population Highly Annoyed	C-Weighted Annual Average Day-Night Sound Level (Ldn)
I	Acceptable	Less than 15%	Less than 62 dB
II	Normally Unacceptable	15-39%	62–70 dB
III	Unacceptable	More than 39%	More than 70 dB

Source: U.S. Department of the Army, Regulation 200-1

C.9 Socioeconomics

Socioeconomics describes the social and economic character of a community through the review of several metrics including population size, employment characteristics, income generated, and the type and cost of housing. This section presents a socioeconomic overview of the region.

C.10 Transportation

Ground Transportation

Traffic circulation refers to the movement of ground transportation vehicles from origins to destinations through a road and rail network. Roadway operating conditions and the adequacy of the existing and future roadway systems to accommodate these vehicular movements usually are described in terms of the volume-to-capacity ratio, which is a comparison of the average daily traffic volume on the roadway to the roadway capacity. The volume-to-capacity ratio corresponds to a Level of Service (LOS) rating, ranging from free-flowing traffic conditions (LOS A) for a volume-to-capacity of usually less than 30 percent of the roadway capacity to forced-flow, congested conditions (LOS F) for a volume-to-capacity of 100 percent of the roadway capacity (U.S. Department of Defense, 2004).

Waterways

Water traffic is the transportation of commercial, private, or military vessels at sea, including submarines. Sea traffic flow in congested waters, especially near coastlines, is controlled by the use of directional shipping lanes for large vessels (cargo, container ships, and tankers). Traffic flow controls also are implemented to ensure that harbors and ports-of-entry do not become congested. There is less control on ocean traffic involving recreational boating, sport fishing, commercial fishing, and activity by naval vessels. However, Navy vessels follow military procedures and orders (e.g., Fleet Forces Command) as well as Federal, State, and local marine regulations. In most cases, the factors that govern shipping or boating traffic include adequate depth of water, weather conditions (primarily affecting recreational vessels), the availability of fish of recreational or commercial value, and water temperature (higher water temperatures will increase recreational boat traffic and diving activities) (U.S. Department of Defense, 2004).

Airways

Air transportation is the movement of aircraft through airspace. The control of airspace used by air traffic varies from very highly controlled to uncontrolled areas. Examples of highly controlled air traffic situations are flight in the vicinity of airports, where aircraft are in critical phases of flight (take-off and landing); flight under IFR; and flight on the high or low altitude route structure (airways). Less-controlled situations include flight VFR or flight outside of U.S. controlled airspace (e.g., flight over international waters off the coast of Hawaii) (U.S. Department of Defense, 2004).

C.11 Water Resources

Regulatory Context

Federal

The objective of the **CWA** and its amendments is to “restore and maintain the chemical, physical and biological integrity of the nation’s waters.” The overall goal of the CWA is to produce waters of the United States that are “fishable and swimmable.” Under the CWA, the Federal government delegated responsibility for establishing water quality criteria to each State, subject to approval by USEPA.

A primary means of evaluating and protecting water quality is establishing and enforcing water quality standards. Water quality standards consist of:

- Designated beneficial uses of water (for example, drinking, recreation, aquatic life);
- Numeric criteria for physical and chemical characteristics for each type of designated use;
- An “antidegradation” provision to protect uses and water quality.

In accordance with the CWA, States define the uses of waters within their borders, and each water body must be managed in accordance with its designated uses. Water quality standards are established for each designated use. Standards must be at least as stringent as those established by USEPA. Most States have adopted the USEPA standards.

Under Section 313 of the CWA, Federal agencies must comply with all Federal, State, interstate, and local requirements to control and abate water pollution. Compliance includes managing any activity that may result in the discharge or runoff of pollutants. The CWA does not apply, however, to Navy training more than 3 nm from the shoreline of the United States.

Water bodies that do not meet designated minimum quality standards are listed as “impaired” waters. For impaired water bodies, States are expected to develop Total Maximum Daily Loads (TMDLs), which are the amounts of pollutants that can be delivered to a body of water without exceeding the water quality standards. Based on the TMDLs that are developed, the State can limit discharges of pollutants to achieve the minimum water quality standards. Hawaii has identified 70 streams and 174 coastal stations as impaired waters.

State

HRS Chapter 342D authorizes Hawaii's Department of Health to regulate water quality in Hawaii. Hawaii’s water quality regulations are found in HAR Title 11, Chapters 54, 55 (Water Pollution Control), 62 (Wastewater Systems), and 64 (Water Quality Standards). The Department of Health Clean Water Branch protects coastal and inland water resources, its Safe Drinking Water Branch safeguards Hawaii’s potable surface and ground waters, and its Wastewater Branch regulates water pollution control and wastewater treatment plants. The Clean Water Branch administers the Federal National Pollutant Discharge Elimination System program and issues State water quality certifications under Section 404 of the CWA.

The **Non-Point Source Pollution Management and Control Law** (HRS 342E) authorizes the Department of Health to regulate the runoff of polluted water into lakes, streams, and coastal waters. This program was established pursuant to portions of the Federal Water Pollution Control Act and Coastal Zone Act Reauthorization Amendments.

Water quality is evaluated relative to criteria established under **State Water Quality Standards (HAR 11-54**). A water body may be polluted by a point source (e.g., sewage or industrial plant outfall) or by non-point-source pollution, which is caused by precipitation moving over and through the ground, picking up and carrying pollutants and depositing them in water bodies. Examples of non-point-source pollution are runoff from agricultural fields and urban streets.

Water quality is an increasing concern in Hawaii. Hawaii's Department of Health is promulgating contaminant TMDLs for impaired surface waters, pursuant to Section 303(d) of the CWA that will further restrict the allowable amounts of pollutants in surface runoff.

Training activities that disturb vegetation or soils can increase sediment concentrations. Training may also result in releases of petroleum products and other pollutants to surface waters. On live fire ranges, explosive and propellant residues, residues from munitions remnants (e.g., heavy metals), and residues from targets could be a particular concern. At some point, further increases in training may conflict with achieving and maintaining Federally mandated TMDLs.

The State's 1991 **Hawaii Ocean Resources Management Plan** (ORMP) identified strategies for conserving and enhancing ocean resources, and for coordinating the resource management efforts of State agencies. The ORMP was updated in 2006. The September 2006 Draft ORMP focuses on (a) reducing pollutant discharges into the ocean, (b) resolving conflicts between expanded urban development, increased tourism, and resource conservation, (c) addressing a trend toward decreased agricultural runoff and increased urban runoff, and (d) managing increased vessel traffic.

Appendix D
Hawaii Range Complex Training

APPENDIX D
HAWAII RANGE COMPLEX TRAINING

Table D-1 lists descriptions of training areas in the Hawaii Range Complex (HRC).

Table D-1. Hawaii Range Complex Training Areas

Training Area	Description
OPEN OCEAN & OFFSHORE	
Northern Warning Areas	
W-188 Rainbow, W-189, W-190	The Northern Warning Areas lie north of Kauai and Oahu. These areas are available from the surface to an unlimited altitude and are used for surface and air operations.
Southern Warning Areas	
W-186, W-187, W-192, W-193, W-194	The Southern Warning Areas are located south of Kauai and Oahu. Available from the surface to an unlimited altitude, they are used for air and surface operations.
W-191	W-191, located directly south of Oahu, is available from the surface to 3,000 feet (ft) for air and surface operations.
W-196	W-196 is used only for surface and helicopter operations. The airspace extends from the surface to 2,000 ft, and is not available to fixed-wing aircraft.
Kapu/Quickdraw, Wela Hot Areas	Kapu/Quickdraw and Wela Hot Areas are located completely within W-192. These Areas are used for surface-to-air and air-to-air gunnery, air-to-surface bombing and gunnery, and jettisoning of ordnance.
Air Traffic Control Assigned Airspace (ATCAA)	
Nene	Nene is the only ATCAA associated with the Northern Warning Areas. It is typically activated for use during Hawaii Air National Guard intercept training.
Pali	Pali is a roughly 40-nautical-mile (nm) circular area over Oahu, from 25,000 ft to an unlimited altitude, although it is normally not available below 28,000 ft. Pali is used by high-altitude aircraft transiting between the Northern and Southern Warning Areas.
Taro	Taro overlies W-191, sharing the same borders and, when available, extending its airspace from 3,000 ft to 16,000 ft. This airspace allows aircraft to remain in controlled airspace while testing above W-191's 3000-ft ceiling.
Quint	Quint is located 45 nm southwest of Honolulu, with available airspace from flight level (FL) 250 to an unlimited altitude, although it is usually not available below FL 280.
Mela North, Mela Central, Mela South	The Mela ATCAAs connect the western border of W-192 with the southern border of W-186 (Pacific Missile Range Facility [PMRF]). They are available from the floor of controlled airspace (1,200 ft) to an unlimited altitude, except for Mela North which has a ceiling of 15,000 ft.
Mako, Lono West, Lono Central, Lono East	The Mako and Lono ATCAAs are available to extend the Special Use Airspace of Mela South, W-192, W-193, and W-194 by an additional 104 nm. All are available from the floor of controlled airspace to an unlimited altitude, and are activated to provide more southern area airspace.
Pele	Pele provides a transit corridor from W-194 and Lono East into R-3103 airspace over Pohakuloa Training Area on Hawaii. When activated, Pele extends from 16,000 ft to FL 290.

Table D-1. HRC Training Areas (Continued)

Training Area	Description
Kaula	
R-3107, W-187	Kaula is a 0.5-nm by 0.7-nm island surrounded by a 3-nm radius restricted area (R-3107), and a 5-nm radius warning area (W-187). Both R-3107 and W-187 extend from surface to 18,000 ft.
Pacific Missile Range Facility (PMRF)	
W-186, W-188	W-186 extends from surface to 9,000 ft, and W-188 extends from surface to unlimited. These two warning areas support activities at PMRF.
R-3101, Majors Bay	R-3101 extends from surface to unlimited and provides necessary airspace to support training and research, development, test, and evaluation activities at PMRF. Majors Bay lies beneath R-3101 and includes beach area on PMRF property.
Barking Sands Tactical Underwater Range (BARSTUR)	BARSTUR is an instrumented underwater range that provides approximately 120 nm^2 of underwater tracking of participants and targets
Barking Sands Underwater Range Expansion (BSURE)	BSURE extends BARSTUR to the north, providing an additional 900 nm^2 of underwater tracking capability.
Other Restricted Areas	
Ewa Training Minefield	The Ewa Training Minefield is an ocean area extending from Ewa Beach approximately 2 nm toward Barbers Point, and out to sea approximately 4 nm. This restricted area has been used in the past for surface ship mine avoidance training.
Submarine Operating Area	The Submarine Operating Area encompasses the entire ocean area of the Hawaii Range Complex. This area is bounded by 17N, 25N, 154W, and 162 W.
Naval Undersea Warfare Center (NUWC), Detachment Pacific Ranges	
Fleet Technical Evaluation Center (FTEC)	The FTEC Range Operations Building is located on the southern shore of Oahu, west of the former Barbers Point Naval Air Station. The FTEC supports SESEF events, and will support FORACS events in the future.
Shipboard Electronic Systems Evaluation Facility (SESEF)	The SESEF range is located south and west of FTEC. Ships operate and maneuver in this area as necessary to remain within electronic signal reception range of FTEC.
Fleet Operational Readiness Accuracy Check Site (FORACS)	The FORACS range includes an approximately 5-nm by 5-nm ocean area just offshore of the southwestern coast of Oahu, northwest of the SESEF range.
Explosive Ordnance Disposal (EOD) Ranges	
West Loch EOD Shore Area	The EOD shore area consists of a 2.75-acre facility at Naval Magazine Pearl Harbor West Loch.
Lima Landing Underwater Area	Lima Landing is a small underwater area just off an abandoned concrete pier at the approach to Pearl Harbor near the entrance of West Loch.
Puuloa Underwater Range	The Puuloa Underwater Range is a 1 nm^2 area in the open ocean outside and to the west of the entrance to Pearl Harbor.

Table D-1. HRC Training Areas (Continued)

Training Area	Description
ONSHORE	
Kauai	Activities occur at the following PMRF locations: Main Base, Makaha Ridge, Kokee, Kamokala Magazine, Hawaii Air National Guard, Kauai Test Facility, Port Allen, Kikiaola Boat Harbor, and Mt. Kahili.
Niihau	Activities occur at Perch site, and other authorized areas.
Kaula	Kaula is used exclusively for air-to-ground bombing and gunnery training.
Oahu	Activities occur at Naval Inactive Ship Maintenance Facility, Pearl Harbor, EOD Land Range Naval Magazine Pearl Harbor West Loch, Marine Corps Training Area/Bellows, Ford Island, Marine Corps Base Hawaii, Hickam Air Force Base, Wheeler Army Airfield, Schofield Barracks (R-3109), Coast Guard Station Barbers Point/Kalaeloa Airport, Makua Military Reservation (R-3110), Kahuku Training Area (A-311), Kaena Point, Mt. Kaala, Wheeler Network Communications Control, and Dillingham Military Reservation.
Maui	Activities occur at Maui Space Surveillance System, Maui High Performance Computing Center, and Sandia Maui Haleakala Facility.
Hawaii	Activities occur at Pohakuloa Training Area (R-3103) and adjacent leased property, Bradshaw Army Airfield, and Kawaihae Pier.

Anti-Air Warfare

Air Combat Maneuver

Air Combat Maneuver (ACM) includes basic flight maneuvers where aircraft engage in offensive and defensive maneuvering against each other. These maneuvers typically involve supersonic flight and use of chaff and flares. No air-to-air ordnance is released during this training event. ACM training events within the HRC are primarily conducted within W-188, W-189, W-190, W-192, W-193, and W-194 under Fleet Area Control and Surveillance Facility (FACSFAC) Pearl Harbor's control. These training events typically involve from two to eight aircraft. However, based on the training requirement, ACM training events may involve over a dozen aircraft. Sorties can be as short as 30 minutes or as long as 2 hours, but the typical ACM mission has an average duration of 1.5 hours. No live ordnance is used, only chaff and flares.

Baseline Training Events					
	NTA	Area	Metric	Duration (Hours)	Total Training Events
Air Combat Maneuver (ACM)	3.2.3	W-188, 189, 190, 192, 193, 194	Ops	1.5	738

Air-to-Air Missile Exercise

In an Air-to-Air Missile Exercise (A-A MISSILEX), missiles are fired from aircraft against unmanned aerial target drones such as BXM-34s and BQM-74s. Additionally, weapons may be fired against flares or Tactical Air Launched Decoys dropped by supporting aircraft. Typically, about half of the missiles fired have live warheads and half have telemetry packages. The fired missiles and targets are not recovered, with the exception of the BQM drones, which have parachutes and will float to the surface, where they are recovered by boat.

A-A MISSILEX training events include 1 to 6 jet target drones, 2 to 20 aircraft, 2 to 20 missiles, and a weapons recovery boat for target recovery, and are conducted within Pacific Missile Range Facility (PMRF) Warning Area W-188. Jet target drones are launched from an existing ground-based target launch site at PMRF Launch Complex, from a Mobile Aerial Target Support System (MATSS) located in the open ocean within the PMRF Warning Areas, or from an aircraft controlled by PMRF. The targets are engaged by aircraft equipped with air-to-air missiles. The targets are tracked by the aircraft and then the air-to-air missiles are launched at the targets. Recoverable target drones and all recoverable elements are refurbished and reused. Live and inert missiles can be fired during this training event.

Baseline Training Events					
A-A MISSILEX	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.3	W-188	Ops	2-6	12

Surface-to-Air Gunnery Exercise

A Surface-to-Air Gunnery Exercise (S-A GUNEX) requires an aircraft or missile that will fly high or low altitude threat profiles. Commercial aircraft also tows a target drone unit that ships track, target, and engage with their surface-to-air weapon systems. The training event involves 1 to 10 surface vessels, towed aerial targets, and/or jet aerial targets. Ship-deployed and air-deployed weapons systems are used, ranging from 20-mm to 5-inch caliber guns. GUNEX events are conducted within PMRF Warning Areas W-186 and W-188, Oahu Warning Areas W-187 (Kaula), W-194, and Restricted Airspace R-3107 (Kaula). Live and inert missiles can be fired during this training event.

Baseline Training Events					
Surface to Air Gunnery Exercise (S-A GUNEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.7	W-188, 192, Mela South	Ops	3.1	86

Surface-to-Air Missile Exercise

A Surface-to-Air Missile Exercise (S-A MISSILEX) involves surface combatants firing live missiles (RIM-7 Sea Sparrows, SM-1 or SM-2 Standard Missiles) at target drones. The surface ship must detect, track, and engage the target using its onboard weapon systems. The purpose of the training event is to provide realistic training and evaluation of surface ships and their crews in defending against enemy aircraft and missiles.

Target drones representing enemy aircraft or missiles are flown or towed into the vicinity of the surface ship. The crew must identify the incoming object and respond with surface-to-air missiles as appropriate. There are two types of missiles: one type of missile is equipped with an instrumentation package, while the other type is equipped with a warhead. Recoverable target drones are refurbished and reused.

The training event consists of one or more surface ships, one or more target drones, and a helicopter and weapons recovery boat for target recovery. The surface-to-air missiles are launched from ships located within PMRF Warning Area W-188. Targets are launched from an existing ground-based target launch site at PMRF Launch Complex; from a MATSS located in the open ocean within the PMRF Warning Areas; or released from an aircraft. Live missiles are fired at target drones.

Baseline Training Events					
Surface-to-Air Missile Exercise (S-A MISSILEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.7	W-188	Ops	5.1	17

Chaff Exercise

A Chaff Exercise (CHAFFEX) trains aircraft and shipboard personnel in the use of chaff to counter anti-ship missile threats. During a CHAFFEX, the ship combines maneuvering with deployment of multiple rounds of MK-36 super rapid bloom offboard chaff to confuse incoming missile threats, simulated by aircraft. In an integrated CHAFFEX scenario, helicopters deploy air-launched, rapid-bloom offboard chaff in pre-established patterns designed to enhance anti-ship missile defense. CHAFFEXs average 3.8 hours in duration. No ordnance is used during this training event.

Baseline Training Events					
Chaff Exercise (CHAFFEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.9	Hawaii Operating Area	Ops	3.8	34

Amphibious Warfare

Naval Surface Fire Support Exercise (NSFS)

Navy surface combatants conduct Fire Support Exercise (FIREX) events at PMRF on a virtual range against “Fake Island,” located on Barking Sands Tactical Underwater Range (BARSTUR). Fake Island is unique in that it is a virtual landmass simulated in three dimensions. Ships conducting FIREX training against targets on the island are given the coordinates and elevation of targets. PMRF is capable of tracking fired rounds to an accuracy of 30 feet (ft). Live gunnery rounds are fired into the ocean during this training event.

Baseline Training Events					
Naval Surface Fire Support Exercise NSFS	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.8	W-188	Ops	8.1	4

Expeditionary Assault

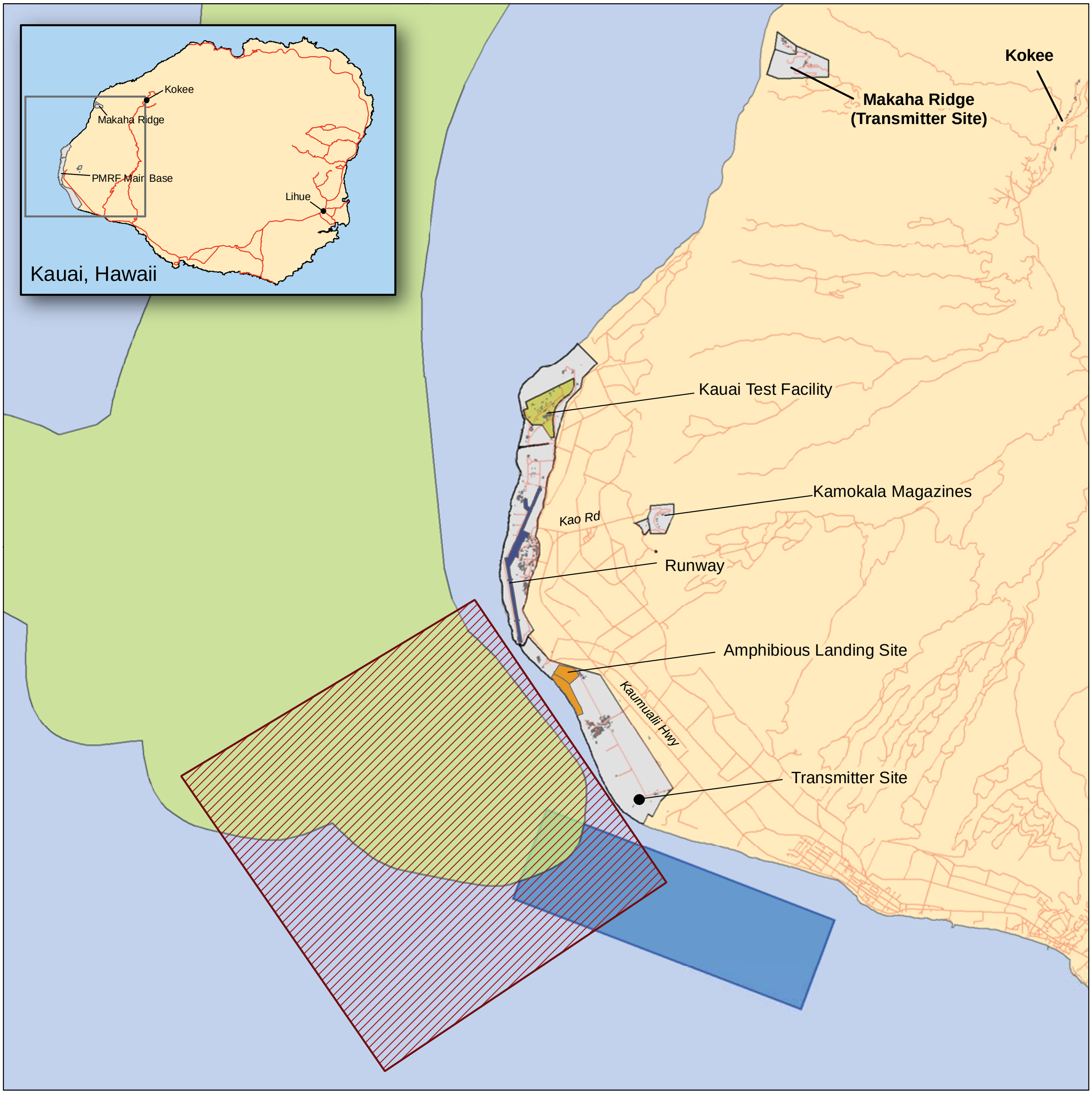
An Expeditionary Assault training event provides a realistic environment for amphibious training, reconnaissance training, hydrographic surveying, surf condition observance, and communication. Expeditionary Assault (formerly known as Amphibious Exercise) consists of a seaborne force assaulting a beach with a combination of helicopters, Vertical Takeoff and Landing (VTOL) aircraft, Landing Craft Air Cushion (LCAC), Amphibious Assault Vehicles (AAVs), Expeditionary Fighting Vehicle (EFV) and landing craft. More robust Expeditionary Assault events include support by Naval Surface Fire Support (NSFS), Close Air Support (CAS), and Marine artillery.

Types of amphibious landing craft and vehicles include:

- LCAC, an air-cushioned vessel equipped with an open-bay craft with roll-on, roll-off ramps capable of carrying tank-sized vehicles or up to 185 troops. The LCAC is approximately 88 ft by 47 ft.
- Landing Craft, Utility (LCU), a displacement hull craft designed to land very heavy vehicles, equipment, and cargo or up to 400 troops on the beach. The LCU is approximately 135 ft by 29 ft.
- AAV, a tracked, armored personnel carrier with a capacity of 21 troops. The AAV is approximately 24 ft by 13 ft.
- Combat Rubber Raiding Craft (CRRC), a lightweight, inflatable boat carrying up to 8 people used for raid and reconnaissance missions. The CRRC is approximately 16 ft by 6 ft.
- Rigid Hull, Inflatable Boat (RHIB), similar to the CRRC, but larger, carrying up to 15 people. The RHIB is approximately 24 ft by 9 ft.

An Expeditionary Strike Group (ESG) is normally a mix of three to five amphibious ships equipped with aircraft landing platforms for helicopter and fixed wing activities and well decks for carrying landing craft and AAVs. The ESG typically launches its aircraft and landing craft up to 25 miles from a training beachhead. AAVs are typically launched approximately 2,000 yards from the beach. The aircraft provide support while the landing craft approach and move onto the beach. The troops disperse from the landing craft and use existing vegetation for cover and concealment while attacking enemy positions. The landing craft and troops proceed to a designated area where they stay 1 to 4 days. When the Expeditionary Assault training event is complete, the backload takes place. The backload is normally accomplished over a 2- to 3-day period.

Amphibious landings are restricted to specific areas of designated beaches. Before each major amphibious landing training event is conducted, a hydrographic survey is performed to map out the precise transit routes through sandy bottom areas. During the landing, the crews follow established procedures, such as having a designated lookout watching for other vessels, obstructions to navigation, marine mammals (whales or monk seals), or sea turtles. The primary location for the amphibious landings is Majors Bay, PMRF, Kauai (Figure D-1). Amphibious landings could also occur at Marine Corps Base Hawaii (three beaches), Marine Corps Training Area–Bellows (MCTAB), Oahu (Figure D-2), and K-Pier boat ramp, Kawaihae, Hawaii. No ordnance is used during this training event.



EXPLANATION

- Roads
- Existing Kingfisher Area
- Kauai Test Facility
- PMRF Shallow Water Training Range (SWTR)
- AMPHIBEX / Demolition Area
- RIMPAC Amphibious Landing Site
- Airfield
- Existing Structures
- PMRF Installation Areas
- Land

NORTH

0 1 2 4 Miles

Location of Pacific Missile Range Facility and Related Sites

Kauai, Hawaii

Figure D-1

EXPLANATION

Major Roads

Airfield Runway

Installation Areas

Land

AAV	Amphibious Assault Vehicle
CRRC	Combat Rubber Raiding Craft
LCAC	Landing Craft, Air Cushioned
LCU	Landing Craft, Utility
RHIB	Rigid Hull, Inflatable Boat

NORTH

0 0.5 1 2 Miles

Marine Corps Base Hawaii and Marine Corps Training Area / Bellows

Oahu, Hawaii

Figure D-2

Baseline Training Events					
Expeditionary Assault	NTA	Area	Metric	Duration (Hours)	Total Training Events
	1.5.4	Pacific Missile Range Facility, Marine Corps Training Area-Bellows, Kawaihae Pier	Ops	48	11

Anti-Surface Warfare

Visit, Board, Search, and Seizure

Visit, Board, Search, and Seizure (VBSS) is conducted to train helicopter crews to insert personnel onto a vessel for the purpose of inspecting the ship's personnel and cargo for compliance with applicable laws and sanctions. VBSS training requires a cooperative surface ship. Typical duration of a VBSS is approximately 1.5 hours. No ordnance is used during this training event.

Baseline Training Events					
Visit, Board, Search, and Seizure (VBSS)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	1.4.6	Hawaii Operating Area	Ops	1.5	60

Surface-to-Surface Gunnery Exercise

Surface-to-Surface Gunnery Exercises (S-S GUNEX) take place in the open ocean to provide gunnery practice for Navy and Coast Guard ship crews. S-S GUNEX training events conducted in the Offshore Operating Area (OPAREA) involve stationary targets such as an MK-42 Floating At Sea Target (FAST) or an MK-58 marker (smoke) buoy. An S-S GUNEX lasts approximately 2 to 4 hours, depending on target services and weather conditions.

The gun systems employed against surface targets include the 5-inch, 76-millimeter (mm), 25-mm chain gun, 20-mm Close In Weapon System, and .50-caliber machine gun. Typical ordnance expenditure for a single GUNEX is a minimum of 21 rounds of 5-inch or 76-mm ammunition, and approximately 150 rounds of 25-mm or .50-caliber ammunition. Both live and inert training rounds are used. After impacting the water, the rounds and fragments sink to the bottom of the ocean.

There are three new rounds of 5-inch gun ordnance nearing introduction to the Fleet. The High Explosive Electronically Timed Projectile is a standard High Explosive round with an improved electronically timed fuse. The Kinetic Energy Projectile, commonly called the "BB" round, contains 9,000 tungsten pellets and is designed to be fired down a bearing at incoming boats. The EX-171 Extended Range Guided Munition projectile is a major component of the Navy's littoral warfare concept. The 5-inch, rocket-assisted projectile is capable of carrying a 4-caliber submunition, and will be fired from the new 5-inch, 62-caliber gun being installed on Arleigh

Burke (DDG-51) class destroyers. Live gunnery rounds are fired at surface targets during this training event.

Baseline Training Events					
Surface-to-Surface Gunnery Exercise (S-S GUNEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.1	W-191, 192, 193, 194, 196, Mela South,	Ops	2 to 4	14

Surface-to-Surface Missile Exercise

A Surface-to-Surface Missile Exercise (S-S MISSILEX) involves the attack of surface targets at sea by use of cruise missiles or other missile systems, usually by a single ship conducting training in the detection, classification, tracking and engagement of a surface target. Engagement is usually with surface-to-surface Harpoon missiles or Standard missiles. Targets include virtual targets or the seaborne powered target (SEPTAR) or ship deployed surface target.

S-S MISSILEX includes 4 to 20 surface-to-surface missiles, SEPTARs, a weapons recovery boat, and a helicopter for environmental and photo evaluation. All missiles are equipped with instrumentation packages or a warhead. Surface-to-air missiles can also be used in a surface-to-surface mode.

S-S MISSILEX activities are conducted within PMRF Warning Area W-188. Each training event typically lasts 5 hours. Future S-S MISSILEX could range from 4 to 35 hours. Live and inert missiles are fired against surface targets during this training event.

Baseline Training Events					
Surface-to-Surface Missile Exercise (S-S MISSILEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.1	Pacific Missile Range Facility (W-188)	Ops	5.0	7

Air-to-Surface Gunnery Exercise

Air-to-Surface Gunnery Exercise (A-S GUNEX) training events are conducted by rotary-wing aircraft against stationary targets (FAST and smoke buoy). Rotary-wing aircraft involved in this training event include a single SH-60 using either 7.62-mm or .50-caliber door-mounted machine guns. A typical GUNEX lasts approximately 1 hour and involves the expenditure of approximately 400 rounds of .50-caliber or 7.62-mm ammunition. Live gunnery rounds are fired at surface targets during this training event.

Baseline Training Events					
Air-to-Surface Gunnery Exercise (A-S GUNEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.1	Hawaii Operating Area	Ops	1.1	128

Air-to-Surface Missile Exercise

The Air-to-Surface Missile Exercise (A-S MISSILEX) consists of releasing a forward-fired, guided weapon at the designated towed target. The training event involves designating the target with a laser.

A-S MISSILEX training that does not involve the release of a live weapon can take place if a captive air training missile (CATM), simulating the weapon involved in the training, is carried. The CATM MISSILEX is identical to a Live Fire Exercise (LFX) in every aspect except that a weapon is not released. The training event requires a laser-safe range as the target is designated just as in an LFX.

From 1 to 16 fixed wing aircraft and/or helicopters, carrying air training missiles or flying without ordnance (dry runs), are used during the training event. Missiles include air-to-surface missiles and anti-radiation missiles (electromagnetic radiation source-seeking missiles). When a high-speed anti-radiation missile (HARM) is used, the event is called a HARMEX. At sea, SEPTARs, Improved Surface Towed Targets, and excess ship hulks are used as targets. Inert HELLFIRE missiles are fired at targets during this training event.

Baseline Training Events					
Air-to-Surface Missile Exercise (A-S MISSILEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.1	Pacific Missile Range Facility (W-188)	Ops	5.5	36

Bombing Exercise (BOMBEX [Sea])

Fixed-wing aircraft conduct BOMBEX (Sea) against stationary targets (MK-42 FAST or MK-58 smoke buoy) at sea. An aircraft clears the area, deploys a smoke buoy or other floating target, and then sets up a racetrack pattern, dropping on the target with each pass. At PMRF, a range boat might be used to deploy the target for an aircraft to attack. Live and inert bombs are dropped on surface targets during this training event.

Baseline Training Events					
Bombing Exercise (BOMBEX) (Sea)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.1	Hawaii Operating Area	Ops	6.0	35

Sinking Exercise

A Sinking Exercise (SINKEX) provides training to ship and aircraft crews in delivering live ordnance on a real target. Each SINKEX uses an excess vessel hulk as a target that is eventually sunk during the course of the training event. The target is an empty, cleaned, and environmentally remediated ship hull that is towed to a designated location where multiple types of weapons are used against the hulk. SINKEX vessels can number from one to as many as six during a Major Exercise. The duration of a SINKEX is unpredictable since it ends when the target sinks, sometimes immediately after the first weapon impact and sometimes only after multiple impacts by a variety of weapons.

Weapons can include missiles, precision and non-precision bombs, gunfire, and torpedoes. Examples of missiles that could be fired at the targets include AGM-142 from a B-52 bomber, Walleye AGM-62 from FA-18 aircraft, and a Harpoon from a P-3C aircraft. Surface ships and submarines may use either torpedoes or Harpoons, surface-to-air missiles in the surface-to-surface mode, and guns. Other weapons and ordnance could include, but are not limited to, bombs, Mavericks, and Hellfire.

If none of the shots result in the hulk sinking, either a submarine shot or placed explosive charges are used to sink the ship. Charges ranging from 100 to 200 pounds (lb), depending on the size of the ship, are placed on or in the hulk.

The vessels used as targets are selected from a list of U.S. Environmental Protection Agency (USEPA) approved destroyers, tenders, cutters, frigates, cruisers, tugs, and transports. USEPA granted the Department of the Navy a general permit through the Marine Protection, Research, and Sanctuaries Act to transport vessels “for the purpose of sinking such vessels in ocean waters…” (40 CFR Part 229.2) Subparagraph (a)(3) of this regulation states “All such vessel sinkings shall be conducted in water at least 1,000 fathoms (6,000 feet) deep and at least 50 nautical miles from land.” In Hawaii, SINKEX events take place within PMRF Warning Area W-188. Multiple types of live ordnance are fired on an excess vessel hulk during this training event.

Baseline Training Events					
Sinking Exercise (SINKEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.1	Hawaii Operating Area	Ops	14.5	6

Anti-Surface Warfare Torpedo Exercise (Submarine-Surface)

Submarines conduct most of their torpedo firings at PMRF, and many of those are against surface targets. Surface targets will typically be PMRF range boats or targets, or Navy combatants. The Anti-Surface Warfare (ASUW) Torpedo Exercise (TORPEX) culminates with the submarine firing an MK-48 torpedo against the surface target.

Twice a year, "Hollywood" training events are conducted on PMRF as part of the Submarine Commander's Course, which trains prospective submarine Commanding Officers and Executive Officers. These are integrated training events involving complex scenarios that will include a coordinated surface, air, and submarine force challenging the submarine Commanding Officers and crew. During these events, submarines engage in ASUW torpedo firings, as well as Anti-Submarine Warfare (ASW) Tracking Exercises (TRACKEX), and ASW TORPEX. Inert exercise torpedoes are fired during this training event.

Baseline Training Events					
Anti-Submarine Warfare Torpedo Exercise (ASUW TORPEX) (Submarine-Surface)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.1	Hawaii Operating Area	Ops	12.3	35

Flare Exercise

A Flare Exercise is an aircraft defensive event in which the aircrew uses an infrared (IR) source or radar energy absorbing chaff to disrupt attempts to lock onto the aircraft. During IR break-lock (flare) training, a shoulder-mounted IR surface-to-air missile simulator is trained on the aircraft by an operator attempting to lock onto the aircraft's IR signature. The aircraft maneuvers while expending flares. The scenario is captured on videotape for replay and debrief. No actual missiles are fired during this training event. Radar break-lock training is similar except that the energy source is an electronic warfare (EW) simulator, and the aircraft expels chaff during its defensive maneuvering. Chaff is a radar confusion reflector, consisting of thin, narrow metallic strips of various lengths and frequency responses, used to deceive radars.

Baseline Training Events					
Flare Exercise	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.9	Pacific Missile Range Facility (W-188)	Ops	5.7	6

Anti-Submarine Warfare

Other Anti-Submarine Warfare Exercises

Anti-Submarine Warfare Tracking Exercise

An Anti-Submarine Warfare Tracking Exercise (ASW TRACKEX) trains aircraft, ship, and submarine crews in tactics, techniques, and procedures for search, detection, and tracking of submarines. No torpedoes are fired during a TRACKEX. ASW TRACKEX includes ships, fixed wing aircraft, helicopters, torpedo targets, 1 to 10 submarines, and weapons recovery boats and/or helicopters. As a unit-level training event, an aircraft, ship, or submarine is typically used versus one target submarine or simulated target.

The target may be non-evading while operating on a specified track or it may be fully evasive, depending on the state of training of the ASW unit. Duration of a TRACKEX is highly dependent on the tracking platform and its available on-station time. A maritime patrol aircraft can remain on station for 8 hours, and typically conducts tracking events that last 3 to 6 hours. An ASW helicopter has a much shorter on-station time, and conducts a typical TRACKEX in 1 to 2 hours. Surface ships and submarines, which measure their on-station time in days, conduct tracking events exceeding 8 hours and averaging up to 18 hours. For modeling purposes, TRACKEX and TORPEX sonar hours are averaged resulting in a sonar time of 13.5 hours.

ASW TRACKEX events are conducted on ranges within PMRF Warning Area W-188, the Hawaii Offshore Areas and/or the open ocean. Whenever aircraft use the ranges for ASW training, range clearance procedures include a detailed visual range search for marine mammals and unauthorized boats and planes by the aircraft releasing the inert torpedoes, range safety boats/aircraft, and range controllers.

Sensors used during ASW training events include sonars, sonobuoys, non-acoustic sensors, such as radars. The use of sonobuoys is generally limited to areas greater than 100 fathoms, or 600 ft, in depth. Before dropping sonobuoys, the crew visually determines that the area is clear. When the sonobuoy is released, a small parachute (about 4 ft in diameter) retards its entry into the ocean. The sonobuoy is designed to float on the surface and, after a controlled period of time (no longer than 8 hours), the complete package (with the parachute) sinks to the bottom. No ordinance is used during this training event. Sonobuoys are released from aircraft, and active and passive sonar is used.

Anti-Submarine Warfare Torpedo Exercises

Anti-submarine Warfare Torpedo Exercises (ASW TORPEX) events train crews in tracking and attack of submerged targets, firing one or two exercise torpedoes or recoverable exercise torpedoes. TORPEX targets used in the Offshore Areas include live submarines, MK-30 ASW training targets, and MK-39 Expendable Mobile ASW Training Targets. The target may be non-evading while operating on a specified track, or it may be fully evasive, depending on the training requirements.

Submarines periodically conduct torpedo firing training events within the Hawaii Offshore OPAREA. Typical duration of a submarine TORPEX event is 22.7 hours, while air and surface ASW platform TORPEX events are considerably shorter. Inert exercise torpedoes are fired, and active and passive sonar is used during this training event. For modeling purposes, TRACKEX and TORPEX sonar hours are averaged resulting in a sonar time of 13.5 hours.

Baseline Training Events					
Anti-Submarine Warfare Tracking Exercise (ASW TRACKEX) and Anti-Submarine Warfare Torpedo Exercises (ASW TORPEX)	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.2	Hawaii Operating Area, Pacific Missile Range Facility	Ops	15	29

Major Integrated ASW Training Exercises

Integrated ASW training events conducted during a Major Integrated ASW Training Event are called a Major Exercise, which uses ships, submarines, aircraft, non-explosive training weapons, and other training systems and devices. No new or unique events take place during integrated training; it is merely the compilation of numerous ASW events as conducted by multiple units over a period of time ranging from 3 to 30 days. No ordinance is used during this training event. Sonobuoys are released from aircraft and active and passive sonar is used.

Baseline Training Events					
Major Integrated ASW Training Exercise	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.1.2	Hawaii Operating Area	Ops	Various	6

Extended Echo Ranging/Improved Extended Echo Ranging Training Exercise

The Extended Echo Ranging and Improved Extended Echo Ranging (EER/IEER) Systems are airborne ASW systems used in conducting “large area” searches for submarines. These systems are made up of airborne avionics ASW acoustic processing and sonobuoy types that are deployed in pairs. The IEER System's active sonobuoy component, the AN/SSQ-110 Sonobuoy, contains a small explosive charge that generates acoustic energy when detonated. If an underwater target is within range, the echo is received by the passive AN/SSQ-101 Air Deployable Active Receiver (ADAR) sonobuoy and transmitted to the aircraft. These sonobuoys are designed to provide underwater acoustic data necessary for naval aircrews to quickly and accurately detect submerged submarines. The sonobuoy pairs are dropped from a fixed-wing aircraft into the ocean in a predetermined pattern with a few buoys covering a very large area. Each training event includes approximately 12 events with 10 to 20 sonobuoys per event for a total of 120 to 240 sonobuoys per training event. The AN/SSQ-110 Sonobuoy Series is an expendable and commandable sonobuoy. Upon command from the aircraft, the bottom payload is released to sink to a designated operating depth. A second command is required from the aircraft to cause the second payload to release and detonate generating a “ping.” There is only one detonation in the pattern of buoys at a time.

The ANJSSQ-101 ADAR Sonobuoy is an expendable passive sonobuoy. After water entry, the ADAR sonobuoy descends to a selected depth and deploys hydrophones. Once activated, the ADAR sonobuoy works in conjunction with the SSQ-110 sonobuoy sound source, receiving active echoes reflecting off any target or reverberant present, including submarine hulls, seamounts, bottom features, etc.

Ordnance is used during this training event. Sonobuoys are released from aircraft, and active and passive sonar is used.

Baseline Training Events					
Extended Echo Ranging and Improved Extended Echo Ranging (EER/IEER)	NTA	Area	Metric	Duration (Hours)	Total Training Events
		Hawaii Operating Area	Ops	4 to 8 hours	4

Electronic Combat

Electronic Combat Operations

Electronic Combat (EC) Operations consist of air-, land-, and sea-based emitters simulating enemy systems and activating air, surface and submarine electronic support measures and electronic countermeasures systems. Appropriately configured aircraft fly threat profiles against the ships so that crews can be trained to detect electronic signatures of various threat aircraft, or so that ship crews can be trained to detect counter jamming of their own electronic equipment by the simulated threat. No ordnance is expended during this training event.

Baseline Training Events					
Electronic Combat (EC) Operations	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.5	Hawaii Operating Area	Ops	6.1	50

Mine Warfare

Mine Countermeasures Exercise

Mine Countermeasures (MCM) Exercises train forces to detect, identify, mark, and/or disable mines using a variety of methods. No ordnance is expended during this training event. Active sonar is used.

Organic Mine Countermeasures

Organic Mine Countermeasures (OMCM) include systems deployed by air, ship, and submarine. Five Organic Airborne Mine Countermeasures (OAMCM) systems (Figure D-3) are deployed by the MH-60S Seahawk Multi-Mission, including:

- **Advanced Mine Hunting Sonar:** The AN/AQS-20A Advanced Mine Hunting Sonar is a single-pass multi-sonar system designed to detect, locate, and identify mines on the sea floor and in the water.
- **AN/AES-1 Airborne Laser Mine Detection System (ALMDS):** The AN/AES-1 ALMDS is a sensor designed to detect moored, near surface mines using light detection and ranging technology.

AN/AES-1

AN/ASQ-20A

AN/AWS-2

AN/ALQ-220 OASIS

Organic Mine Countermeasures

Figure D-3

- **AN/ALQ-220 Organic Airborne and Surface Influence Sweep (OASIS):** The AN/ALQ-220 OASIS System is a lightweight magnetic/acoustic system employed by the MH-60S.
- **AN/AWS-2 Rapid Airborne Mine Clearance System (RAMICS):** The AN/AWS-2 RAMICS is being developed to destroy near-surface and floating mines using a 30-mm cannon hydro-ballistic projectile, and includes a target reacquisition pod on the MH-60S.
- **AN/ASQ-235 Airborne Mine Neutralization System (AMNS):** The AN/ASQ-235 AMNS is a lightweight expendable system designed to rapidly neutralize bottom and moored mines.

One OMCM System, the Remote Minehunting System, is deployed from a surface ship. Another OMCM system, the Long-term Mine Reconnaissance System, is deployed from a submarine. The Remote Minehunting System and the Long-term Mine Reconnaissance System should be operational after FY 2007.

Baseline Training Events					
	NTA	Area	Metric	Duration (Hours)	Total Training Events
Mine Countermeasures Exercise (MCM)	1.3.1	Hawaii Operating Area, Kingfisher, Shallow-water Minefield Sonar Training Area	Ops	6-12	32

Mine Neutralization

Mine Neutralization involves the detection, identification, evaluation, rendering safe, and disposal of mines and unexploded ordnance (UXO) that constitutes a threat to ships or personnel. Mine neutralization training is conducted by a variety of air, surface, and sub-surface assets.

Tactics for neutralizing ground or bottom mines involve the diver placing a specific amount of explosives which, when detonated underwater at a specific distance from a mine, results in neutralization of the mine. Floating, or moored, mines involve the diver placing a specific amount of explosives directly on the mine. Floating mines encountered by fleet ships in open-ocean areas are detonated at the surface. In support of a military expeditionary assault, the Navy deploys divers in very shallow water depths (10 to 40 ft) to locate mines and obstructions.

Divers are transported to the mines by boat or helicopter. Inert dummy mines are used in training events. The total net explosive weight used against each mine ranges from 1 lb to 20 lb.

Various types of surveying equipment are used during RIMPAC Exercises. Examples include the Canadian Route Survey System that hydrographically maps the ocean floor using multi-beam side scan sonar, and the Bottom Object Inspection Vehicle used for object identification.

These units help to support mine detection prior to Special Warfare Operations (SPECWAROPS) and Expeditionary Assault.

Occasionally, marine mammals are used in mine detection training. The Navy's Very Shallow Water Mine Countermeasures Detachment of Commander Mine Warfare Command deploys trained Atlantic bottlenose dolphins (*Tursiops truncatus*) of their marine mammal mine-hunting systems in several missions. Each mission includes up to four motorized small craft, several crew members and a trained dolphin. Training events using dolphins are coordinated with other Navy units to avoid conflicts with other Navy activities, underwater acoustic emissions associated with those activities, or civilian craft. Any unplanned situation that has the potential for exposing a dolphin to dangerous or conflicting underwater acoustic emissions or other interference is mitigated by recalling it into a small craft and moving the dolphin out of the area. As such, these marine mammals are continuously protected. Transportation of these animals into the State of Hawaii is in accordance with the regulations of the Hawaii State Department of Agriculture.

Mine neutralization events take place offshore in the Puuloa Underwater Range (called Keahi Point in earlier documents), Pearl Harbor; Lima Landing; Barbers Point Underwater Range off-shore of Coast Guard Air Station Barbers Point/Kalaeloa Airport (formerly Naval Air Station Barbers Point); PMRF, Kauai (Majors Bay area); PMRF and Oahu Training Areas; and in open-ocean areas.

All demolition activities are conducted in accordance with Commander Naval Surface Forces Pacific Instruction 3120.8F, Procedures for Disposal of Explosives at Sea/Firing of Depth Charges and Other Underwater Ordnance (U.S. Department of the Navy, 2003a). Before any explosive is detonated, divers are transported a safe distance away from the explosive. Standard practices for tethered mines in Hawaiian waters require ground mine explosive charges to be suspended 10 ft below the surface of the water. For mines on the shallow water floor (less than 40 ft of water), only sandy areas that avoid/minimize potential impacts on coral are used for explosive charges. Underwater detonations do occur during this training event.

Baseline Training Events					
	NTA	Area	Metric	Duration (Hours)	Total Training Events
Mine Neutralization	1.3.1	Puuloa Underwater Range, MCBH, MCTAB, Barbers Point Underwater Range, Naval Inactive Ship Maintenance Facility, Lima landing, Ewa Training Minefield	Ops	6	62

Mine Laying

Mine Laying events are designed to train forces to conduct offensive (deploy mines to tactical advantage of friendly forces) and defensive (deploy mines for protection of friendly forces and facilities) mining events. Mines can be laid from the air (FA-18/P-3) or by submarine.

Airborne Mine Laying involves one or more aircraft and either computer-simulated or inert exercise mines. Mine warfare events are limited to either the simulated laying of aircraft-deployed mines, where no actual mine ordnance is dropped, or the use of inert exercise mines or inert exercise submarine-deployed mines.

The use of inert exercise mines is generally limited to areas greater than 100 fathoms, or 600 ft in depth. Before dropping inert exercise mines, the crew visually determines that the area is clear. Although the altitude at which inert exercise mines are dropped varies, the potential for drift during descent generally favors release at lower altitudes, where visual searches for marine mammals are more effective. When the inert exercise mine is released, a small parachute retards its entry into the ocean. The mine can be designed to float on the surface or near surface or to sink on a tether. Ultimately the mine sinks carrying the parachute with it. Standard Navy procedures are followed for the deployment of inert mines from submarines.

Aerial mining lines are generally developed off the southwest coast of Kauai and the southeast coast of Niihau, within PMRF Warning Areas W-186 and W-188. Submarine mining events are conducted within PMRF Warning Area W-188. Air Operations are conducted within R3101. Inert mine shapes are released into the ocean during these training events.

Baseline Training Events					
Mine Laying	NTA	Area	Metric	Duration (Hours)	Total Training Events
	1.4.1	Pacific Missile Range Facility (R-3101)	Ops	6-12	22

Land Demolitions

Land demolitions events are designed to train forces to cause the explosion and the resulting destruction of enemy personnel, vehicles, aircraft, obstacles, facilities, or terrain on land. These events are also designed to develop and hone Explosive Ordnance Disposal (EOD) mission proficiency in locating, identifying, excavating, and neutralizing land mines. Land demolitions take place at the West Loch EOD Training Facility. In addition to Navy personnel, Honolulu Police, Federal Bureau of Investigation, and several research, development, test, and evaluation (RDT&E) companies conduct land demolitions at the EOD land facility. The EOD facility is limited to 2.5 lb of non-fragment producing explosives. EOD Range demolition events take approximately 4.5 hours to complete, and there are between 70 and 80 events per year. Land detonations occur during this training event.

Baseline Training Events					
Land Demolitions	NTA	Area	Metric	Duration (Hours)	Total Training Events
	1.4.4	Explosive Ordnance Disposal Land Range	Ops	4	85

Naval Special Warfare

Swimmer Insertion/Extraction

Naval Special Warfare (NSW) personnel conduct underwater swimmer insertion and extraction training in the Hawaii Offshore Areas using either the Sea, Air, Land (SEAL) Delivery Vehicle (SDV), or the Advanced SEAL Delivery System (ASDS). Both submersibles are designed to deliver special operations forces for clandestine activities. The SDV is an older, open-design delivery vehicle. The ASDS is a new dry compartment vehicle that keeps the SEALs warmer during transit. The battery-powered ASDS is capable of operating independently or with submarines.

Two types of training occur with the ASDS—unit and integrated. Unit training with the ASDS consists of the SDV Team operating the ASDS independently. Integrated training involves the SDV Team working with a submarine and the ASDS.

Underwater swimmer insertion and extraction training is focused on undersea operation of the SDV or ASDS, and does not typically involve SEAL personnel landing ashore or conducting shore training. Although undersea range areas are usually reserved for a 24-hour period, the insertion/extraction event itself lasts approximately 8 hours. Swimmer insertion and extraction events can also include the use of helicopters to insert or extract NSW personnel using a variety of techniques. No ordnance or sonar will be used during this training event.

Baseline Training Events					
	NTA	Area	Metric	Duration (Hours)	Total Training Events
Swimmer Insertion/Extraction	1.1.2.4	Hawaii Operating Area, Marine Corps Training Area-Bellows, Pacific Missile Range Facility (Main Base)	Days	8	132

Special Warfare Operations

SPECWAROPS are performed by Navy SEALs and U.S. Marines. Activities include special reconnaissance (SR), reconnaissance and surveillance, combat search and rescue (CSAR), and direct action (DA). SR units consist of small special warfare unit and utilize helicopters, submarines, and combat rubber raiding craft to gain covert access to military assets, gather intelligence, stage raids, and return to their host units. Reconnaissance inserts and beach surveys are often conducted before large-scale amphibious landings and can involve several units gaining covert access using a boat. CSAR activities are similar to SR (R&S), but the mission is to locate and recover a downed aircrew. DA missions consist of an initial insertion, followed by the helicopters/boats inserting additional troops to take control of an area. The helicopters may land for refueling. No ordnance or sonar will be used during this training.

Baseline Training Events					
	NTA	Area	Metric	Duration (Hours)	Total Training Events
Special Warfare Operations (SPECWAROPS)	1.5.6	PMRF (Main Base, Makaha Ridge), Puuloa underwater Range, MCBH, Barbers Point Underwater Range, Naval Station Pearl Harbor, Naval Inactive Ship Maintenance Facility, Lima Landing, U.S. Coast guard Air Station Barbers Point/Kalaeloa Airport, Hickam AFB, Bradshaw Army Airfield, Makua Military Reservation, Kahuku Training Area, Kawaihae Pier, Dillingham Military Reservation, Wheeler Army Airfield, Niihau, MCTAB, Pohakuloa Training Area	Days	8	30

Strike Warfare

Bombing Exercise (Land)

Kaula also is used for BOMBEX training. BOMBEX events consist of air-to-ground delivery of small, 25-lb, inert MK-76 (a type of training ordnance); inert laser-guided bombs, such as the Hellfire, or the MK-82, a 500-lb bomb. BOMBEX events originate from an aircraft carrier or a land base. CSG fixed-wing aircraft account for all of the Navy BOMBEX events at Kaula. Only inert ordnance 500 lb or less is authorized for use on Kaula. Inert bombs will be dropped from aircraft during this training. Live and inert bombs may be used at Pohakuloa Training Area.

Baseline Training Events					
	NTA	Area	Metric	Duration (Hours)	Total Training Events
Bombing Exercise (BOMBEX) (Land)	3.2.6	Kaula, Pohakuloa Training Area	Ops	0.8	165

Air-to-Ground Gunnery Exercise

Kaula, a small island southwest of Kauai (shown in Figure 1.2-2), is used for air-to-ground gunnery training. Air-to-ground GUNEX includes live fire gunnery training from fixed- or rotary-wing aircraft. The use of 20-mm and 30-mm cannon fire is not allowed from November through May. Live gunnery rounds will be fired at land targets during this training event.

Baseline Training Events					
	NTA	Area	Metric	Duration (Hours)	Total Training Events
Air-to-Ground Gunnery Exercise (GUNEX)	3.2.6	Kaula, Pohakuloa Training Area	Ops	0.8	16

Other Training

Salvage Operations

The purpose of Salvage Operations is to provide a realistic training environment for battling fires at sea, de-beaching of stranded ships, and harbor clearance operations training by Navy diving and salvage units.

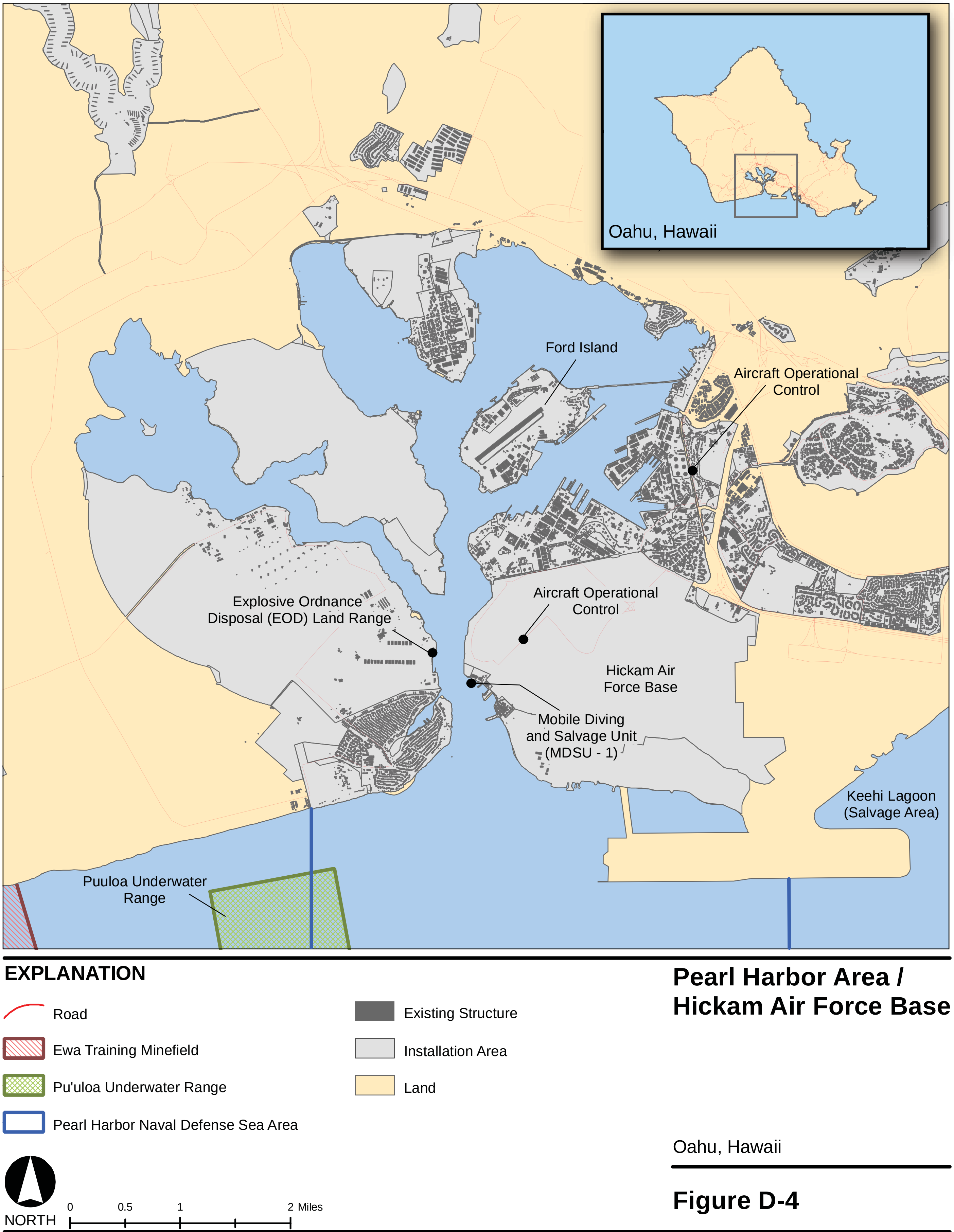
The Navy's Mobile Diving and Salvage Unit One (MDSU-1) (Figure D-4) and divers from other countries practice swift and mobile ship and barge salvage, towing, battle damage repair, deep ocean recovery, harbor clearance, removal of objects from navigable waters, and underwater ship repair capabilities.

Diving and salvage forces training include the following activities:

- SCUBA and surface supplied air and mixed gas (HeO_2) diving operations to depths of 300 ft of sea water
- Hyperbaric recompression chamber operations
- Underwater ship inspection, husbandry, and repair of coalition Naval ships and submarines
- Underwater search and recovery operations
- Underwater cutting employing hydraulic, pneumatic, and oxy-arc powered tools
- Underwater welding
- Removal of petroleum, oil, and lubricants (POL) exercising various POL offload techniques
- Restoring Buoyancy (Survey, Patch, De-water) to a grounded or sunken vessel or object of value
- Harbor clearance for removal of derelict vessels or other obstructions from navigable waterways and berthing
- Off-Ship fire fighting to simulate rescue and assistance operations battling fires

These activities take place at Puuloa Underwater Range, Pearl Harbor, and Keehi Lagoon. Staging for these activities is from the MDSU-1 Facility located on Bishop Point, an annex of Pearl Harbor, on the southwestern side of Hickam Air Force Base, Oahu. To capitalize on real-world training opportunities and to provide mutual benefit for both the U.S. Naval and Coalition Salvage Force and for the State of Hawaii, salvage training and harbor clearance events take place in any of the shoal waters, harbors, ports, and in-land waterways throughout the Hawaiian OPAREA.

The ship fire training lasts no more than 1 day per event. De-beaching activities last no more than 1 to 2 days per event. Deep ocean recovery training last up to 2 weeks and could be longer depending on the availability of missions.



Pearl Harbor Area / Hickam Air Force Base

Oahu, Hawaii

Figure D-4

The duration of Salvage Operations varies considerably. For a fire at sea or ship retraction of a grounded vessel, the training event lasts up to 4 days. For underwater cutting, welding, pumping, restoring buoyancy, and training that practice a single skill in a controlled environment, the event usually does not exceed 1 day. However, multiple iterations could extend throughout the duration of the training event. No ordnance or sonar will be used during this training.

All U.S. and Coalition Naval Salvage Force training event scenarios will be conducted in accordance with the following references:

a. U.S. Navy Diving Manual Revision 4, with a change dated March 2001
b. U.S. Navy Salvage Safety Manual
c. U.S. Navy Salvage Manual Vol. 1—Strandings
d. U.S. Navy Salvage Manual Vol. 2—Harbor Clearance
e. U.S. Navy Salvage Manual Vol. 3—Firefighting and Damage Control
f. U.S. Navy Salvage Manual Vol. 5—Petroleum Oil and Lubricant Offload
g. U.S. Navy Towing Manual
h. OPNAVINST 5100.19B (safety manual)
i. Fleet Exercise Publication–4, Chapter 12, Mobile Diving and Salvage Units and Chapter X, ARSs

Baseline Training Events					
	NTA	Area	Metric	Duration (Days)	Total Training Events
Salvage Operations	4.13	Naval Station Pearl Harbor, Puuloa Underwater Range, Naval Defensive Sea Area, Keehi Lagoon	Ops	1	3

Live Fire Exercise

Live Fire Exercise (LFX) provides ground troops with live fire training and combined arms LFX training, including aerial gunnery and artillery firing. These training events include platoon troop movements through numerous target objectives with various weapons. Aerial Gunnery Exercises and artillery and mortar training are also conducted as part of combined and separate training events. Live fire and blanks are used. Blanks are used outside of defined impact areas. LFX benefit ground personnel who receive semi-realistic training.

LFX typically consists of ground troops and special forces, including a sniper unit, of about 2 to 18 people, a helicopter, artillery, mortars, and miscellaneous small arms. In the future, up to a brigade of U.S. or foreign troops could receive LFX training during a Major Exercise. LFX is conducted at Pohakuloa Training Area (Figure D-5) and Makua Military Reservation (Figure D-6). Live rounds will be fired at Pohakuloa Training Area, and inert rounds (blanks) will be fired at Makua Military Reservation.

EXPLANATION

- Road
- Pohakuloa Training Area
- Bradshaw Army Airfield
- Impact Area
- Land

NORTH

0 1 2 4 Miles

Pohakuloa Training Area and Bradshaw Army Airfield

Hawaii, Hawaii

Figure D-5

EXPLANATION

Roads

Installation Areas

Land

NORTH

0 2,000 4,000 8,000 Feet

Makua Military Reservation and Dillingham Military Reservation

Oahu, Hawaii

Figure D-6

Baseline Training Events					
LFX	NTA	Area	Metric	Duration (Hours)	Total Training Events
	3.2.2	Makua Military Reservation, Pohakuloa Training Area	Ops	1 - 24	3

Humanitarian Assistance Operation/Non-combatant Evacuation Operation

The purpose of Humanitarian Assistance Operation/Non-combatant Evacuation Operation (HAO/NEO) is to provide training in providing humanitarian assistance in an increasingly hostile setting, which could require the evacuation of personnel and troops. Marine Corps Base Hawaii is used for HAO/NEO and direct action training. MCTAB, Kahuku Training Area, Majors Bay at PMRF, and Niihau are also used for HAO/NEO.

HAO/NEO training events, which last approximately 4 days, involve approximately 150 personnel, troops, and specialists who initially provide assistance to civilians and then evacuate them when necessary. This scenario is also used to simulate a prisoner-of-war camp or place where people are interned. A Direct Action Exercise (lasting several hours) is another scenario included in the HAO/NEO. It is much quicker and involves approximately 50 personnel and 150 troops who gain access to an area by boat or helicopter, storm the location, recover the mission target, and return to their units.

HAO/NEO events use trucks, helicopters, LCAC, LCU, and/or CRRC to shuttle supplies. Evacuations may be made using helicopters, and/or LCAC vehicles. Direct Actions may use CRRC, RHIB, trucks, and/or helicopters. Existing building and facilities are used to the extent practicable, but in some instances tents and other temporary structures may be used. No ordnance is used during this training.

Baseline Training Events					
Humanitarian Assistance Operation/Non-combatant Evacuation Operation (HAO/NEO)	NTA	Area	Metric	Duration (Days)	Total Training Events
	6.2.1	Niihau, MCBH, MCTAB, Kahuku Training Area, Pacific Missile Range Facility (Main Base)	Ops	4	1

Humanitarian Assistance/Disaster Relief

The purpose of Humanitarian Assistance/Disaster Relief (HA/DR) is to provide training in responding to a United Nations request for complex emergency support. HA/DR training events involve approximately 125 to 250 troops and 125 to 200 refugee actors. An amphibious landing craft off-loads approximately 4 transport trucks, 3 support vehicles, 3 water supply vehicles, water and food supply, and 125 troops. They travel along authorized highways to the HA/DR site. A safe haven camp is established in existing facilities or temporary facilities (tents, etc.).

The HA/DR training event lasts for approximately 10 days. Future HA/DR training events could range from 2 to 18 days. The camp is established in 2 days. Personnel are provided water, shelter, food, sanitation, and communications for 5 days. Takedown takes about 2 days.

For each training event, there are two sites: a refugee camp and a Civil–Military Operations Center area. There are roughly 30 five-person Red Cross tents within the refugee camp, with a few larger tents for various support functions including meals, showers, recreation, administration, and storage. The Civil–Military Operations Center section contains more storage, communication links, staff housing, experimentation (including information management and high-bandwidth informatics support, digital transcription facilities to interview refugees for war-crimes documentation, and solar powered computer systems), and various public relations areas for visitors. Approximately 18 portable latrines are at the sites. Buses and/or trucks, and military helicopters as needed, are used to transport refugees.

A safe haven refugee camp would be established within the Marine Corps Base Hawaii, MCTAB, and/or Kahuku Training Area. An amphibious landing craft or trucks would offload equipment, vehicles, troops, and refugees. Airstrips at these locations would be used to transport personnel.

The HA/DR training event takes place near an existing training trail. The access road to the site would be graded before the event, if required. Grading would be within the existing roadway in accordance with standard procedures. Equipment and personnel would be transferred to the camp location via transport trucks and buses, respectively. Training map overlays that identify the transit route, camp location, and any nearby restricted areas or sensitive biological and cultural resource areas would be used by participants. No ordnance is used during this training.

Baseline Training Events					
Humanitarian Assistance/Disaster Relief HA/DR	NTA	Area	Metric	Duration (Days)	Total Training Events
	6.2.3	MCBH, MCTAB, Kahuku Training Area	Ops	10	1

Table D-2 includes the current and future RDT&E activities conducted within the HRC.

Table D-2. Baseline and Planned RDT&E Activities

Mission Area	Activity	Activity Description
Pacific Missile Range Facility (PMRF)	Anti-Air Warfare RDT&E	Testing and training on Aegis-capable ships after refurbishment or overhaul.
	Anti-Submarine Warfare	Sensor, fire control, and weapon testing.
	Combat System Ship Qualification Trial	Conducted for new ships and for ships that have undergone modification and/or overhaul of their combat systems, can include operating any or all of a ship's combat systems.
	Electronic Combat/Electronic Warfare (EC/EW)	Tests designed to assess how well EC/EW training and RDT&E activities are performed.
	High Frequency	Use of high-frequency radio signals and the evaluation of their effectiveness.
	Missile Defense	Aerial targets launched from PMRF, mobile sea-based platforms, or military cargo aircraft. A ballistic missile target vehicle is launched from PMRF and intercepted by a ship- or land-launched missile.
	Joint Task Force Wide Area Relay Network	Demonstration of advanced Command, Control and Communications technologies in a highly mobile, wireless, wide-area relay network in support of tactical forces.
Naval Undersea Warfare Center Ranges	Shipboard Electronic Systems Evaluation Facility (SESEF) Quick Look Tests	Evaluate ship, shore, and aircraft systems that emit or detect electronic emissions. These systems include those used for radio communications, data transfer, navigation, radar, and identification of friend and foe.
	SESEF System Performance Tests	Provide accuracy checks of ship and submarine sonar, both in active and passive modes, and to evaluate the accuracy of a ship's radar.
	Fleet Operational Readiness Accuracy Check Site (FORACS) Tests	Provide accuracy checks of ship and submarine sonar, both in active and passive modes, and to evaluate the accuracy of a ship's radar.
Future RDT&E Activities	Additional Chemical Simulant	Target launches from PMRF would incorporate additional chemical simulants to include larger quantities of tributyl phosphate (TBP) and various glycols.
	Intercept Targets launched into PMRF Controlled Area	Launches from Wake Island, the Reagan Test Site at U.S. Army Kwajalein Atoll (USAKA), and Vandenberg AFB towards the vicinity of PMRF are proposed. Intercept areas would be in the Broad Ocean Area and Temporary Operating Area.
	Launched SM-6 from Sea-Based Platform (AEGIS)	Capability to launch the Extended Range Active Missile, tentatively designated SM-6, from a sea-based platform. Similar to ongoing launches of the current version of the Standard Missile from Aegis ships.
	Micro-Satellites Launch	A joint venture between PMRF, the Department of Energy at the Kauai Test Facility, and the University of Hawaii to launch micro-satellites into space.
	Test Unmanned Surface Vehicles	Remote-controlled boats equipped with modular packages to potentially support surveillance and reconnaissance activities, mine warfare, anti-terrorism/force protection, port protection, Special Forces operations, and possibly anti-submarine warfare.
	Test Unmanned Aerial Vehicles	Remotely piloted or self-piloted aircraft that include fixed-wing, rotary-wing, and other vertical takeoff vehicles. Can carry cameras, sensors, communications equipment, weapons, or other payloads. Could support intelligence, surveillance, and reconnaissance; suppression of enemy air defenses; electronic attack; anti-surface ship and anti-submarine warfare; mine warfare; communications relay; and derivations of these themes.

Table D-2. Baseline and Planned RDT&E Activities (Continued)

Mission Area	Activity	Activity Description
Future RDT&E Activities	Test Hypersonic Vehicles	Development of air-breathing hypersonic vehicles that are capable of maximum sustainable cruising speeds in excess of Mach 4, as potential ordnance delivery systems.
Offshore Enhancements	Portable Undersea Tracking Range	Provide submarine training in areas where the ocean depth is between 300 ft and 12,000 ft and at least 3 nm from land.
PMRF Enhancements	Large Area Tracking Range Upgrade	Upgraded with ground relay stations to cover training throughout much of the HRC. Proposed ground relay stations would be modifications to existing facilities.
	Enhanced Electronic Warfare Training	Capability for EW training would be enhanced to include sites on other islands (e.g., Maui and Hawaii).
	Expanded Training Capability for Transient Air Wings	Provide dedicated equipment to enable Mid-Pacific and transiting strike groups to participate in either live or virtual activities.
	Kingfisher Underwater Training Area	Underwater training area would be approximately 2 mi off the southeast coast of Niihau at a depth of between 300 and 400 ft.
	FORCEnet Antenna	Effort to integrate military personnel, sensors, networks, command and control, platforms, and weapons into a fully netted, combat force. Existing building or a portable trailer.
	Enhanced Auto ID System and Force Protection Capability	AIS equipment installed on each island so each ship would have sensor connectivity and communication connections.
	Construct Range Operations Control Building	Build a new, almost 90,000 sq-ft range operations building to consolidate the activities currently in 13 buildings.
	Improve Fiber Optics Infrastructure	Installation of approximately 23 mi of fiber optic cable, which would be hung on existing Kauai Island Utility Cooperative poles between PMRF/Main Base and Kokee.
Pearl Harbor Enhancements	MK-84/MK-72 Pinger Acoustic Test Facility	New open-water Acoustic Test Facility capability near the Naval Undersea Warfare Center's Ford Island facility in Pearl Harbor.
	Mobile Diving and Salvage Unit Training Area	Establish an underwater training area in which Mobile Diving and Salvage Unit-1 can conduct military diving and salvage training, including submerging a 100-ft by 50-ft barge.
Future RDT&E Activities	Directed Energy	Develop the necessary standard operating procedures and range safety requirements necessary to provide safe operations associated with future high-energy laser tests.
	Advanced Hypersonic Weapon	Launches of long range (greater than 3,400 miles) missiles deploying an unpowered payload. A four-missile launch program, with the first two tests using a Strategic Target System booster launched from Kauai Test Facility (KTF) at PMRF. The payload would travel approximately 2,500 mi from PMRF to Illeginni Island in USAKA.

RIMPAC and USWEX

The Commander, U.S. THIRD Fleet, conducts RIMPAC within the HRC every other year. The biennial RIMPAC is a multinational, sea control and power projection Major Exercise that consists of various phases of activity by Army, Marine Corps, Navy, and Air Force forces, as well as the military forces of several Pacific Rim nations. During the month-long Major Exercise, individual training events occur in open ocean, offshore, and onshore areas. Table D-3 shows the matrix of training events used during previous RIMPAC Exercises by location.

USWEX includes a single Strike Group, training in the HRC for up to 4 days, four times per year. Table D-4 shows the matrix of training events generally used during a USWEX Exercise by location.

Under Alternative 1 the Navy proposes to continue RIMPAC and USWEX Exercises described in the No-action Alternative. USWEX frequency would increase from four to six times per year. RIMPAC would include two Strike Groups, and FCLPs would occur in association with transiting Strike Groups participating in Major Exercises. The training associated with Major Exercises would be chosen from the appropriate matrix of training events, in Table D-5.

Under Alternatives 2 and 3, up to three Strike Groups would conduct training events simultaneously in the HRC. The Strike Groups would not be homeported in Hawaii, but would stop in Hawaii en route to a final destination. The Strike Groups would be in Hawaii for up to 10 days per event. Proposed training would be similar to current training events for the RIMPAC and USWEX Exercises. Also included in the training would be FCLP events conducted at the following airfields: Marine Corps Base Hawaii and PMRF. The events associated with Multiple Strike Group training would be chosen from the appropriate matrix of training events listed in Table D-6.

Table D-3. Rim of the Pacific 06 Exercise Matrix

			Training Events																						
					AAW				ASUW / ASW		MIW				ASUW										
												MCM													
Service	Location	Island	IN-PORT/ SUPPORTEX	C2	AIROPS	S-A MISSILEX	A-A MISSILEX/ ACM	A-S MISSILEX	S-S MISSILEX	ASW	MINEX	SMWEX	Air MIWEX	UMWEX	STW, CASEX	GUNEX	SINKEX	LFX	HAO/NEO	HA/DR	SPECWAROPS	DEMO	SALVAGE OPS	Expeditionary Assault	SUBOPS	Seaglider
Navy	Pacific Missile Range Facility*	Kauai																								
	Niihau	Niihau																								
	Kaula	Kaula																								
	Pearl Harbor**	Oahu																								
	Lima Landing	Oahu																								
	Puuloa Underwater Range – Pearl Harbor	Oahu																								
	Barbers Point Underwater Range	Oahu																								
	Coast Guard AS Barbers Point/ Kalaeloa Airport	Oahu																								
	PMRF Warning Areas#	Ocean Areas																								
	Oahu Warning Areas#	Ocean Areas																								
	Open Ocean Areas#	Ocean Areas																								
	U.S. Command Ship	Ocean Areas																								
Marines	Marine Corps Base Hawaii	Oahu																								
	Marine Corps Training Area Bellows	Oahu																								
Air Force	Hickam Air Force Base	Oahu																								
Army	Kahuku Training Area	Oahu																								
	Makua Military Reservation	Oahu																								
	Dillingham Military Reservation	Oahu																								
	Wheeler Army Airfield	Oahu																								
	K-Pier, Kawaihae	Hawaii																								
	Bradshaw Army Airfield	Hawaii																								
	Pohakuloa Training Area	Hawaii																								
State	Keehi Lagoon	Oahu																								

* Includes Port Allen and Makaha Ridge ** Includes Ford Island and all other areas within the harbor.

These areas are included in the HRC. The HRC is now used to define the outer limits of the ocean areas used during Major Exercises.

Locations where events can occur | RIMPAC 02 Programmatic | Added RIMPAC 04 Supplement | Added RIMPAC 06 Supplement

Training Events:

A-A MISSILEX	Air-to-Air Missile Exercise (formerly AAMEX)	C2	Command and Control
AAW[1]	Anti-Air Warfare	DEMO	Demolition Exercise
AIROPS	Air Operations	GUNEX	Gunnery Exercise
AMPHIBEX	Amphibious Landing Exercise (now Expeditionary Assault)	HA/DR	Humanitarian Assistance/Disaster Relief
Air MIWEX	Air Mine Warfare Exercise (formerly AMWEX)	HAO/NEO	Humanitarian Assistance Operation/ Non-Combatant Evacuation Operation
A-S MISSILEX	Air-to-Surface Missile Exercise (formerly ASMEX)	IN-PORT	In-port Briefings and Activities
ASUW[2]/ASW[3]	Anti-Surface Warfare/ Anti-Submarine Warfare Exercise	LFX	Live Fire Exercise
ASW	Anti-Submarine Warfare Exercise (formerly ASWEX)	MCM	Mine Countermeasures
CASEX	Close Air Support	MINEX	Mine Exercise
		MIW[4]	Mine Warfare
SALVAGE OPS	Salvage Operations		
S-A MISSILEX	Surface-to-Air Missile Exercise (formerly SAMEX)		
SINKEX	Sinking Exercise		
SMWEX	Ship Mine Warfare Exercise		
SPECWAROPS	Special Warfare Operations		
S-S MISSILEX	Surface-to-Surface Missile (formerly SSMEX)		
STW	Strike Warfare Exercise (formerly STWEX)		
SUBOPS	Submarine Operations		
SUPPORTEX	In-Port Support Exercise		
UMWEX	Underwater Mine Warfare Exercise		

Note: Since the publication of the RIMPAC 02 Programmatic (U.S. Department of the Navy, 2002a), new terminology and/or categories of exercises have come into use. They are as follows:

[1] AAW includes AIROPS, S-A MISSILEX, A-A MISSILEX, and A-S MISSILEX

[2] ASUW includes GUNEX, S-S MISSILEX, and ASW

[3] ASW includes S-S MISSILEX and ASW

[4] MIW encompasses two subsets, MINEX and MCM. MINEX is the act of laying mines. MCM is the act of locating and countering mining by others and includes SMWEX, AMWEX, and UMWEX.

Table D-4. Example Undersea Warfare Exercise Matrix

Training Events

Service	Location	Island	IN-PORT/ SUPPORTEX	C2	AAW/ACM: AIROPS	AAW/ACM: S-A MISSILEX	AAW/ACM: A-A MISSILEX/ ACM	AAW/ACM: A-S MISSILEX	ASUW / ASW: S-S MISSILEX	ASUW / ASW: ASW	MIW: MINEX	MIW: MCM: SMWEX	MIW: MCM: Air MIWEX	MIW: MCM: UMWEX	ASUW: STW, CASEX	ASUW: GUNEX	ASUW: SINKEX	LFX	HAO/NEO	HA/DR	SPECWAROPS	DEMO	SALVAGE OPS	Expeditionary Assault	SUBOPS	Seaglider
Navy	Pacific Missile Range Facility*	Kauai		gray	gray	gray	gray		gray			gray			gray				gray		gray	gray		yellow		
	Niihau	Niihau																	gray		gray					
	Kaula	Kaula													gray	yellow										
	Pearl Harbor**	Oahu	gray	gray	gray																gray	gray	gray			
	Lima Landing	Oahu																			gray	gray				
	Puuloa Underwater Range – Pearl Harbor	Oahu																			gray	gray	gray			
	Barbers Point Underwater Range	Oahu																			gray	gray				
	Coast Guard AS Barbers Point/ Kalaeloa Airport	Oahu			gray																gray					
	PMRF Warning Areas[#]	Ocean Areas				gray	yellow	yellow	gray	yellow	gray				yellow	yellow	gray				gray	gray			yellow	
	Oahu Warning Areas[#]	Ocean Areas				gray	yellow			yellow						yellow					gray	gray			yellow	
	Open Ocean Areas[#]	Ocean Areas								yellow		gray	gray	gray							gray	gray			yellow	gray
	U.S. Command Ship	Ocean Areas		gray																						
Marines	Marine Corps Base Hawaii	Oahu		gray	gray									gray					gray	gray	gray			gray		
	Marine Corps Training Area Bellows	Oahu																	gray	gray	gray			yellow		
Air Force	Hickam Air Force Base	Oahu		gray	gray																gray					
Army	Kahuku Training Area	Oahu																	gray	gray	gray					
	Makua Military Reservation	Oahu																gray			gray					
	Dillingham Military Reservation	Oahu																			gray					
	Wheeler Army Airfield	Oahu		gray	gray																gray					
	K-Pier, Kawaihae	Hawaii																			gray			gray		
	Bradshaw Army Airfield	Hawaii		gray	gray																gray					
	Pohakuloa Training Area	Hawaii		gray											yellow			gray			gray					
State	Keehi Lagoon	Oahu																					gray			

* Includes Port Allen and Makaha Ridge

** Includes Ford Island and all other areas within the harbor.

[#] These areas are included in the HRC. The HRC is now used to define the outer limits of the ocean areas used during Major Exercises.

(gray) Locations where training events occur

(yellow) USWEX training events

Training Events:

A-A MISSILEX	Air-to-Air Missile Exercise (formerly AAMEX)
AAW[1]	Anti-Air Warfare
AIROPS	Air Operations
AMPHIBEX	Amphibious Landing Exercise (now Expeditionary Assault)
Air MIWEX	Air Mine Warfare Exercise (formerly AMWEX)
A-S MISSILEX	Air-to-Surface Missile Exercise (formerly ASMEX)
ASUW[2]/ASW[3]	Anti-Surface Warfare/ Anti-Submarine Warfare Exercise
ASW	Anti-Submarine Warfare Exercise (formerly ASWEX)
CASEX	Close Air Support
C2	Command and Control
DEMO	Demolition Exercise
GUNEX	Gunnery Exercise
HA/DR	Humanitarian Assistance/Disaster Relief
HAO/NEO	Humanitarian Assistance Operation/ Non-Combatant Evacuation Operation
IN-PORT	In-port Briefings and Activities
LFX	Live Fire Exercise
MCM	Mine Countermeasures
MINEX	Mining Exercise
MIW[4]	Mine Warfare
SALVAGE OPS	Salvage Operations
S-A MISSILEX	Surface-to-Air Missile Exercise (formerly SAMEX)
SINKEX	Sinking Exercise
SMWEX	Ship Mine Warfare Exercise
SPECWAROPS	Special Warfare Operations
S-S MISSILEX	Surface-to-Surface Missile (formerly SSMEX)
STW	Strike Warfare Exercise (formerly STWEX)
SUBOPS	Submarine Operations
SUPPORTEX	In-Port Support Exercise
UMWEX	Underwater Mine Warfare Exercise

Note: Since the publication of the RIMPAC 02 Programmatic (U.S. Department of the Navy, 2002a), new terminology and/or categories of exercises have come into use. They are as follows:

[1] AAW includes AIROPS, S-A MISSILEX, A-A MISSILEX, and A-S MISSILEX

[2] ASUW includes GUNEX, S-S MISSILEX, and ASW

[3] ASW includes S-S MISSILEX and ASW

[4] MIW encompasses two subsets, MINEX and MCM. MINEX is the act of laying mines. MCM is the act of locating and countering mining by others and includes SMWEX, AMWEX, and UMWEX.

Table D-5. Proposed Future RIMPAC Exercise Matrix

Service	Location	Island	Training Events																								
											MIW																
					AAW				ASUW / ASW			MCM			ASUW												
			IN-PORT/ SUPPORTEX	C2	AIROPS	S-A MISSILEX	A-A MISSILEX/ ACM	A-S MISSILEX	S-S MISSILEX	ASW	MINEX	SMWEX	Air MIWEX	UMWEX	STW, CASEX	GUNEX	SINKEX	LFX	HAO/NEO	HA/DR	SPECWAROPS	DEMO	SALVAGE OPS	Expeditionary Assault	SUBOPS	Seaglider	FCLP
Navy	Pacific Missile Range Facility*	Kauai		■	■	■	■		■			■			■				■		■	■		■			■ (yellow)
	Niihau	Niihau																	■		■						
	Kaula	Kaula													■	■											
	Pearl Harbor**	Oahu	■	■	■																■	■	■				
	Lima Landing	Oahu																			■	■					
	Puuloa Underwater Range – Pearl Harbor	Oahu																			■	■	■				
	Barbers Point Underwater Range	Oahu																			■	■					
	Coast Guard AS Barbers Point/ Kalaeloa Airport	Oahu			■																■						
	PMRF Warning Areas#	Ocean Areas				■	■	■	■	■	■				■	■	■				■	■			■		
	Oahu Warning Areas#	Ocean Areas				■	■			■						■					■	■			■		
	Open Ocean Areas#	Ocean Areas																									
	U.S. Command Ship	Ocean Areas		■																							
Marines	Marine Corps Base Hawaii	Oahu		■	■									■					■	■	■			■			■ (yellow)
	Marine Corps Training Area Bellows	Oahu																	■	■	■			■			
Air Force	Hickam Air Force Base	Oahu		■	■																■						
Army	Kahuku Training Area	Oahu																	■	■	■						
	Makua Military Reservation	Oahu																■			■						
	Dillingham Military Reservation	Oahu																			■						
	Wheeler Army Airfield	Oahu		■	■																■						
	K-Pier, Kawaihae	Hawaii																			■			■			
	Bradshaw Army Airfield	Hawaii		■	■																■						
	Pohakuloa Training Area	Hawaii		■											■			■			■						
State	Keehi Lagoon	Oahu																					■				

* Includes Port Allen and Makaha Ridge   ** Includes Ford Island and all other areas within the harbor.

[#] These areas are included in the HRC. The HRC is now used to define the outer limits of the ocean areas used during Major Exercises.

■ Locations where events can occur   ■ (yellow) Future RIMPAC (Additional Exercises)

Training Events:

A-A MISSILEX	Air-to-Air Missile Exercise (formerly AAMEX)	C2	Command and Control	SALVAGE OPS	Salvage Operations
AAW[1]	Anti-Air Warfare	DEMO	Demolition Exercise	S-A MISSILEX	Surface-to-Air Missile Exercise (formerly SAMEX)
AIROPS	Air Operations	FCLP	Field Carrier Landing Practice	SINKEX	Sinking Exercise
AMPHIBEX	Amphibious Landing Exercise (now Expeditionary Assault)	GUNEX	Gunnery Exercise	SMWEX	Ship Mine Warfare Exercise
Air MIWEX	Air Mine Warfare Exercise (formerly AMWEX)	HA/DR	Humanitarian Assistance/Disaster Relief	SPECWAROPS	Special Warfare Operations
A-S MISSILEX	Air-to-Surface Missile Exercise (formerly ASMEX)	HAO/NEO	Humanitarian Assistance Operation/Non-Combatant Evacuation Operation	S-S MISSILEX	Surface-to-Surface Missile (formerly SSMEX)
ASUW[2]/ASW[3]	Anti-Surface Warfare/ Anti-Submarine Warfare Exercise	IN-PORT	In-port Briefings and Activities	STW	Strike Warfare Exercise (formerly STWEX)
		LFX	Live Fire Exercise	SUBOPS	Submarine Operations
ASW	Anti-Submarine Warfare Exercise (formerly ASWEX)	MCM	Mine Countermeasures	SUPPORTEX	In-Port Support Exercise
CASEX	Close Air Support	MINEX	Mine Exercise	UMWEX	Underwater Mine Warfare Exercise
		MIW[4]	Mine Warfare		

Note: Since the publication of the RIMPAC 02 Programmatic (U.S. Department of the Navy, 2002a), new terminology and/or categories of exercises have come into use. They are as follows:

[1] AAW includes AIROPS, S-A MISSILEX, A-A MISSILEX, and A-S MISSILEX   [2] ASUW includes GUNEX, S-S MISSILEX, and ASW   [3] ASW includes S-S MISSILEX and ASW

[4] MIW encompasses two subsets, MINEX and MCM. MINEX is the act of laying mines. MCM is the act of locating and countering mining by others and includes SMWEX, AMWEX, and UMWEX.

Table D-6. Proposed Multiple Carrier Strike Group Matrix

Training Events

Service	Location	Island			AAW				ASUW / ASW		MIW	MIW / MCM			ASUW												
			IN-PORT/ SUPPORTEX	C2	AIROPS	S-A MISSILEX	A-A MISSILEX/ ACM	A-S MISSILEX	S-S MISSILEX	ASW	MINEX	SMWEX	Air MIWEX	UMWEX	STW, CASEX	GUNEX	SINKEX	LFX	HAO/NEO	HA/DR	SPECWAROPS	DEMO	SALVAGE OPS	Expeditionary Assault	SUBOPS	Seaglider	FCLP
U.S. Navy	Pacific Missile Range Facility*	Kauai																									
	Niihau	Niihau																									
	Kaula	Kaula																									
	Pearl Harbor**	Oahu																									
	Lima Landing	Oahu																									
	Puuloa Underwater Range – Pearl Harbor	Oahu																									
	Barbers Point Underwater Range	Oahu																									
	Coast Guard AS Barbers Point/Kalaeloa Airport	Oahu																									
	PMRF Warning Areas#	Ocean Areas																									
	Oahu Warning Areas#	Ocean Areas																									
	Open Ocean Areas#	Ocean Areas																									
	U.S. Command Ship	Ocean Areas																									
U.S. Marines	Marine Corps Base Hawaii	Oahu																									
	Marine Corps Training Area Bellows	Oahu																									
U.S. Air Force	Hickam Air Force Base	Oahu																									
U.S. Army	Kahuku Training Area	Oahu																									
	Makua Military Reservation	Oahu																									
	Dillingham Military Reservation	Oahu																									
	Wheeler Army Airfield	Oahu																									
	K-Pier, Kawaihae	Hawaii																									
	Bradshaw Army Airfield	Hawaii																									
	Pohakuloa Training Area	Hawaii																									
State	Keehi Lagoon	Oahu																									

* Includes Port Allen and Makaha Ridge

** Includes Ford Island and all other areas within the harbor.

These areas are included in the HRC. The HRC is now used to define the outer limits of the ocean areas used during Major Exercises.

Locations where events can occur

Multiple Carrier Strike Group

Training Events:

A-A MISSILEX	Air-to-Air Missile Exercise (formerly AAMEX)
AAW[1]	Anti-Air Warfare
AIROPS	Air Operations
AMPHIBEX	Amphibious Landing Exercise (now Expeditionary Assault)
Air MIWEX	Air Mine Warfare Exercise (formerly AMWEX)
A-S MISSILEX	Air-to-Surface Missile Exercise (formerly ASMEX)
ASUW[2]/ASW[3]	Anti-Surface Warfare/ Anti-Submarine Warfare Exercise
ASW	Anti-Submarine Warfare Exercise (formerly ASWEX)
CASEX	Close Air Support
C2	Command and Control
DEMO	Demolition Exercise
GUNEX	Gunnery Exercise
HA/DR	Humanitarian Assistance/Disaster Relief
HAO/NEO	Humanitarian Assistance Operation/ Non-Combatant Evacuation Operation
IN-PORT	In-port Briefings and Activities
LFX	Live Fire Exercise
MCM	Mine Countermeasures
MINEX	Mine Exercise
MIW[4]	Mine Warfare
SALVAGE OPS	Salvage Operations
SAMEX	Surface-to-Air Missile Exercise (now S-A MISSILEX)
SINKEX	Sinking Exercise
SMWEX	Ship Mine Warfare Exercise
SPECWAROPS	Special Warfare Operations
SSMEX	Surface-to-Surface Missile (now S-S MISSILEX)
STWEX	Strike Warfare Exercise
SUBOPS	Submarine Operations
SUPPORTEX	In-Port Support Exercise
UMWEX	Underwater Mine Warfare Exercise

Note: Since the publication of the RIMPAC 02 Programmatic (U.S. Department of the Navy, 2002a), new terminology and/or categories of exercises have come into use. They are as follows:

[1] AAW includes AIROPS, S-A MISSILEX, A-A MISSILEX, and A-S MISSILEX

[2] ASUW includes GUNEX, S-S MISSILEX, and ASW

[3] ASW includes S-S MISSILEX and ASW

[4] MIW encompasses two subsets, MINEX and MCM. MINEX is the act of laying mines. MCM is the act of locating and countering mining by others and includes SMWEX, AMWEX, and UMWEX.

Appendix E
Weapon Systems

APPENDIX E
WEAPON SYSTEMS

Table E-1. Typical Missile Exercise Weapons Used at Pacific Missile Range Facility

TYPE	CHARACTERISTICS				
	Weight	**Length**	**Diameter**	**Range**	**Propulsion**
Surface-to-Air Missiles					
Short Range					
Stinger (FIM-92A)	10.0 kg (22 lb)	1.5 m (5 ft)	70 mm (2.8 in)	4.8 km (3.4 nm)	Solid fuel
Sea Sparrow (RIM-7)	204 kg (450 lb)	3.7 m (12 ft)	203-2 mm (8 in)	14.8 km (10.6 nm)	Solid fuel
Rolling Airframe (RIM-116)	73.5 kg (162 lb)	2.8 m (9 ft 3 in)	127 mm (5 in)	7 km (5.0 nm)	Solid fuel
Medium Range					
Standard SM-1 MR (RIM-66B)	499 kg (1,100 lb)	4.5 m (14 ft 8 in)	342.9 mm (13.5 in)	46.3 km (33 nm)	Solid fuel
Standard SM-2 (RIM-66C)	612 kg (1,350 lb)	4.4 m (14 ft 7 in)	342.9 mm (13.5 in)	74.1 km (53 nm)	Solid fuel
Long Range					
Standard SM-2 ER (RIM-67A/B and 67-C/D)	1,325 kg (2,920 lb)	8.2 m (27 ft)	342.9 mm (13.5 in)	166.7 km (90 nm)	Solid fuel
Standard SM-2 AER (RIM-67B)	1,452 kg (3,200 lb)	6.7 m (22 ft)	342.9 mm (13.5 in)	150 km (107.1 nm)	Solid fuel
Air-to-Air Missiles					
Short Range					
Sidewinder (AIM-9)	84.4 kg (186 lb)	2.9 m (9 ft 6 in)	127 mm (5 in)	18.5 km (10 nm)	Solid fuel
Medium Range					
Sparrow (AIM-7)	231 kg (510 lb)	3.6 m (11 ft 10 in)	203.2 mm (8 in)	55.6 km (30 nm)	Solid fuel
Long Range					
Phoenix (AIM-54)	447 kg (985 lb)	4 m (13 ft)	381 mm (15 in)	203.9 km (110 nm)	Solid fuel
Air-to-Surface Missiles					
Short Range					
Skipper II (AGM-123)	582 kg (1,283 lb)	4.3 m (14 ft)	355.6 mm (14 in)	9.6 km (5.2 nm)	Solid fuel

Notes:

ft	feet	lb	pounds
in	inches	m	meters
kg	kilograms	mm	millimeters
km	kilometers	nm	nautical miles

Table E-1. Typical Missile Exercise Weapons Used at Pacific Missile Range Facility (Continued)

TYPE	CHARACTERISTICS				
	Weight	**Length**	**Diameter**	**Range**	**Propulsion**
Air-to-Surface Missiles (Concluded)					
Medium Range					
HARM (AGM-88)	366.1 kg (807 lb)	4.2 m (13 ft 9 in)	254 mm (10 in)	18.5 km (10 nm)	Solid fuel
Shrike (AGM-45)	177 kg (390 lb)	3 m (10 ft)	203.2 mm (8 in)	18.5 km (10 nm)	Solid fuel
Sidearm (AGM-122)	90.7 kg (200 lb)	3 m (10 ft)	127 mm (5 in)	17.8 km (9.6 nm)	Solid fuel
Long Range					
Harpoon (AGM-84/ RGM-84/UGM-84)*	797 kg (1,757 lb)	5.2 m (17 ft 2-in)	342.9 mm (13.5 in)	278 km (150 nm)	Solid fuel
Surface-to-Surface Missiles (Cruise)					
Harpoon (AGM-84/ RGM-84/UGM-84)*	797 kg (1,757 lb)	5.2 m (17 ft 2-in)	342.9 mm (13.5 in)	278 km (150 nm)	Solid fuel

Source: U.S. Department of the Navy, 1998a

Notes:

*Characteristics vary according to variant. Those for RGM-84F are shown.

ft	feet	lb	pounds
in	inches	m	meters
kg	kilograms	mm	millimeters
km	kilometers	nm	nautical miles

Table E-2. Typical Aerial Target Drones and Missiles Used at Pacific Missile Range Facility

TYPE	CHARACTERISTICS			
	Length	**Speed (Maximum)**	**Operational Altitude (Maximum)**	**Time on Station (Maximum)**
Subsonic				
BQM-34S	7 m (23 ft)	Mach 0.9	15,240 m (50,000 ft)	60 minutes
BQM-74C	4 m (13 ft)	430 knots	10,668 m (35,000 ft)	75 minutes
Supersonic				
MQM-8G (ER)	7.6 m (25 ft)	Mach 2.7	1,524 m (5,000 ft)	N/A
AQM-37C	4.1 m (13.6 ft)	Mach 4.0	30,480 m (100,000 ft)	N/A

Source: U.S. Department of the Navy, 1998a

Notes:

ft feet
m meters
N/A Not Applicable

Table E-3. Typical Existing Target Systems Used at Pacific Missile Range Facility

Type	Category	Name	Propellant Type
Ballistic Missile			
	Small	AQM-37C	Liquid
		Black Brant V	Solid
		Hawk	Solid
		Recruit	Solid
		Malemute	Solid
		HERMES	Solid
		Lance	Liquid
		Standard	Solid
		Tomahawk (Rocket)	Liquid/Solid
		Honest John (Booster)	Solid
		Nike (Booster)	Solid
		PATRIOT as a Target (PAAT)	Solid
		Apache	Solid
		Cajun	Solid
		Genie (14” diameter)	Solid
	Medium	Terrier	Solid
		Talos	Solid
		Castor	Solid
		STRYPI	Solid
		Antares (Stack)	Solid
		Aries	Solid
		Spartan	Solid
		Talos	Solid
		SR-19 (Air Drop)	Solid
		STORM	Solid
		MA-31	Liquid
		Liquid Fuel Target System	Liquid
	Large	Strategic Target System	Solid
		Hera	Solid
		Terrier	Solid
	Supersonic	AQM-37C	Liquid
		Vandal	Liquid/Solid

Table E-3. Typical Existing Target Systems Used at Pacific Missile Range Facility (Continued)

Type	Category	Name	Propellant Type
Aircraft			
	Subsonic	QF-4	Liquid
		AF-16	Liquid
Balloon			
		Balloon	N/A
Towed			
	Aerial	TDU-34A	N/A
Subsurface			
		MK-30 Mod 1	Liquid
		EMATT	Liquid
		SPAT-1 (Self Prop Acoustic Target)	Liquid
		MK-17 (Stationary Target for MK-46)	N/A
Surface			
		QST 35	Liquid
		HULK (TBD)	N/A
		ISTT (Improved Surface Towed Target)	N/A
Cruise Missiles			
	Subsonic	BQM-34S	Liquid
		BQM-74/CHUKAR	Liquid
		AQM-34	Liquid
		MQM-107	Liquid
		Harpoon	Liquid
		Liquid Fuel Target System	Liquid
		Tactical Air Launched Decoy (TALD ADM-141A)	Liquid
		ITALD (Improved version ADM-141C)	Liquid
	Supersonic	Vandal	Liquid/Solid
		MA-31	Liquid
		Terrier	Solid
		GQM-163A (Coyote)	Solid
		Liquid Fuel Target System	Liquid

Source: U.S. Department of the Navy, 1988a

Notes: N/A Not Applicable

Table E-4. Typical Existing Weapon Systems Used at Pacific Missile Range Facility

Type	Category	Name	Propellant Type (Liquid/Solid)
Missiles			
	Ship	ASROC	Liquid/Solid
	Ship	Harpoon (RTM-84)	Liquid
	Ship	MK-46 VLA	Liquid/Solid
	Ship	SM-2 BLK II	Solid
	Ship	SM-2 BLK III	Solid
	Ship	SM-2 BLK IV	Solid
	Ship	Sparrow (A1M7)	Solid
	Surf/Ship/Sub	Harpoon (R/UGM-84)	Liquid/Solid
	Air	AGM-45 (SHRIKE)	Solid
	Air	Harpoon (AGM-84)	Liquid
	Air	Phoenix	Solid
	Air	Sidewinder	Solid
	Air	Sparrow	Solid
	Air/Surf/Sub	Tomahawk	Liquid/Solid
	Land	Hawk	Solid
	Land	MEADS	Solid
	Land	PATRIOT	Solid
	Land	THAAD	Solid
	Land/Ship	Stinger	Solid
Guns			
	Ship	Naval Guns	N/A
	Ship	Phalanx/Vulcan	N/A
	Air	Aircraft Mounted Guns	N/A
	Land	Howitzer	N/A
Weather Rocket			
	Land	PWN-11D	Solid
	Land	PWN-12A	Solid
Torpedoes			
	Sub	MK-48 ADCAP	Liquid
	Sub	MK-48	Liquid
	Air/Ship	MK-44 (PLLT)	Battery
	Air/Ship	MK-30	Battery
	Air/Ship	MK-50	Liquid
	Air/Ship	MK-54	Liquid
	Air/Ship	Type 80 (Japanese)	Liquid
	Air/Surf	MK-46	Liquid

Source: U.S. Department of the Navy, 1998a

Note: N/A Not Applicable

Table E-4. Typical Existing Weapon Systems Used at Pacific Missile Range Facility (Continued)

Type	Category	Name	Propellant Type (Liquid/Solid)
Sub Launched Mines			
	Sub	MK-67-2 Sub Launched Mobile Mine (SLMM)	Battery
Air Deployed Mines			
	Air	MK-25	N/A
	Air	MK-36	N/A
	Air	MK-36 DST	N/A
	Air	MK-52	N/A
	Air	MK-76	N/A
Bombs			
	Air	BDU-45	N/A
	Air	MK-82	N/A

Source: adapted from U.S. Department of the Navy, 1998a
Note: N/A Not Applicable

Table E-5. Typical Electronic Warfare Assets Used at Pacific Missile Range Facility

TYPE	CHARACTERISTICS		
	Frequency Bands	Power Output (Maximum)	Location Used
Air and Seaborne Electronic Warfare Assets			
Airborne Simulator Systems			
APS-504(V)5	8.9925 to 9.375 GHz	8 kW	Pacific Missile Range Facility (PMRF) RC-12F Aircraft
MK-67	907.2 kg (2,000 lb)	4.00 m (13 ft 5 in)	533 mm (21 in)
Expendable Radar Transmitter Sets			
AN/DPT-1(V)	7.8 to 9.6, 14.0 to 15.2 GHz	80 kW	BQM-334S Targets
AN/DPT-2(V)	9.375 GHz	20 kW	BQM-74C Targets
Airborne Electronic Countermeasures Systems			
Traveling Wave Tube Countermeasures System	425 to 445 MHz, 902 to 928 MHz, 2 to 4 GHz	100 W	PMRF RC-12F Aircraft
ALT-41	425 to 445 MHz	100 W	PMRF RC-12F Aircraft
ALT-42	902 to 928 MHz	100 W	PMRF RC-12F Aircraft
DLQ-3	2 to 4 GHz	100 W	PMRF RC-12F Aircraft
ULQ-21	8 to 10.5 GHz	100 W	PMRF RC-12F Aircraft

Table E-5. Typical Electronic Warfare Assets Used at Pacific Missile Range Facility (Continued)

TYPE	CHARACTERISTICS		
	Frequency Bands	Power Output (Maximum)	Location Used
Seaborne Simulator Systems			
AN/DPT-1(V)	7.8 to 9.6, 14.0 to 15.2 GHz	80 kW	Range Boats
AN/DPT-2(V)	7.8 to 9.6, 14.0 to 15.2 GHz	150 kW	Range Boats
Land-Based Electronic Warfare Assets			
Simulator Systems - Fixed			
AN/DPT-1(V)	7.8 to 9.6, 14.0 to 15.2 GHz	70 kW	Makaha Ridge, Kauai
ENSYN	2 to 4, 7 to 11 GHz	1 kW	Makaha Ridge, Kauai
I/J-TES	7.8 to 9.6, 14.0 to 15.2 GHz	70 kW	Makaha Ridge, Kauai
AN/DPT-1(V)	7.8 to 9.6, 14.0 to 15.2 GHz	70 kW	Mauna Kapu, Oahu
Simulator Systems - Mobile			
AN/DPT-1(V)	2.9 to 3.1, 7.8 to 9.6, 14.0 to 15.2 GHz	70 kW	Barking Sands, Kauai
AN/UPT-2A(V)	2.9 to 3.1, 7.8 to 9.6, 14.0 to 15.2 GHz	150 kW	Barking Sands, Kauai
AN/D/DPT-1(V)	7.8 to 9.6, 14.0 to 15.2 GHz	70 kW	Perch Site, Niihau
AN/UPT-2A(V)	2 to 4, 8 to 18 GHz	150 kW	Perch Site, Niihau
ENSYN	2 to 4, 8 to 18 GHz	1 kW	Naval Air Station (NAS) Barbers Point, Oahu
AN/DPT-1(V)	2.9 to 3.1, 7.8 to 9.6, 14.0 to 15.2 GHz	70 kW	NAS Barbers Point, Oahu
Electronic Countermeasures Systems - Fixed			
ALT-41	425 to 445 MHz	100 W	Makaha Ridge, Kauai
ALT-42	902 to 928 MHz	100 W	Makaha Ridge, Kauai
ULQ-26	2 to 4 GHz	100 W	Makaha Ridge, Kauai
ULQ-21	8.0 to 10.5-GHz	100 W	Makaha Ridge, Kauai
Electronic Countermeasures Systems - Mobile			
DLQ-3	425 to 445 MHz 14.0 to 15.2 GHz	100 W	Range Boats, Remote Sites
ULQ-26	425 to 445 MHz 14.0 to 15.2 GHz	100 W	Range Boats, Remote Sites
ULQ-21	425 to 445 MHz 14.0 to 15.2 GHz	100 W	Range Boats, Remote Sites
ALT-41/42	425 to 445 MHz 14.0 to 15.2 GHz	100 W	Range Boats, Remote Sites

Source: adapted from U.S. Department of the Navy, 1998a

Notes:

ft	feet	in	inches	kW	kilowatts	m	meters	mm	millimeters
GHz	gigahertz	kg	kilograms	lb	pounds	MHz	megahertz	W	watts

Table E-6. Existing Pacific Missile Range Facility Radars, Locations, and Characteristics

Emitter	Comments	Location	Power Peak (kW)	Scan Rate	Frequency (MHz) Low	Frequency (MHz) High	Pulse Width (μS)	PRF (PPS)	Ant. Gain (dBi)	Ant. Elev. (m)	Remarks
AN/MPS-25	Monopulse Tracking (2 each)	Main Base	1,000	--	5,400	5,900	0.25, 0.5, 1	160, 640	46	18	AZ=0 to 360 degrees. Elevation=-5 to +185 degrees
AN/SPS-10	Surveillance	Main Base	250	15 rpm	5,450	5,825	0.5, 1.3	640	30	22	
AN/UPX-27	AN/SPS-10 IFF Interrogator	Main Base	1	15 rpm	1,030	1,030	0.8	640	23	22	Uses AN/SPS-10 antenna
AN/FPS-106	Weather Radar	Main Base	500		5,450	5,650	0.5	320	35	20	
AN/WRF-100	DOE Radar Facility	Main Base	250	--	9,375	9,375	1	640	32	10	
THAAD Radar	X-Band Tracking	Main Base			8,000	12,000				22	
AN/MPS-25	Monopulse Tracking (2 each)	Makaha Ridge	1,000	--	5,400	5,900	0.25, 0.5, 1	160, 640	46	500	AZ=0 to 360 degrees. Elevation=-5 to +185 degrees
AN/FPQ-10	Monopulse Tracking (2 each)	Makaha Ridge	1,000	--	5,400	5,900	0.25, 0.5, 1	160, 640	43	473	AZ=0 to 360 degrees. Elevation=-5 to +90 degrees
AN/SPS-48E	Track-While-Scan Surveillance	Makaha Ridge	2,400	15 rpm	2,908	3,110	27	Various	39.1	462	
AN/UPX-27	AN/SPS-48E IFF Interrogator	Makaha Ridge	1	15 rpm	1,030	1,030	0.8	Various	19	462	
AN/APS-134	Surface Surveillance	Makaha Ridge	500	15 rpm	9,500	10,000	0.5	500	42	457	Linear frequency chirp each pulse
AN/FPS-16	Monopulse Tracking	Kokee	1,000	--	5,400	5,900	0.25, 0.5, 1	160, 640	43	1,155	AZ=0 to 360 degrees. Elevation=-5 to +185 degrees
AN/FPQ-10	Monopulse Tracking	Kokee	1,000	--	5,400	5,900	0.25, 0.5, 1	160, 640	43	1,150	AZ=0 to 360 degrees. Elevation=-5 to +90 degrees
USB	Unified S-Band System	Kokee	20	--	2,090	2,120	CW	CW	44	1,110	
AN/FPS-117	Surveillance	Kokee	24.75	5 rpm	1,215	1,400	51.2, 409.6	241	38.6	1,310	
OX-60/FPS-117	AN/FPS-117 IFF Interrogator	Kokee	2	5 rpm	1,030	1,030	Various	241	21	1,310	
AN/APS-134	Surveillance	Niihau	500	15 rpm	9,500	10,000	0.5	500	42	375	
R73-6	Raytheon Pathfinder (3 each)	Weapons Recovery Boat and Torpedo Weapons Recovery	10	24 rpm	9,410	9,410	0.08, 0.4, 0.8, 1.2	2,000, 1,500, 750, 500	16	8	
APS-134	Surveillance	HIANG Kokee	500	15 rpm	9,500	10,000	0.5	500	42	375	

Source: U.S. Department of the Navy, 1998a

Table E-7. Representative Proposed Target Systems

Type	Name	Propellant Type
Ballistic Missile		
	New Advanced Hypersonic Weapon 1st stage	Solid
	New Advanced Hypersonic Weapon 2nd stage	Solid
	Super STRYPI	Solid

Table E-8. Target Launch Pad—Rail and Stool Requirements

Item/Facility Type	Requirements 0 to 1,200 kilometers (0 to 647.9 nautical miles)
Dimensions of Launch Pads/Construction Materials Assumed	12.2 meters x 15.2 meters + 15.2 meters (40 x 50 feet + 50 feet) for environmental shelter = 12.2 meters x 30.5 meters (40 x 100 feet) = 371.6 square meters (4,000 square feet). Concrete pad with outer gravel or coral area.
Cleared Area/No Vegetation Zone Surrounding Launch Pad	15.2 to 30.5 meters (50 to 100 feet)
Explosive Safety Quantity-Distance (ESQDs) by Category Type (Intraline [IL], Public Transportation Route [PTR], Inhabited Building [IB])	85.3 meters (280 feet) IL 228.6 meters (750 feet) PTR 381 meters (1,250 feet) IB ESQD
Ground Hazard Area (GHA) Radius	For most unguided systems, GHA = 609.6 meters (2,000 feet) For guided systems, GHA = 1,828.8 to 3,048 meters (6,000 to 10,000 feet)
Electromagnetic Radiation Constraints to Personnel, Fuels, or Ordnance	Consider HERO (ordnance electronic triggering mechanisms potentially set off due to electromagnetic radiation).
Launch Pad Fencing/Security Needs	Should have access control to the hazardous operations/ launching area. The target payload may be classified.
Utilities to Launch Pad/Type Needed	Will bring some portable electrical generator capability (campaign). Will require a power distribution system, fuel storage, and containment area to avoid soil contamination.
Road Access to Launch Pad/Hazardous Transportation Route/ % Grade	Prefer gravel road of less than 6 percent grade. Prefer to stay off public highways.
Environmental Shelter/Pad/Dimensions	Depends on the type of missile system and site environmental constraints (some missiles are temperature, humidity, and salt spray dependent). At Kauai Test Facility, only tarps are used in some cases. Some booster rockets must be maintained between 15.5 to 26.7 degrees Celsius (60 to 80 degrees Fahrenheit). Also stool launch items will require wind protection.
Soil Conditions Desired	Stable soil, cleared gravel or paved area around the launcher.
Minimum Distance to Shoreline If Any	None. Consider waves, salt spray.

Source: U.S. Department of the Navy, 1998a

Table E-9. Target Support/Preparation and Launch Control Facilities Requirements

Item/Facility Type	Requirements
Missile Assembly—Need missile assembly building on Island or Build-up at Another Location (Specify if Known), Ship by Aircraft or Barge to Island, or Other Logistics Based on Distance, Weight, Airfield, etc.	No new missile assembly building needed. Build up at Pacific Missile Range Facility (PMRF). Transport by aircraft or barge to island. May have an environmental shelter (stool) and/or clamshell (rail) at the launch site. .
Vertical Target Missile Service Tower Needed, Dimensions	None required.
Launch Control Van or Building	Mobile Launch Control Van [could be a van brought in by air or barge or a trailer like Kokole Point at PMRF with a berm (if a rail), or a van in a hardened van shelter (if a stool)].
Launch Pad Equipment Building	Equipment building [8 x 8 feet] next to pad.
Missile Storage Facility	May need missile storage if the number of launches per year justifies the cost.
Warehousing	Would use existing warehousing if available. If not, keep supplies on a barge or fly in/out. May use military vans or enclosed semi trailers.
Road Access Dimensions/Minimum Radii	12 feet wide road minimum, 50 feet turning radius to launch pad, 8 feet minimum to launch control.
Min. Distance to Shoreline If Any	None. Consider wave action, salt spray.
Utilities to Facilities/Type Needed	Electricity.
Security/Fencing/Clear Zone Needed/Dimensions	Not required unless there is a need to provide security protection or to mitigate for bird control (site specific—Tern). Dimensions undefined.
Electromagnetic Radiation Constraints to Personnel, Fuels, or Ordnance	Consider HERO (ordnance electronic triggering mechanisms potentially set off as a result of electromagnetic radiation).
View of Launch Pad Needed from Control Van/Building	Desired.

Source: U.S. Department of the Navy, 1998a

Table E-10. Representative Defensive Missile Systems

Type	Category	Name	Propellant Type (Liquid/Solid)
Missiles			
	Ship	SM-2 BLK IVA	Solid
	Ship	SM-3	Solid
	Ship	SM-6	Solid
	Air	AMRAAM	Solid
	Land	MEADS	Solid
	Land	PATRIOT (PAC-2)	Solid
	Land	PAC-3	Solid
	Land	THAAD	Solid

Source: U.S. Department of the Navy, 1998a

Table E-11. Land-based Interceptor Launch Site (Mobile) Requirements

Item/Facility Type	Requirements 0 to 1,200 kilometers (0 to 647.9 nautical miles)
Desired Operational Launch Orientation/Flight Path	Need target range of between 350 and 1,000 kilometers (217.5 and 621.4 miles)
Dimensions of Launch Pads/Construction Materials Assumed	Need a hardstand area (prefer gravel or coral) and relatively level ground. Need an area of approximately 42.1 x 20.1 meters = 846 square meters (138 x 66 feet = 9,108 square feet). The launchers are to be sited within the 120 degree angle of the radar signal (60 degrees either side of the boresight). The launchers are to be located between 130.1 meters (427 feet) and 10 kilometers (6.2 miles) from the radar set. Several launchers may be sited within this area.
Cleared Area/No Vegetation Zone Surrounding Launch Pad	None. Consider security/visibility.
Explosive Safety Quantity-Distance (ESQD) by Category Type (Intraline [IL], Public Transportation Route [PTR], Inhabited Building [IB])	381 meters (1,250 feet) for IB ESQD, 85.3 meters (280 feet) IL, 228.6 meters (750 feet) PTR Note—Should plan for 381 meters (1,250 feet)—Dual mode Area Interceptors.
Ground Hazard Area (GHA) Radius	1,829-meter (6,000-foot) radius
Electromagnetic Radiation Constraints to Personnel, Fuels, or Ordnance	120.1 meters (394 feet) in front of the radar - 60 degrees both sides of boresight (refer to PAC-3 environmental document).
Launch Pad Fencing/ Security Needs/Dimensions	Security guards required.
Utilities to Launch Pad/Type Needed	Utilities are required for aerospace ground equipment and test instrumentation.
Road Access to Launch Pad/Percent Grade	Require road access through rough terrain, gravel preferred. Turning radius of 15.2 meters (50 feet). System designed to be mobile.
Soil Conditions Desired	Stable soil. Gravel surface desirable. Do not want equipment to sink.
Environmental Shelter/Pad/Dimensions	Re-enforced structures for Command and Control trailers.
Minimum Distance to Shoreline If Any	None. Consider wave action, salt spray.

Source: U.S. Department of the Navy, 1998a

Table E-12. Telemetry, Optics, and Radar Instrumentation Requirements

Item/Facility Type	Requirements
Instrumentation Devices/Facilities Required—Targets	Targets—Short- and medium-range multi-participant target and interceptor tracking and telemetry reception, additional range safety monitoring, and additional data products needed. Makaha Ridge: Radars (COSIP), optics, lasers, electronic warfare, telemetry (receivers, recorders, antennas) and internal power plant upgrades Kokee Parcel A: Radar (x band), Communications (CEC [tower], voice, data [telephone poles]) Parcel C: Telemetry antenna (phase array or dish), building (40x60) Parcel D: Radar (COSIP), telemetry antenna
Instrumentation Device(s)/Facilities Required - Interceptors	Area Interceptors—Assumes that Range assets are fixed or trailer mounted (portable).
Number of Interceptor Personnel Working/How Long	Radar site requires 15 people working 2 to 3 weeks.
Mobile Instrumentation Alternative	May consider mobile instrumentation at some sites if no or inadequate on-ground facilities exist. Example is the Wallops Flight Facility (NASA) system. Requires C-141 accessibility for airborne assets. On-ground assets require concrete pad for mobile radar pedestal, line of sight, adequate safety clear zone, and generator use. May also consider military P-3 aircraft use.

Source: U.S. Department of the Navy, 1998a

Table E-13. Communications, Command, and Control Requirements

Item/Facility Type	Requirements
Number of Interceptor Personnel Working/How Long	Battle management, communications, command, and control, and intelligence—15 people for 2 to 3 weeks.
Command and Control Enhancements—Targets/ Interceptors	Command and control needed; enhanced range safety monitoring needed; and FTS enhancement needed. Possible use of Building 105—Control Center at PMRF. Expand fiber optics. Expand office space. Add transmitters and receivers, other communication equipment. Could be mobile in aircraft.

Source: U.S. Department of the Navy, 1998a

Table E-14. Support Infrastructure Requirements

Item/Facility Type	Requirements
Electric Power/Portable Generator/Backup	For Interceptors—Need power under Test mode, no power under Tactical mode. Self contained. For Targets—Power needed, either local power or a generator.
Sanitation/Septic/Waste Treatment	For Interceptors—Total sanitation need is for 47 personnel for 2 to 3 weeks/launch. For Targets—Total sanitation need is for 6 to 10 personnel for 1 to 2 weeks/launch.
Solar Power	None for Interceptors. Targets—No need defined.
Natural Gas/Propane	None for Interceptors. Targets—No need defined.
Potable Water/Fire Flow/Storage	Interceptors and Targets—Drinking water for personnel, minor fire control.
Solid Waste Disposal/Transfer	Interceptors and Targets—Temporary on site storage and/or transport away.
Hazardous Materials Temporary Storage Transfer–Liquid and Storage	Interceptors and Targets—Temporary storage.
Storage/Warehousing/ Logistics Support and Services—Campaign Only	Interceptors and Targets—Use existing space, if available.
On-Island Road Access/Vehicle Storage, Maintenance, and Parking—Campaign Only	Interceptors and Targets—Semi-trailer road access to assets required. Campaign—No storage.
Off-Island Transportation (Air, Barge, Other)	Interceptors and Targets—Air transport (C-130, C-141, and C-5/C-17) and landing craft or ship. Aircraft use desirable.
Fire Station/Pumper/Training/Equipment/ Emergency Medical Team	As defined by PMRF Safety.
Security Forces/Training	Interceptors and Targets—Security guards will be required during launches. No permanent support.
Recreation Facilities/Services	Interceptor and Targets—No need defined.
Fuel Storage	Interceptor and Targets—Electric generator and vehicle fuel storage.
Transient Quarters/Berthing Quarters-Barges	Interceptor and Targets—Need defined. Self-contained onshore camp concept or ship/barge quarters. See personnel numbers. Depends on frequency/location.
Permanent Housing (Base UEPH/Family Housing or Private Rental Housing)	Interceptor and Targets–No need defined.
Administrative Services/Office Space/ Campaign Trailer	Interceptor and Targets—Possible use of Building 105 at PMRF or SNL/KTF complex. Possible use of campaign trailer(s).
Medical Facility and Services	Interceptors and Targets—No special facilities required. Typical services assumed.
Mess Hall/Laundry Facility and Services	Interceptors and Targets—Self-contained onshore camp concept or ship/barge facilities.
Communications Facility and Services	Interceptors and Targets—No need defined.
Liquid Propellant Storage (Hypergolic)	Interceptor—May require temporary storage. Targets—Need defined for targets.

Table E-14. Support Infrastructure Requirements (Continued)

Item/Facility Type	Requirements
Small Explosives/Igniter/Squib Storage/Setbacks	Interceptor—No need defined. Targets—May require squib storage.
Heavy Equipment/Crane	Interceptor—No need defined. Targets—May require crane.
Lightering Boat and Marine Crew Services/Stevedoring	Interceptor and Targets—Need defined.
Berthing/Moorage/Dock and Ramp	Interceptor and Targets–Need defined if no adequate airfield.
Helipad	Interceptor and Targets–Need helipad support capability for emergency medical evacuation and supplies delivery, or airfield capability.
Aircraft Runway (C-130, C-141, C-5, C-17 or Other)/Airfield operations and maintenance/Hotpad/Aircraft Parking and Maintenance	C-130, C-141, and C-5/C-17.

Source: U.S. Department of the Navy, 1998a

Table E–15. Representative Missile Propellant and Exhaust Components

Missile	Propellant Class	Major Propellant Components	Major Exhaust Components
Weapon Systems			
MEADS	Solid	Aluminum, HTPB	Aluminum Oxide, Carbon Dioxide, Carbon Monoxide, Hydrogen, Hydrogen Chloride, Nitrogen, Water
PAC-2	Solid	Aluminum, Ammonium Perchlorate, Iron Oxide, Polymer Binder	Aluminum Oxide, Carbon Dioxide, Carbon Monoxide, Hydrogen, Hydrogen Chloride, Nitrogen, Water
PAC-3	Solid	Aluminum, HTPB	Aluminum Oxide, Carbon Dioxide, Carbon Monoxide, Hydrogen, Hydrogen Chloride, Nitrogen, Water
Standard Missile	Solid	Aluminum, Ammonium Perchlorate, HMX	Aluminum Chloride, Aluminum Oxide, Ammonia, Carbon Dioxide, Carbon Monoxide, Ferric Chloride, Ferric Oxide, Hydrogen, Hydrogen Chloride, Nitric Oxide, Nitrogen, Water
THAAD	Solid	Aluminum, Ammonium Perchlorate, Binder	Aluminum Oxide, Carbon Dioxide, Carbon Monoxide, Hydrogen, Hydrogen Chloride, Nitrogen, Water
Target System			
HERA	Solid	Aluminum, Ammonium Perchlorate, CTPB, HMX, Nitrocellulose-Nitroglycerine	Aluminum Oxide, Carbon Dioxide, Carbon Monoxide, Hydrogen, Hydrogen Chloride, Nitrogen, Water
LANCE	Liquid	IRFNA (Hydrogen Fluoride, Nitric Acid, Nitrogen Dioxide), UDMH, Water	Carbon Dioxide, Carbon Monoxide, Nitrogen, Oxygen, Water
STRYPI	Solid	Aluminum, Ammonium Perchlorate, CTPB, Nitrocellulose-Nitroglycerine, Polysulfide Elastomer	Aluminum Oxide, Carbon Dioxide, Carbon Monoxide, Chlorine, Hydrogen, Hydrogen Chloride, Hydrogen Sulfide, Nitrogen, Sulfur Dioxide, Water

Source: U.S. Department of the Navy, 1998a
Notes:
CTPB = Carboxyl-terminated Polybutadiene
HMX = Cyclotetramethylenetetranitramine
IRFNA = Inhibited Red Fuming Nitric Acid
HTPB = Hydroxyl-terminated Polybutadiene
UDMH = Unsymmetrical Dimethyl Hydrazine

Appendix F
Major Exercise Monitoring Reports

APPENDIX F

2006 Rim of the Pacific Exercise After Action Report:

Analysis of the Effectiveness of the Mitigation and Monitoring Measures as Required Under the Marine Mammal Protection Act (MMPA) Incidental Harassment Authorization and National Defense Exemption from the Requirements of the MMPA for Mid-Frequency Active Sonar Mitigation Measures

Dated December 7, 2006

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INTRODUCTION

This report is presented to fulfill the requirements conditional to the 2006 Rim of the Pacific Exercise (RIMPAC 06) Marine Mammal Protection Act (MMPA) Incidental Harassment Authorization (IHA) and the National Defense Exemption from the Requirements of the MMPA for Certain DoD Mid-Frequency Active Sonar Activities (NDE).

Pursuant to the MMPA, an IHA was sought from the National Marine Fisheries Service (NMFS), which was issued by the NMFS Division of Permits, Conservation, and Education, Office of Protected Resources for 2006 RIMPAC Exercise on 27 June 2006. On 30 June 2006, the Deputy Secretary of Defense issued the NDE, which specified that for the conduct of RIMPAC 2006, the Navy would comply with all mitigation measures set out in the IHA. The IHA required that the Navy, "Submit a report to the Division of Permits, Conservation, and Education, Office of Protected Resources, NMFS and the Pacific Islands Regional Office, NMFS, within 90 days of the completion of RIMPAC."[1] The IHA further specifies that the report contain and summarize the following information:

> (1) "An estimate of the number of marine mammals affected by the RIMPAC ASW exercises and a discussion of the nature of the effects, if observed, based on both the modeled results of real-time exercises and sightings of marine mammals";
> (2) "An assessment of the effectiveness of the mitigation and monitoring measures with recommendations on how to improve them";
> (3) "Results of the marine species monitoring (real-time monitoring from all platforms, independent aerial monitoring, shore-based monitoring at chokepoints, etc.) before, during, and after the RIMPAC exercises"; and
> (4) "As much information (unclassified and, to appropriately cleared recipients, classified "secret") as the Navy can provide including, but not limited to, where and when sonar was used (including sources not considered in take estimates, such as submarine and aircraft sonars) in relation to any measures received levels (such as sonobuoys or on PMRF range), source levels, numbers of sources, and frequencies so it can be coordinated with observed cetacean behaviors."

This report, which contains only unclassified material, provides the necessary information and analyses, and thus fulfills these requirements. The report is organized by section following the order of the requirements in the IHA.

Section 1 provides an estimated number of marine mammals affected by the RIMPAC 06 ASW events based on analysis of actual events and sightings of marine mammals, noting the nature of any observed effects where possible.

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1 Given that the last day of the RIMPAC 2006 exercise was 26 July 2006, this report is due no later than 24 October 2006.

Section 2 of this report assesses the effectiveness of the mitigation and monitoring measures required during RIMPAC 2006 with regard to minimizing the use of Mid-Frequency Active Sonar (MFAS) in the vicinity of marine mammals. This section also includes an assessment of the practicality of implementation of the mitigation measures, the scientific basis behind those measures, and the impact some of the measures had on safety and the effectiveness of the required military readiness activities.

Section 3 presents the results of the marine species monitoring comprised of independent aerial reconnaissance, shore-based monitoring in the vicinity of the chokepoint events, and results from the NMFS observers embarked on the USS LINCOLN during one of the choke-point exercises. Also included in this section is a summary of the 29 marine mammal detections made by exercise participants during RIMPAC 06.

Section 4 of this report provides data on the location and hours of active MFAS used during RIMPAC 06 placed in context with observations of cetacean behaviors resulting from the aerial reconnaissance and shore-based monitoring and exercise participants.

SECTION 1: Marine Mammals Affected

The requirements stipulated in the IHA are to provide; "An estimate of the number of marine mammals affected by the RIMPAC ASW exercises and a discussion of the nature of the effects, if observed, based on both the modeled results of real-time exercises and sightings of marine mammals". To meet this requirement, Section 1 provides an estimated number of marine mammals affected by the RIMPAC 06 ASW events based on Navy's original calculations using a threshold of 190dB for sub-TTS effects, and analysis of actual events and sightings of marine mammals, noting the nature of any observed effects. It is compared to the estimated number of marine mammals affected as calculated when applying the 173dB sub-TTS threshold required by NMFS for issuance of the IHA.

The RIMPAC 2006 Supplemental Environmental Assessment predicted 532 hours of hull mounted MFAS use by exercise participants based on what had occurred in the previous RIMPAC exercise (RIMPAC 2004) and based on the present tactical ASW training requirements. In actuality, 472 hours of MFAS use from hull mounted sources occurred during RIMPAC 06 exercise.[2]

The types of ASW training conducted during RIMPAC 06 involved the use of ships, submarines, aircraft, non-explosive exercise weapons, and other training related devices. While ASW events would occur throughout the Hawaiian Islands Operating Area, most events would occur within six areas that were used for the modeling analysis since they were representative of variation in the marine mammal habitats and the bathymetric, seabed, wind speed, and sound velocity profile conditions within the entire Hawaiian Islands Operating Area (OPAREA). Figure 1 on the following page displays the areas used for modeling and the OPAREA for the RIMPAC 06 exercise.

For purposes of the impacts analysis, all likely RIMPAC 06 ASW events were modeled as occurring in these areas. In fact, the majority of MFAS use occurred in the modeled areas as predicted (see Section 4 for a more detailed discussion), but any deviation from this would have been immaterial since the modeled areas were delineated so as to encompass the variation occurring in the entire Hawaiian Islands Operating Area.

Modeling a predicted number of marine mammals affected by the RIMPAC 06 ASW events was undertaken based on acoustic thresholds derived from experimental data – 190 dB Sound Exposure Level (SEL), which Navy believed, in a worst case analysis, indicated the potential to affect 289 marine mammals (for further details see the 2006 Supplement to the 2002 Rim of the Pacific Programmatic Environmental Assessment). This number was calculated from the modeling without consideration for reductions resulting from the standard Navy protective measures mitigating exposure to MFAS or the additional measures imposed by the IHA.

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2 Three days of planned MFAS use were precluded by a temporary restraining order resulting from a lawsuit.

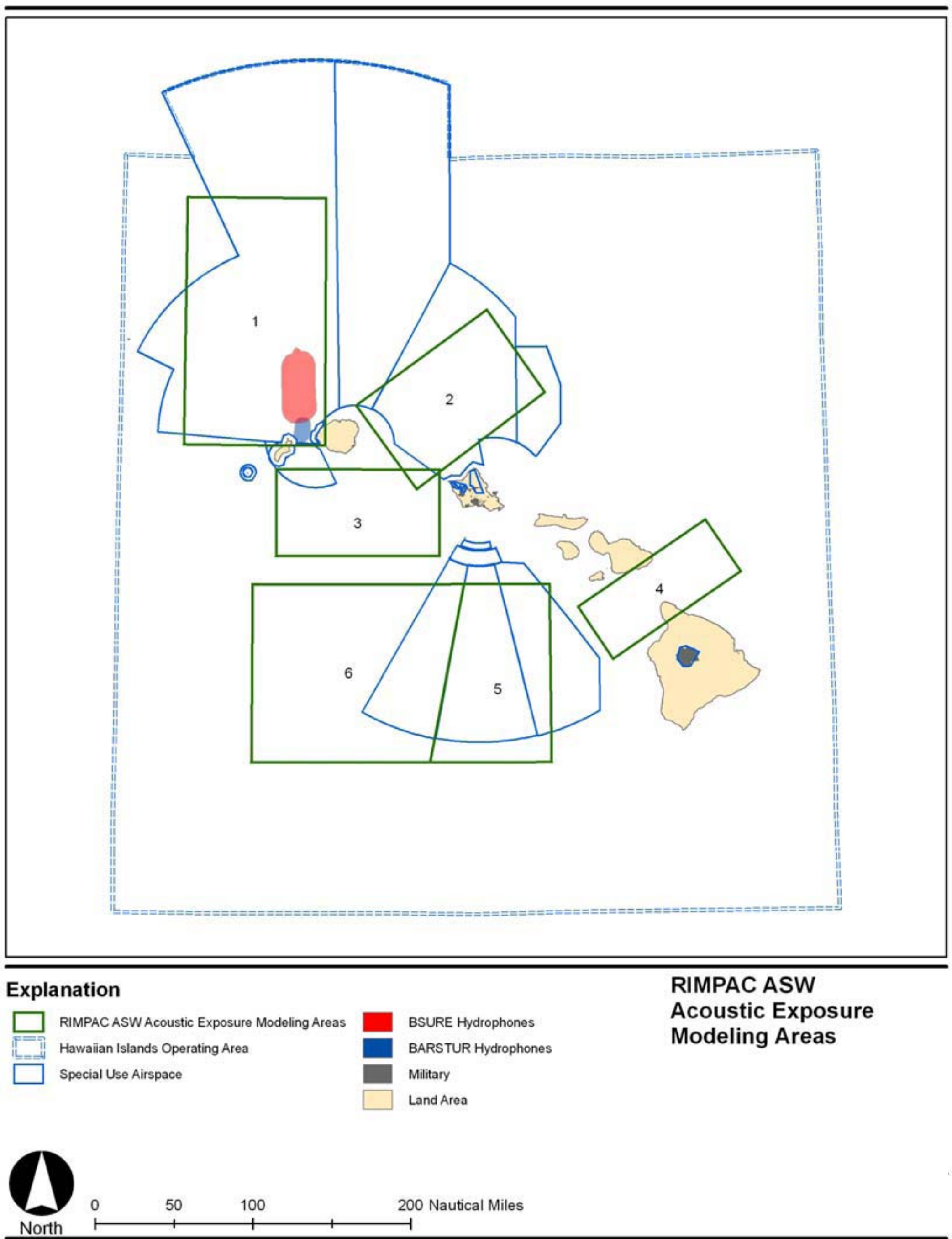

Figure 1. RIMPAC 2006 Exercise Operating Area depicting the areas used for modeling purposes in the analysis of effects on marine mammals.

Based on the reduction of MFAS hours from the modeled 532 to the actual 472 hours, the estimated potential number of marine mammals affected may be reduced to approximately 256 marine mammals (based on a ratio of marine mammal exposures exceeding the threshold to hours of MFAS operation).

Following the modeled calculation of marine mammals affected, if required to determine the actual number of marine mammals affected by the exercise as mandated by the IHA, it is necessary to take into consideration standard Navy protective measures including decreasing the source level and then shutting down MFAS when detected marine mammals are approached. This must be done since the mitigative effect of the protective measures were not factored into the modeling calculations. While there is no clear metric value that can be assigned to mitigative effect of these measures, there was a reduction in potential to impact marine mammals by their implementation.

During the exercise, there were 29 instances when marine mammals (individuals or pods) were detected by exercise participants. All detections were made by standard lookout and aircraft reporting procedures except for one case of passive acoustic detection, which is also a standard Navy practice protective measure. As a result of the protective measures in place and the high-level emphasis placed upon marine mammal protection, MFAS was shutdown by 12 exercise participants due to the detected marine mammals as detailed in Table 1.

Table 1. Details of the 29 marine mammal detections and actions by exercise participants during RIMPAC 06.

	July Date-Time (Z)	**Modeled Area (Fig. 1)**	**Lost Hours**	**Description of Actions Taken**
1	7/10-1738	1	0.5	Helicopter sighted "marine mammal" >30Kyds from two active ships. Two ships shutdown MFAS for 15 min until further information from reporting unit was obtained and assessed in regard to requirements. Submarines in vicinity.
2	7/10-1912	5	1.5	Surface ship sighted "marine mammal" and shutdown MFAS. Other Surface Action Group (SAG) units notified. Helicopter obtained visual on "a whale"; notified nearest ship in SAG. Second helicopter 11 nm west detected another "whale" four minutes later but contact then immediately lost on both whales. Ship in SAG obtained visual on "pod of dolphins", which then approached w/in 1000 yards so MFAS reduced sonar by 6 dB. Second pod of dolphins appeared soon thereafter and then a third "whale" appeared inside 200 yards MFAS shutdown for all three 3 SAG surface and 2 air units 30 min. MFAS resumed 30 minutes later after range opened. Submarine in vicinity. Note: 6 total marine mammal detections this event.
3	7/11-1314	2		Surface ship sighted "dolphin" at 500 yds. MFAS not active.
4	7/11-1522	2		Surface ship sighted "pod of whales" range at 300 yds. Maneuvered to open range. MFAS not active.
5	7/11-1641	2		Surface ship sighted "whale" at 200 yds. MFAS not active.
6	7/12 0215	2	0.5	Sighted "marine mammal" and shutdown MFAS opened range prior to recommencing active.

Table 1 (cont.). Details of marine mammal detections and actions by exercise participants during RIMPAC 06

	July Date-Time (Z)	Modeled Area (Fig. 1)	Lost Hours	Description of Actions Taken
7	7/12-1827	5	2.0	P-3 aircraft detected passive acoustic marine mammal traces within 4000 yards. Active tracking of submarine ceased with limitation to passive only and lost contact. Four submarines in vicinity.
8	7/14-1909	1		Ship sighted "whale" >1000 yards. MFAS remained active.
9	7/14-1923	1		Ship sighted "marine mammal" >1000 yards. MFAS remained active.
10	7/17-1625	1		Ship sighted a "dolphin". MFAS not active.
11	7/17 2248	2	0.5	P-3 aircraft sighted two "whales". Could not use active (DICASS) buoys. Submarine in vicinity.
12	7/19 0046	1	0.25	Ship sighted "2 pods of 10 pilot whales". Shutdown MFAS.
13	7/19 0320	1	0.5	Ship sighted "pod of three pilot whales" to the south bearing 040T @200 yds. Shutdown MFAS.
14	7/19 1819	2	0.25	Ship sighted "whales" 1000 yards off port beam. Shutdown MFAS.
15	7/20 0346	5	1.0	Ship sighted "pod of whales". Shutdown MFAS.
16	7/20 1612	2	0.5	Ship sighted "marine mammals". Shutdown MFAS. Submarine in vicinity.
17	7/20 2013	6		Ship sighted "dolphins" off bow. MFAS not active.
18	7/20 2128	6		P-3 aircraft sighting of 8 "whales". DICASS not available for tactical development. Submarine in immediate vicinity.
19	7/20 2300	5		Ship sighted 5 "dolphins" moving SE at 8 kts. MFAS not active Two submarines in vicinity.
20	7/21 1742	5		Ship sighted pod of approx 20 "dolphins" moving to SE. MFAS not active. Two submarines in vicinity.
21	7/22 0429	5		Ship sighted "porpoises" 1-2 miles off starboard beam. MFAS not active. Two submarines in vicinity.
22	7/23 0457	3		Ship sighted "pilot whale". MFAS not active.
23	7/23 1913	5	0.5	Ship sighted 20 "whales" heading SW and shutdown MFAS. Two submarines in the area.
24	7/25 0015	4		**NMFS** passed along report of pod of approx 400-500 melon-headed whales in channel between Maui and Hawaii. P-3 tasked to investigate but verification precluded due to cloud cover.
25	7/25 0430	5		Ship sighted "whale". MFAS not active.
		Participant Hours Lost	**8.0**	

As noted previously, instances of marine mammal detection by exercise participants with the resulting implementation of protective measures was unaccounted for by the predictive modeling assessing potential exercise effects on marine mammals. In RIMPAC 06, there were 29 marine mammal detections by exercise participants, which resulted in protective measures being implemented for approximately 70 marine mammals and eight additional "pods" of marine mammals (Table 1). Assuming that each detected (un-quantified) pod of marine mammals consisted of at least four marine mammals, then the total number of detected marine mammals for which exposure to MFAS was limited by standard Navy lookouts was approximately 100 marine mammals.

Also required for the analysis in this section was consideration of "the nature of any observed effects" resulting from MFAS use. The reports from exercise participants contained nothing that could be construed as abnormal or "observed effects" of MFAS. There were no instances where marine mammals behaved in an erratic, unusual, or anything other than a normal manner.

Details regarding sightings and behaviors resulting from the aerial reconnaissance and the shore-based observers are presented in Section 3 of this report. In short, there were no abnormal behaviors or unusual distributions of marine mammals observed during these monitoring efforts and, therefore, no observed effects resulting from MFAS use.

Of the estimated potential 256 marine mammals affected by 472 hours of MFAS use, approximately 100 were precluded from exposure to MFAS by implementation of the protective measures. Therefore, an estimate of the number of marine mammals affected by the RIMPAC ASW exercises was 156 marine mammals based on the modeled results of real-time exercises, actual events, and sightings.

NMFS believed that the 190dB SEL sub-TTS threshold was not sufficiently precautionary and required Navy to apply for its IHA using 173dB SEL. Using the 173dB threshold with the same modeling program and marine mammal density estimates as before, we arrived at in excess of 33,000 behavioral disturbances, or takes. For perspective, this is about twice the number of marine mammals estimated to inhabit the waters around Hawaii in which the exercise took place.

There were no affected marine mammals observed by exercise participants, aerial or shore based monitors, or via any other reports. Therefore, further analysis based on observed effects, as mandated by this reporting requirement, is not possible and was not attempted.

In summary, the pre-exercise estimate of marine mammals behaviorally affected in RIMPAC 06 was 289 using 190dB sub-TTS threshold and over 33,000 using 173dB. No observers, from any platform or vantage point, noted in any reports that any marine mammals were affected by sonar. Conclusions are:

- Using 173dB SEL, a discrete decibel level, to define sub-TTS threshold was overly precautionary to a significant degree.

- There was no evidence of any behavioral affects on marine mammals throughout the exercise.

SECTION 2: Mitigation And Monitoring

As required under the IHA the report must contain, “An assessment of the effectiveness of the mitigation and monitoring measures with recommendations on how to improve them”. This section of the report, therefore, provides an assessment of the effectiveness of the mitigation and monitoring measures, the scientific validity behind each measure, and recommendations on how to improve them with regard to practicality of implementation, their impact on exercise safety, and their impact on the effectiveness of the military readiness training activity.

During RIMPAC 06, there were 199 anti-submarine warfare (ASW) events and 472 total hours of mid-frequency active sonar (MFAS) use. There were no reported stranding events or observations of behavioral disturbance of marine mammals linked to sonar use during the exercise. Specifically, there were three monitored choke-point exercises with observations by aerial reconnaissance and shore-based monitors before, during, and after. There was no indication from the Navy monitors or from the non-governmental civilian monitors of any effects on marine mammals. These results are consistent with the previous 19 RIMPAC exercises in which no strandings linked to sonar use.

The only mitigation measures that prevented the use of MFAS in the vicinity of marine mammals were those that the Navy already had in place (Lookouts, aircraft reporting, and “safety zones”) with the exception of a modification of the Navy’s safety zone (450 yds) to 1000 m, agreed to for issuance of the IHA. The result of applying these standard mitigation measures was that exercise participants lost approximately eight hours of active sonar use.

In the 12 events where MFAS was shutdown by exercise participants, a total of approximately eight hours of ongoing MFAS use ceased, thus impacting the effectiveness of those military readiness activities. Some of the interrupted events involved lost time by multiple units operating in an integrated manner with the ramification being that shutdown of MFAS by a Surface Action Group (SAG) consisting of three vessels for 30 minutes resulted in 1.5 hours lost training time. Many of these events took place when submarines were in the vicinity of exercise participants and could have possibly been detected if MFAS had been available. It is important to realize that for the remainder of the instances for which marine mammals were detected, the option to use MFAS as tactically indicated was precluded and thus impacted the effectiveness of exercise event since commanders were operating without the option of their full sensor suite (e.g., helicopters operating with the SAG). This is especially true in the case of events involving sonobuoys where the inability to command-activate DICASS may have precluded the ability to track a contact or precluded development of attack criteria. In one case during RIMPAC 06 (Table 1, #7), a P-3 aircraft lost track on a submarine actively being prosecuted resulting in a major training impact to the unit involved.

ASW proceeds slowly and requires careful development of a tactical frame of reference over time as data is integrated from a number of sources and sensors. Once MFAS is turned off for a period of time, simply turning it back on minutes later does not usually allow a Commander to simply continue from the last frame of reference. Thus, 15 minutes of lost MFAS time does not equate to only 15 minutes of lost exercise time but should be considered in the fuller context of its overall impact on the tempo and tactical development of a Common Operational Picture shared among exercise participants as they trained with the goal of interoperability and improvement of ASW skills in general.

While the Navy's standard protective measures impacted the effectiveness of the training, a subset of the additional measures imposed by the IHA had no observed increased effectiveness in the protection of mammals during this exercise, and restricted the ability to train realistically in the known diesel submarine threat environments required for warfighting readiness. This subset of mitigation measures is as follows:

- Requirements regarding "strong surface ducting conditions"
- Requirements regarding "low visibility conditions"
- Restrictions from operating MFAS within 25 km of the 200 m isobath.
- Restrictions from operating MFAS in choke-points, constricted channels or canyon-like areas.

The following requirements associated with choke-point events were monitoring efforts mandated by NMFS as a sampling strategy to determine if there was any effect on marine mammals during these transits of the channels while conducting ASW operations..

- Additional requirements when conducting choke-point operations, to include:
    - Additional Non-Navy observers
    - Extensive additional aircraft monitoring
    - Shoreline reconnaissance
    - Additional Navy lookouts

These measures arose from a precautionary concern that MFAS use in the channels could possibly have greater potential to impact marine mammals, despite no evidence suggestive of this from previous RIMPAC exercises. The cost to implement these requirements was $66,000 for RIMPAC 06.

Analysis of results from RIMPAC indicates that the types of measures already in place in the Protective Measures Assessment Protocol (PMAP) were adequate to prevent operation of MFAS in the vicinity of detected marine mammals:

- There were no indications of any effects to any marine species throughout the exercise.
- Of the 29 instances where marine mammals were detected, MFAS was shutdown for 12 units and ASW events were interrupted by implementation of standard mitigation measures by Navy watch standers or aircraft (see Table 1). Mitigation

measures agreed to for this exercise that were in addition to Navy SOP protective measures did not provide observable increased protection to marine mammals.

- Burdensome administration of the IHA's additional mitigation measures distracted exercise participants, watchstanders, and exercise commanders at the headquarters level from their primary responsibility of exercise training and safety. While personnel seemed to adequately absorb this increased workload, there were no indications from all observations that the additional mitigation measures required provided additional protection to marine mammals during this exercise.

The following protective measures were already Navy SOP (PMAP) and were also mandated as mitigation measures for RIMPAC:

1. Personnel are trained on marine mammal awareness and mitigation measures.
2. There are personnel on lookout with binoculars at all times when the vessel is moving through the water.
3. On surface ships there are always at least three people on the bridge on lookout at all times and during ASW operations at least five people on lookout.
4. Lookouts report the sighting of any marine species, disturbance to the water's surface, or object in the water to the Officer of the Deck, who is the Commanding Officer's direct representative on watch.
5. A safety zone is established around an active sonar source and sonar power is reduced when marine mammals enter this zone.
6. Submarine sonar operators review detection indicators of close-aboard marine mammals prior to the commencement of ASW operations involving MFAS.
7. Aerial surveillance for marine species occurs whenever possible and detections are reported to ships in the vicinity.
8. Helicopters using active (dipping) sonar observe and employ a safety zone.
9. Sonar is always operated at the lowest practicable level to meet tactical training objectives.

The following mitigation measures agreed to for issuance of the IHA had no observable impact on the protection of mammals in this exercise and negatively affected training. Prohibitions against operating in shallow water or in choke-points are contrary to ASW training requirements. These measures affect the ability to train realistically in the known diesel submarine threat environment and directly impact vital military readiness activity:

1. The restriction from operating MFAS within 25 km of the 200 m isobath.
2. The restriction from conducting sonar activities in constricted channels or canyon-like areas.

The following measures had no observable effect on the protection of mammals during this exercise, and could not be accurately and uniformly employed:

1. Requirements regarding "strong surface ducting conditions"
2. Requirements regarding "low visibility conditions"

To organize the assessment of each mitigation measure, they are presented below in the order and organization as presented by in the IHA.

RIMPAC 06 IHA Mitigation and Monitoring Requirements

Measures (a) and (b)
The first two mitigation measures ((a) and (b)) detail training requirements for units participating in MFAS ASW exercises. All of the requirements within these two measures are redundant with the Marine Species Awareness Training (MSAT) that Navy lookouts and bridge personnel receive as Navy SOP. MSAT was developed in coordination with marine biology experts within the Navy and provides all effective marine species detection cues and information necessary to detect marine mammals and sea turtles. This material is part of the Navy Lookout watchstander qualification system, and will soon be available as online interactive training, and can also be provided in a video format for large audience presentations.

NMFS (Pacific Islands Region) reviewed and approved MSAT to meet the purposes of these first two mitigation measures.

Measure (a)
The MMPA Permit Monitoring and Mitigation Measure (a) read as follows:

(a) All RIMPAC participants will receive the following marine mammal training/briefing during the port phase of RIMPAC:

(i) Exercise participants (CO/XO/Ops) will review the C3F Marine Mammal Brief, available OPNAV N45 video presentations, and a NOAA brief presented by C3F on marine mammal issues in the Hawaiian Islands.

(ii) NUWC will train observers on marine mammal identification observation techniques.

(iii) Third fleet will brief all participants on marine mammal mitigation requirements.

(iv) Participants will receive video training on marine mammal awareness.

Assessment: Training was already standard for all units before RIMPAC and is effective as a mitigation measure.

Operational Impact of this mitigation measure:
None. Using standardized and required training materials and procedures is more practical and effective.

Recommendation
Training personnel in marine species detection and cues to enable operators to make informed decisions regarding potential interactions with protected marine species should be retained and is standard Navy practice. This measure should be rewritten as provided in Appendix (A).

Measure (b)
The MMPA Permit Monitoring and Mitigation Measure (b) read as follows:

> *(b) Navy watchstanders, the individuals responsible for detecting marine mammals in the Navy's standard operating procedures, will participate in marine mammal observer training by a NMFS-approved instructor. Training will focus on identification cues and behaviors that will assist in the detection of marine mammals and the recognition of behaviors potentially indicative of injury or stranding. Training will also include information aiding in the avoidance of marine mammals and the safe navigation of the vessel, as well as species identification review (with a focus on beaked whales and other species most susceptible to stranding). At least one individual who has received this training will be present, and on watch, at all times during operation of tactical mid-frequency sonar, on each vessel operating mid-frequency sonar.*

Assessment: Training as a mitigation measure can be captured in one requirement as provided in Appendix (A).

Operational Impact of this mitigation measure:
None. Using standardized and required training materials and procedures is more practical and effective.

Recommendation
For Navy authorizations, adopt the training measure provided in Appendix (A), which is based on the MSAT training video.

(1) The Navy's training and qualification program meets or exceeds the expectations of this mitigation measure. Navy personnel serving as lookouts and on bridge watch are highly qualified and experienced marine observers. At all times, they are required to sight and report all objects sighted in the water (regardless of the distance from the vessel) to the Officer of the Deck, because any object (e.g., trash, periscope) or disturbance (e.g., surface disturbance, discoloration) in the water may be indicative of a threat to the vessel. Navy lookouts undergo extensive training in order to qualify. This training includes on-the-job instruction under the supervision of an experienced lookout, followed by completion of the Personal Qualification Standard program, certifying that they have demonstrated the necessary skills (such as detection and reporting of partially submerged objects). In addition to these requirements, many lookouts periodically undergo a 2-day refresher training course.

(2) The Navy includes MSAT as part of its regular training regimen for its bridge lookout personnel on ships and submarines. This training is the most appropriate material available to allow for the safe operation of Naval vessels while limiting interactions with marine mammals and has been approved by NMFS. This training addresses the lookout's role in environmental protection, laws governing the protection of marine species, Navy stewardship commitments, and general observation information to aid in avoiding interactions with marine mammals. Finally, Navy personnel are trained

in the most effective means to ensure quick and effective communication within the command structure and facilitate implementation of protective measures if marine species are spotted. Navy personnel are trained to act swiftly and decisively to ensure that information is passed to the appropriate supervisory personnel.

Measure (c)

This measure reads:

> *(c) All ships and surfaced submarines participating in the RIMPAC ASW exercises will have personnel on lookout with binoculars at all times when the vessel is moving through the water (or operating sonar). These personnel will report the sighting of any marine species, disturbance to the water's surface, or object to the Officer in Command.*

Assessment: This measure is included Navy's SOPs, but as written requires one change.

Operational Impact of this mitigation measure:
None.

Recommendation
This mitigation measure is standard Navy practice and necessary for safe navigation. Reference to surfaced submarines should be removed since surfaced submarines are never engaged in ASW or use MFAS for ASW when on the surface.

Measure (d)

This measure reads:

> *(d) All aircraft participating in RIMPAC ASW events will conduct and maintain, whenever possible, surveillance for marine species prior to and during the event. Marine mammal sightings will be immediately reported to ships in the vicinity of the event as appropriate.*

Assessment: This measure is part of Navy's SOPs.

Operational Impact of this mitigation measure:
None.

Recommendation
This mitigation measure is standard Navy practice and necessary for safe navigation.

Measure (e)

This measure reads:

> *(e) Submarine sonar operators will review detection indicators of close-aboard marine mammals prior to the commencement of ASW operations involving active mid-frequency sonar. Marine mammals detected by passive acoustic* (sic)[3]

3 The last sentence of this mitigation measure as published in both the IHA and the NDE is incomplete.

Assessment: This measure is in Navy's SOPs.

<u>Operational Impact of this mitigation measure</u>:
None.

<u>Recommendation</u>
These practices are already standard Navy procedures.

<u>Measure (f)</u>
This measure reads:

> *(f) Safety Zones - When marine mammals are detected by any means (aircraft, lookout, or acoustically) within 1000 m of the sonar dome (the bow), the ship or submarine will limit active transmission levels to at least 6 dB below normal operating levels. Ships and submarines will continue to limit maximum transmission levels by this 6-dB factor until the animal has been seen to leave the area, has not been seen for 30 minutes, or the vessel has transited more than 2000 m beyond the location of the sighting.*
>
> *Should a marine mammal be detected within or closing to inside 500 m of the sonar dome, active sonar transmissions will be limited to at least 10 dB below the equipment's normal operating level. Ships and submarines will continue to limit maximum ping levels by this 10-dB factor until the animal has been seen to leave the area, has not been seen for 30 minutes, or the vessel has transited more than 1500 m beyond the location of the sighting.*
>
> *Should the marine mammal be detected within or closing to inside 200 m of the sonar dome, active sonar transmissions will cease. Sonar will not resume until the animal has been seen to leave the area, has not been seen for 30 minutes, or the vessel has transited more than 1200 m beyond the location of the sighting.*
>
> *If the Navy is operating sonar above 235 dB and any of the conditions necessitating a power-down arise ((f), (g), or (h)), the Navy shall follow the requirements as though they were operating at 235 dB - the normal operating level (i.e., the first power-down will be to 229 dB, regardless of at what level above 235 sonar was being operated).*

Assessment: This mitigation measure is effective, and requires improvement.

<u>Operational Impact of this mitigation measure</u>:
During RIMPAC, marine mammals were visually detected three times by fixed-wing aircraft, three times by helicopters, and 23 times by lookouts aboard ships. Active MFAS use ceased in 12 exercise events, as the ships opened the range with the locations where the marine mammals had been detected. In three additional events, P-3 aircraft were not able to use active DICASS sonobuoys as tactics may have required. Due to this mitigation measure, a total of approximately eight hours of training time was lost.

This loss of MFAS training hours is more than a simple metric involving a loss of training time as a small percentage of the overall exercise hours since, in at least six cases, the proximity of a submarine in the vicinity meant there was a potential submarine detection opportunity missed by the exercise participants.

Recommendation

A "safety zone" mitigation measure was already SOP and this mitigation measure should be retained. Expansion of the safety zone beyond 1000 m (or 1000 yards) is not prudent. This distance is the maximum Navy should impose on its ship commanding officers to certify "safe" for marine mammals or decrease the output of MFA sonar.

The provision regarding the reduction of transmission power if operating sonar above 235 dB is reasonable and should be added as Navy SOP.

This mitigation measure involving "safety zones" should be retained with the following revisions:

- Yards should be used vice meters because all Navy training and operations use yards as a term reference and there is no substantive difference in sound propagation between 1000 meters and 1000 yards.
- The 2000 meter, 1500 meter, and 1200 meter variable distance for when active sonar can resume is unnecessarily complex and the expanded distances without scientific merit.

Measure (g)

This measure reads:

> *(g) In strong surface ducting conditions (defined below), the Navy will enlarge the safety zones such that a 6-dB power down will occur if a marine mammal enters the zone within a 2000 m radius around the source, a 10-dB power-down will occur if an animal enters the 1000 m zone, and shut down will occur when an animal closes within 500 m of the sound source.*
>
> *A strong surface duct (half-channel at the surface) is defined as having the all the following factors: (1) A delta SVP between 0.6 to 2.0 m/s occurring within 20 fathoms of the surface with a positive gradient (upward refracting); (2) Sea conditions no greater than Sea State 3 (Beaufort Number 4); and (3) Daytime conditions with no more than 50% overcast (otherwise leading to diurnal warming). This applies only to surface ship mid-frequency active mainframe sonar.*

Assessment: This mitigation measure could not be effectively implemented or uniformly employed in RIMPAC. Additionally, there is no evidence to indicate it is effective or that it provides protection for marine mammals in addition to that provided in measure (f).

Operational Impact of this mitigation measure:

This mitigation measure could not be accurately and uniformly employed during RIMPAC. The exercise headquarters found so many variations in water conditions across the exercise area that the determination of "strong surfacing ducting" was futile. It was problematic for the following reasons:

(1) There is so much local variation in the Pacific Fleet training areas that it would be necessary for a ship to constantly monitor the local environment to accurately comply with this measure. Measurements taken during RIMPAC indicated large variation in the presence or absence of significant surface ducts over relatively short distances in the Hawaiian operating areas.

(2) The models used in forecasting a significant surface duct used high resolution that still resulted in a generalized sea state, SVP, and cloud cover over a large operational area covered by exercise participants. Measured local variations were so different from these forecasts that the determination that "significant surface duct condition do/do not exist" was inherently inaccurate.

(3) There is no means to know if the local SVP ahead of the ship is the same as the SVP being measured. Oceanographic models are years away from being able to model the ocean's structure in four dimensions at the resolution required to accurately predict SVP changes on a detailed scale.

(4) There is no allowance for local variations from tidal flux, differential sea states (as frequently seen in channels or shear lines to the southwest of most points of land in Hawaii), and currents/eddies - all of which have a significant effect on surface ducting.

Recommendation

Because the process to determine if a significant surface duct exists across the entire exercise area could not be effectively implemented or uniformly employed, recommend this measure not be included in future authorizations.
In addition, this measure seems to have been an outgrowth of the apparent evidence that significant surface ducting may have played a role in previous incidents involving stranding of beaked whales in certain conditions. There is no evidence to suggest that significant surface ducting in and of itself causes MFA sonar's overall effects to be increased, and it is still not known whether the presence of surface ducting was actually significant in the known beaked whale stranding incidents.

Measure (h)

This measure reads:

> *(h) In low visibility conditions (i.e., whenever the entire safety zone cannot be effectively monitored due to nighttime, high sea state, or other factors), the Navy will use additional detection measures, such as infrared (IR) or enhanced passive acoustic detection. If detection of marine mammals is not possible out to the prescribed safety zone, the Navy will power down sonar (per the safety zone criteria above) as if marine mammals are present immediately beyond the extent of detection. (For example, if detection of marine mammals is only possible out to 700 m, the Navy must implement a 6 dB power-down, as though an animal is present at 701 m, which is inside the 1000 m safety zone)*

Assessment: This mitigation measure was not necessary in RIMPAC since a condition of low visibility, as defined by the measure, was never encountered. In other words, at night lookouts were still able to monitor out to the limits of the safety zone. This mitigation measure has the potential to directly affect training and therefore the effectiveness of the military readiness activity.

Operational Impact of this mitigation measure:
This measure would preclude use of a sensor when tactically required and significantly affects the military readiness activity. Navy must be allowed to operate MFAS at night and in heavy seas using the full potential of sonar as a sensor.

There is no "enhanced passive acoustic detection" – Navy ships continuously use every passive device available, and the state of technology for detecting marine mammals passively is rudimentary at best.

Recommendation
This procedure has the potential to directly affect the military readiness activity. Recommend it not be incorporated in future authorizations or modified as to avoid impacting training realism in low visibility conditions.

Measure (i)
This measure reads:

> *(i) Helicopters shall observe/survey the vicinity of an ASW exercise for 10 minutes before deploying active (dipping) sonar in the water. Helicopters shall not dip their sonar within 200 yards of a marine mammal and shall cease pinging if a marine mammal closes within 200 yards after pinging has begun.*

Assessment: This measure is part of Navy's SOPs.

Operational Impact of this mitigation measure:
None.

Recommendation
Continue as standard Navy protective measures.

Measure (j)
This measure reads:

> *(j) The Navy will operate sonar at the lowest practicable level, not to exceed 235 dB, except for occasional short periods of time to meet tactical training objectives.*

Assessment: This measure is part of Navy's SOPs.

Operational Impact of this mitigation measure:
None.

Recommendation
Continue as standard Navy protective measures.

Measure (k)
This measure reads:

> *(k) With the exception of three specific choke-point exercises (special measures outlined in item (m)), the Navy will not conduct sonar activities in constricted channels or canyon-like areas.*

Assessment: This mitigation measure could not be precisely implemented, significantly impacts military readiness, has no scientific basis for implementation in the Hawaiian Islands, and provided no observable protection to marine mammals during this exercise.

Operational Impact of this mitigation measure:
Restricting Navy operations in choke-points are contrary to ASW training requirements. This measure limits the ability to train realistically in the known diesel submarine threat environment and directly impacts a vital military readiness activity.

This prohibition against MFAS use in "constricted channels or canyon-like areas" could not be precisely implemented or uniformly enforced because there were no defining metrics. The terms "constricted channels or canyon-like areas" have no meaning within the Navy or in maritime communities and were not defined by the IHA. Additionally, there is no scientific basis for a determination that such vaguely defined bathymetric features tend to concentrate marine mammals and/or have a greater potential to effect marine mammals, and therefore warrant prohibitive measures.

RIMPAC 2006 completed three monitored choke-point events with observations before, during, and after the events. There was no indication of any marine mammal impacts from the Navy monitors or from the non-governmental civilian monitors who were out in small vessels off Kauai and Hawaii Island during these events.

There is no data for the Pacific indicating the need for the precautionary prohibition against choke-point exercises, "constricted channels", or "canyon-like areas". There have been 19 previous RIMPAC exercises and numerous JTFEX, USWEX and COMTUEX exercises in SOCAL and Hawaii involving choke-point exercises that have occurred over many years without an indication of effect on any marine mammals.

Recommendation
This procedure had no observable effect on the protection of mammals during this exercise. Recommend future authorizations contain better definition of bathymetric features of concern and that the features of concern are based on definitive evidence of increased risk to marine mammals.

Measure (l)

This measure reads:

> *(l) With the exception of three specific "choke-point" exercises (special measures outlined in item (m)), the Navy will not operate mid-frequency sonar within 25 km of the 200 m isobath.*

Assessment: This is no scientific basis indicating this measure is warranted in the Pacific and no basis for the specific metrics (25 km of the 200 m isobath). In addition, there are no standard US nautical charts depicting depths in meters making this a difficult measure to implement in the field. This measure significantly impacts military readiness.

Operational Impact of this mitigation measure:

During RIMPAC this measure precluded active ASW training in the littoral region, which significantly impacted realism and training effectiveness. Prohibitions against operating in littoral areas are contrary to ASW training requirements. This measure affects the ability to train realistically in the known diesel submarine threat environment and directly impacts vital military readiness activity. (Note: Any reference to isobath curves should be in fathoms vice meters. There are no approved NOAA nautical charts that provide for a 200m isobath.)

Recommendation

This procedure had no observable effect on the protection of mammals during this exercise and therefore its value is uncertain. Its effect on realistic training is, however, clear and significant. The areas prohibited by this measure are the very ones where training against quiet submarines is most important. With respect to the presence of marine mammals, there is no scientific basis for the metrics particular to the 200 m isobath nor the 25 km distance from the 200 m isobath. In addition, the lengthy history of sonar use in the Hawaiian Islands and SOCAL without any strandings or apparent effect on marine mammals argues that this measure is unnecessary. Recommend it not be included in future authorizations.

Measure (m)

This measure deals with "choke-point" events, contains various subparts, and reads:

> *(m) The Navy will conduct no more than three "choke-point" exercises. These exercises will occur in the Kaulakahi Channel (between Kauai and Niihau) and the Alenuihaha Channel (between Maui and Hawaii). These exercises fall outside of the requirements listed above in (k) and (l), i.e., to avoid canyon-like areas and to operate sonar farther than 25 km from the 200 m isobath. The additional measures required for these three choke-point exercises are as follows:*

Assessment: This measure is not a mitigation and therefore requires no assessment.

Measure (m) Part (i)

This part of measure (m) reads:

(i) The Navy will provide NMFS (Stranding Coordinator and Protected Resources, Headquarters) and the Hawaii marine patrol with information regarding the time and place for the choke-point exercises 24 hours in advance of the exercises.

Assessment: This measure is a monitoring effort vice a mitigation and does not provide additional protection to marine mammals.

<u>Operational Impact of this mitigation measure</u>:
Notification to NMFS did not meet the "24 hours in advance" requirement for several reasons. Since choke-point events are scheduled to occur within a range of time, such as within a 24 hour period, the exercise participants could not provide specific times for when the choke-point transit would begin. The actual transit of the channel occurred based on the on-scene Commander's read of the tactical situation as it developed over the course of many hours. To address this issue during RIMPAC 2006, and in coordination with NMFS Pacific Islands Regional Office, NMFS was kept apprised of the timeframe as it became available.

<u>Recommendation</u>
The coordination with stranding offices and Navy's cooperation with NMFS in the event of a stranding are established procedures and should not be confused with mitigation measures mandated for a specific exercise. In addition, the emphasis on monitoring for strandings during naval exercises has the potential to perpetuate unsubstantiated correlations of strandings as being caused by MFAS use. If a comprehensive marine mammal monitoring program is warranted, it should be pursued by NMFS through implementation of statistically based monitoring protocols and a research and sampling design that objectively assesses stranding occurrence across all potential causal factors, resulting in a baseline understanding of strandings for a given region.

Note: There is no "Hawaii marine patrol" and as a result, this component of the mitigation requirement could not be implemented.

<u>**Measure (m) Part (ii)**</u>
This part of measure (m) reads:

(ii) The Navy will have at least one dedicated Navy marine mammal observer who has received the NMFS-approved training mentioned above in (a), on board each ship and conducting observations during the operation of mid-frequency tactical sonar during the choke-point exercises. The Navy has also authorized the presence of two experienced marine mammal observers (non-Navy personnel) to embark on Navy ships for observation during the exercise.

Assessment: The first component of this measure duplicates standard Navy training requirements and is unnecessary. The "experienced marine mammal observers (non-Navy personnel)" detected no marine mammals during the time they were embarked and therefore provided no additional capability or protection to marine mammals during this exercise.

Operational Impact of this mitigation measure:
None for this exercise, however, it is usually not feasible to provide transportation, berthing, and manning for non-navy personnel aboard exercise vessels. In some cases, inclusion of these observers would result in the inability to accommodate essential Navy personnel associated with the exercise such as trainers and data collection personnel.

The requirement for a "dedicated Navy marine mammal observer" indicates a fundamental misunderstanding of Navy practices. This measure duplicates the watch standing requirements inherent in measures (a) and (b), because all lookouts have been trained to be "dedicated Navy marine mammal observers". Any marine mammals detected are reported to the OOD as required under normal procedures, regardless of whether the ship is conducting a choke point transit.

NMFS embarked two observers on 19 July to the CVN during one of the Kaulakahi choke-point events, because this served as a superb viewing platform in the approximate center of ASW operations. These observers detected no marine mammals, and therefore provided no additional value as a mitigation measure during this exercise. As discussed under measures (a) and (b), Navy spotters receive sufficient training to undertake the required tasks. Use of Navy lookouts is the most effective means to ensure quick and effective communication within the command structure and facilitate implementation of protective measures if marine species are spotted.

Recommendation
Navy lookouts have the skills and training to detect marine mammals without augmentation by additional non-navy observers onboard ships. Additional non-navy observers have the potential to adversely impact an exercise, and did not appear to improve marine mammal detection cabability during RIMPAC. Recommend this measure not be included in future authorizations.

Measure (m) Part (iii)
This part of measure (m) reads:

> *(iii) Prior to start up or restart of sonar, the Navy will ensure that a 2000 m radius around the sound source is clear of marine mammals.*

Assessment: This is unnecessary given that the safety zones established in Measure (f) already provide adequate protection.

Operational Impact of this mitigation measure:
None.

Conclusion
This measure is inconsistent with the provisions required in Measure ((f); Safety Zones). Recommend it not be included in future authorizations.

Measure (m) Part (iv)

This part of measure (m) reads:

> *(iv) The Navy will coordinate a focused monitoring effort around the choke-point exercises, to include pre-exercise monitoring (2 hours), during-exercise monitoring, and post-exercise monitoring (1-2 days). This monitoring effort will include at least one dedicated aircraft or one dedicated vessel for real-time monitoring from the pre- through post-monitoring time period, except at night. The vessel or airplane may be operated by either dedicated Navy personnel, or non-Navy scientists contracted by the Navy, who will be in regular communication with a Tactical Officer with the authority to shut-down, power-down, or delay the start-up of sonar operations. These monitors will communicate with this Officer to ensure the 2000 m safety zone is clear prior to sonar start-up, to recommend power-down and shut-down during the exercise, and to extensively search for potentially injured or stranding animals in the area and down-current of the area post-exercise.*

Assessment: This measure is relatively costly and did not result in any marine mammal sightings requiring MFAS source reduction or shutdown.

Operational Impact of this mitigation measure:

The time and money spent to provide this mitigation measure appeared to provide no additional protection to marine mammals.

Observations

The monitoring efforts consisted of shore-based observers, aerial surveys and the routine patrols of Torpedo Recovery Boats. Though these surveys spotted numerous marine mammals, none of the mammal detected were in the vicinity of exercise participants or provided protection from exercise MFAS. For marine mammals detected before the event, there was no way to determine if they were likely to move into or out of an exercise that was miles from a given observation/detection location.

The capability of sighting marine mammals from both surface and aerial platforms participating in the exercise provides excellent survey capabilities using the Navy's existing exercise assets. Six of the 29 marine mammal detections were made by Navy aerial assets participating in the RIMPAC exercise.

Given the vast distances involved, it was impossible to ensure a 2000 m safety zone was clear of every single participant by these additional monitors. The monitors could not recommend power-down or shut-down during the exercise because the focus of their efforts was so dispersed.

Although monitors did serve to extensively search for potentially injured or stranded animals in the area they were assigned to observe, none were detected and the value provided by this time consuming and expensive search is questionable.

Other comments on this measure: The provision for searching "down-current of the area post-exercise" fails to recognize that an exercise area may involve many hundreds of square miles of ocean with variable currents.

Shore-based monitors' observations: Resident groups of spinner dolphins nearshore at Kekaha, Kauai on five consecutive mornings before, during, and after two choke point exercises taking place in the Kaulakahi Channel. Three days of shore-based observation from the Kohala Coast of Hawaii Island occurred around a choke-point exercise taking place in the Alenuihaha Channel. A pod of bottlenose dolphins was observed feeding nearshore a few hours apart on the first day of observation. Over the eight days of shore-based observation, there were no unusual behaviors exhibited by these animals.

Aerial survey observations: Aerial surveys covered these same channels over six days (18 hours). This aerial survey effort was generally hampered by rough sea state conditions. Two days of aerial survey had to be cancelled due to safety requirements concerning the use of unmanned drones and weapon firing on the range at PMRF on those days. There were a total of 13 sightings of marine mammals over the six days with no unusual behavior or activity observed.

Finally, of note, the aerial surveys conducted around the time of the choke point exercises showed that "the densities of marine mammal species reported here is identical with that normally seen for the Hawaiian Islands, albeit at different times of the year." Therefore, although some 30-40 ships conducted a wide ranging exercise over more than three weeks and employed MFA sonar extensively, marine mammal densities remained stable, and observers detected no unusual behavior in the marine mammals they saw.

Recommendation

This procedure is a monitoring measure vice a mitigation measure and had no demonstrable impact on the protection of mammals during RIMPAC. Due to the experience of Navy aircrews and their sensitivity to detecting marine mammals, as well as the cost involved in contracting these services, recommend that for future authorizations, only Navy assets be considered for increased monitoring, and then only when required in the aggregations of conditions which show the most potential for risk to marine mammals.

Measure (m) Part (v)

This part of measure (m) reads:

> *(v) The Navy will further contract an experienced cetacean researcher to conduct systematic aerial reconnaissance surveys and observations before, during, and after the choke-point exercises with the intent of closely examining local populations of marine mammals during the RIMPAC exercise.*

Assessment: This measure duplicates measure (m)(iv) and provides no additional protection for marine mammals.

Operational Impact of this mitigation measure:
None. However, the money spent to provide this mitigation measure provided no observable protection to marine mammals during this exercise and cannot be resourced for routine Navy's exercises.

Conclusion
The contracted "experienced cetacean researcher" did not spot any marine mammals in the vicinity of the exercise. Recommend this measure not be included in future authorizations.

Measure (m) Part (vi) and (vii)
These parts of measure (m) reads:

> *(vi) Along the Kaulakahi Channel (between Kauai and Niihau), shoreline reconnaissance and nearshore observations will be undertaken by a team of observers located at Kekaha (the approximate mid point of the Channel). Additional observations will be made on a daily basis by range vessels while enroute from Port Allen to the range at PMRF (a distance of approximately 16 nmi) and upon their return at the end of each day's activities. Finally, surveillance of the beach shoreline and nearshore waters bounding PMRF will occur randomly around the clock a minimum four times in each 24 hour period.*
>
> *(vii) In the Alenuihaha Channel (between Maui and Hawaii), the Navy will conduct shoreline reconnaissance and nearshore observations by a team of observers rotating between Mahukona and Lapakahi before, during, and after the exercise.*

Assessment: This measure does not appear to provide additional protection for marine mammals and is unnecessary.

Operational Impact of this mitigation measure:
None. However, the personnel resources spent to provide this mitigation measure provided no demonstrable protection to marine mammals during this exercise and cannot be routinely resourced for Navy's exercises.

Conclusion
This procedure did not result in any effective mitigation during RIMPAC. Tasking personnel to observe a portion of the shoreline during a choke-point as a monitoring measure has no scientific basis (no research questions, research design, or sampling approach).
Although the shore based observers saw marine mammals and sea turtles, and these observations were reported to the RIMPAC Battle Watch as required, the observed marine species were miles from any exercise events and hours before the choke-point transits began. These observations were of no utility as a mitigation measure. Recommend this measure not be included in future authorizations.

Measure (n)
This measure reads:

> *(n) The Navy will continue to coordinate with NMFS on the "Communications and Response Protocol for Stranded Marine Mammal Events During Navy Operations in the Pacific Islands Region" that is currently under preparation by NMFS PIRO to facilitate communication during RIMPAC. The Navy will coordinate with the NMFS Stranding Coordinator for any unusual marine mammal behavior, including stranding, beached live or dead cetacean(s), floating marine mammals, or out-of-habitat/milling live cetaceans that may occur at any time during or shortly after RIMPAC activities. After RIMPAC, NMFS and the Navy (CPF) will prepare a coordinated report on the practicality and effectiveness of the protocol that will be provided to Navy/NMFS leadership.*

Assessment: This measure documents what is standard procedure.

Operational Impact of this mitigation measure:
None.

Recommendation
This requirement documents Navy's standard procedure.

SECTION 2 SUMMARY

During RIMPAC 06, there were 472 total hours of mid-frequency active sonar (MFAS) use. There were no reported observations of behavioral disturbance of marine mammals during the exercise. The Navy's previously developed and used mitigation measures from PMAP, as modified for RIMPAC 06, appeared to be effective in protecting marine mammals observed near exercise ships. Mitigation measures agreed to for issuance of the IHA that went beyond standard Navy measures had no observable effect on protection of marine mammals in this exercise, and their application unnecessarily increased the cost of the exercise or had a negative effect on the fidelity of training.

As the first major exercise for which Navy applied for an authorization under MMPA, RIMPAC '06 presented unique challenges from the perspective of regulatory requirements and public perception. We anticipate that future authorizations for exercises and operating area coverage will recognize the differences in those areas as well as how developing science will inform our understanding of the role of mitigation measures.

SECTION 3: Monitoring Results

The IHA requires this report contain, "Results of the marine species monitoring (real-time monitoring from all platforms, independent aerial monitoring, shore-based monitoring at chokepoints, etc.) before, during, and after the RIMPAC exercises". This section of the report, therefore, provides a summary of the detections of marine species from all exercise participants, the aerial reconnaissance survey, and shore-based monitoring efforts associated with the RIMPAC 06 exercise.

Figure 2. Location of marine mammals sighted by exercise participants depicted in red. Locations with multiple sightings are depicted by a single box. The line of longitude shown is 160˚ West and the latitude is 20˚ North.

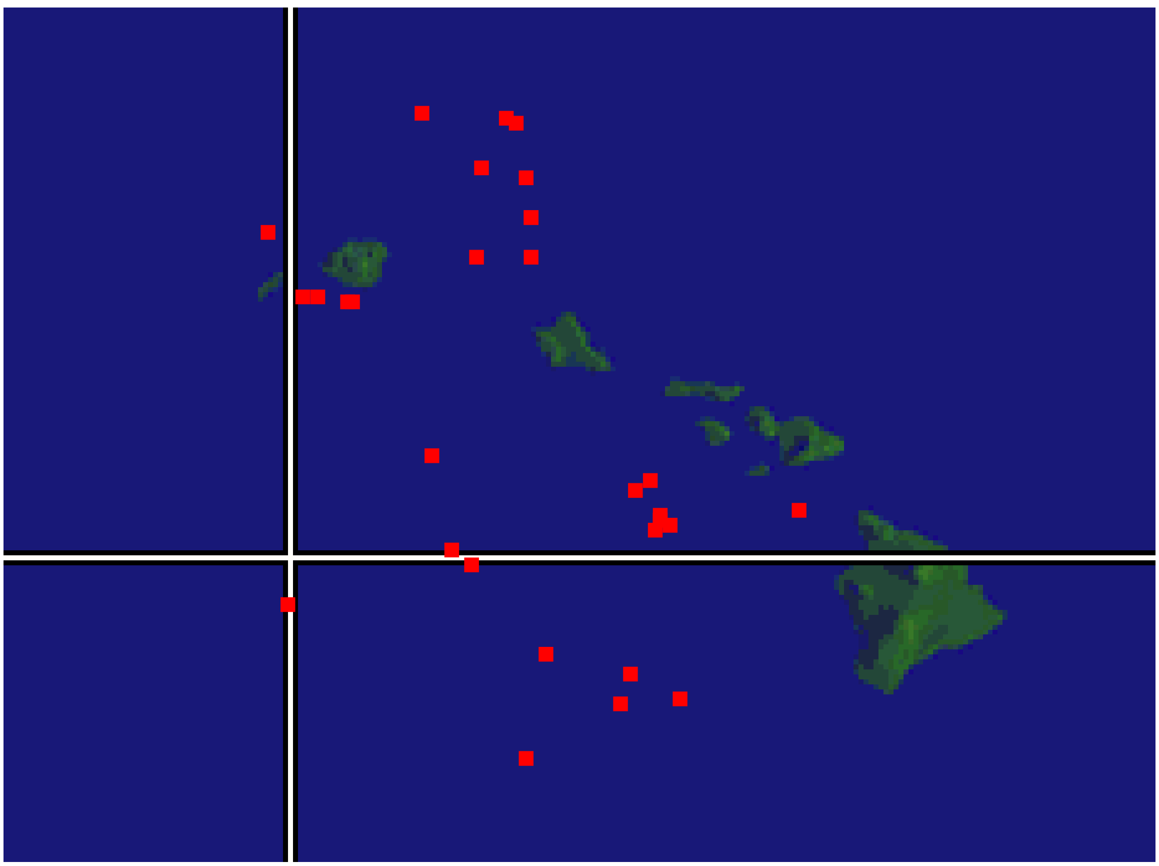

Figure 2 depicts the approximate location of marine mammals that were sighted by exercise participants. This is a skewed sample since there were no attempts made to detect marine mammals by other means in areas not being used by exercise participants. In addition to these sightings, marine species detections occurred as a result of two other

IHA mandated measures consisting of an aerial reconnaissance effort and shore-based monitors.

As noted previously, the additional monitoring requirements consisting of aerial and shipboard monitoring, and shore-based observations before, during, and after choke-point events. These monitoring efforts were required by NMFS as a sampling strategy to determine if there was any observable effect on marine mammals during ASW training events taking place in the channels between two sets of islands. These measures arose from a precautionary concern that MFAS use in the channels could possibly have greater potential to impact marine mammals, despite the lack of evidence suggestive of any problems in this regard from any of the previous 19 RIMPAC exercises. The cost to implement these monitoring requirements was approximately $66,000 for RIMPAC 06

A separate report providing details from the shore-based monitors' observations is presented in Appendix B and summarized here. These shore-based observations took place centered on two channels between the islands. The first of these monitoring efforts took place at Kekaha on Kauai. This is the approximate mid point along the Kaulakahi Channel between Kauai and Niihau, and spanned five consecutive days before, during, and after two choke point exercises taking place in that channel. Each morning of the five days, a pod of spinner dolphins were present 300-400 meters offshore. There were no unusual or abnormal behaviors observed. Sea turtles were also observed on two days.

Additional observations made on a daily basis by range vessels while enroute from Port Allen through the channel to the range at PMRF and surveillance of the beach shoreline and nearshore waters bounding PMRF did not result in any marine mammal detections.

Shore-based observation also took place on the Kohala Coast of Hawaii Island for three full days occurred around a choke-point exercise taking place in the Alenuihaha Channel between Hawaii Island and Maui. A pod of bottlenose dolphins was observed feeding during the first day of observation. There were no unusual or abnormal behaviors observed. Sea turtles were also observed on two days.

Aerial surveys covered these same channels over six days (approximately 18 hours flight time) as detailed in Appendix C. This aerial survey effort was generally hampered by rough sea state conditions. Two days of aerial survey had to be cancelled due to safety requirements concerning the use of unmanned drones and weapon firing on the range at PMRF on those days. There were a total of 13 sightings of marine mammals over the six days with no unusual behavior or activity observed.

Navy also authorized the presence of two experienced marine mammal observers (non-Navy personnel) to embark on a Navy ship for observation during a choke-point exercise. NMFS did not have any marine mammal observers available and alternatively embarked two Fisheries Program observers on 19 July to an available CVN during one of the Kaulakahi choke-point events. This ship was chosen since it served as a superb viewing platform with a large height of eye and unobstructed visibility in the approximate center of ASW operations. These observers detected no marine mammals.

In summary, there were 13 sightings of marine mammals from the air over approximately 18 hours of flight time. Shore based observation for 80 hours of effort by two people produced five sightings of a resident pod of spinner dolphins over five consecutive days on Kauai and a pod of bottlenose dolphins offshore of Hawaii Island. The results of these monitoring efforts provided no evidence of indicating there were any effects on the detected marine mammals as a result of the ASW exercises, which took place in the adjacent channels.

SECTION 4: Sonar Usage and Marine Mammals

The IHA requires that this report contain, "As much information (unclassified and, to appropriately cleared recipients, classified “secret”) as the Navy can provide including, but not limited to, where and when sonar was used (including sources not considered in take estimates, such as submarine and aircraft sonars) in relation to any measures received levels (such as sonobuoys or on PMRF range), source levels, numbers of sources, and frequencies so it can be coordinated with observed cetacean behaviors." Section 4 of the report provides information on the location and hours of active MFAS used during RIMPAC 06. The IHA also required as much data as could be provided on measured received levels, source levels, numbers of sources and frequencies so it could be coordinated with observed cetacean behaviors. Typically, there are no measurements (calibrated or otherwise) of actual sound levels made during an exercise and none were made during RIMPAC 06. Source levels, numbers of sources, and frequencies are classified since that information would provide potential adversaries with important tactical data. The observance of marine mammals by Navy assets only occurred as very brief encounters given the mitigation measures are designed to limit interaction to a minimum.

Observations of marine species and their behaviors resulting from the aerial reconnaissance and shore-based monitoring (as previously detailed in Section 3) observed no unusual behaviors for coordination with MFAS use. There were no indications from the observations that the presence of exercise participants had any affect on any marine mammals.

The requirement to report where and when sonar was used so it can be coordinated with observed cetacean behaviors can not be completed since no animals were observed doing anything unusual or behaving in any overt manner. Information presented previously in Table 1 provides a list of instances when marine mammals were detected and sonar was being used.

As noted previously, during RIMPAC 06, there were 199 anti-submarine warfare (ASW) events and 472 total hours of hull mounted MFAS. This was less than the anticipated number of hours (532) presented in the RIMPAC 2006 Supplemental Environmental Assessment as a result of a temporary restraining order (TRO) restricting the use of MFAS arising from a lawsuit (NRDC v. Winter) in effect for the first days of the exercise. During the period of this TRO, three days of scheduled MFAS training (25 events) were lost including 4 live fire events, 14 P-3 ASW events, and 7 surface ASW events.

In addition to the 472 hours of hull mounted MFAS use, there were approximately 115 hours of operations involving both passive DIFAR and active DICASS sonobuoys reported for RIMPAC 06. This quantity of operational hours does not equate to 115 hours of active sonar use since only approximately 10% of the sonobuoys expended[4] were active DICASS and they are commanded to transmit an active ping only as required by the tactical situation. In short, an individual DICASS sonobuoy, even though deployed, may never be activated during an event. In other instances, DICASS buoys are not deployed until a possible contact is identified and the need to localize the target arises. There is no standard data collection reporting that would serve as a means to determine how much actual active sonar time resulted from DICASS sonobuoy use during RIMPAC.

Finally, there were approximately 45 hours of operations involving the use of dipping sonars deployed from helicopters. Similar to the case for sonobuoys, there is no standard data collection reporting that would serve as a means to determine how much actual active sonar time resulted from this number of hours of dipping sonar operation. During RIMPAC, dipping sonars were not in a search capacity but instead used for localization or confirmation of suspected contacts. In can be estimated that in this capacity dipping sonars, which are used very briefly (2-5 pulses a few hundred msec in duration) approximately every 10 minutes, would have resulted in approximately 11-12 minutes of active sonar over a 20 day period spread across the RIMPAC exercise area.

4 There were 2,713 passive and 292 active sonobuoys expended in RMPAC 06.

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Appendix (A)

PROPOSED MITIGATION MEASURES FOR MFAS DURING MAJOR ASW EXERCISES

I. General Maritime Protective Measures: Personnel Training:

1. All lookouts onboard platforms involved in ASW training events will review the NMFS approved Marine Species Awareness Training (MSAT) material prior to MFAS use.

2. All Commanding Officers, Executive Officers, and officers standing watch on the Bridge will have reviewed the MSAT material prior to a training event employing the use of MFAS.

3. Navy lookouts will undertake extensive training in order to qualify as a watchstander in accordance with the Lookout Training Handbook (NAVEDTRA 12968-B).

4. Lookout training will include on-the-job instruction under the supervision of a qualified, experienced watchstander. Following successful completion of this supervised training period, Lookouts will complete the Personal Qualification Standard program, certifying that they have demonstrated the necessary skills (such as detection and reporting of partially submerged objects). This does not forbid personnel being trained as lookouts counted as those listed in previous measures so long as supervisors monitor their progress and performance.

5. Lookouts will be trained in the most effective means to ensure quick and effective communication within the command structure in order to facilitate implementation of protective measures if marine species are spotted.

II. General Maritime Protective Measures: Lookout and Watchstander Responsibilities:

6. On the bridge of surface ships, there will always be at least three people on watch whose duties include observing the water surface around the vessel.

7. All surface ships participating in ASW exercises will, in addition to the three personnel on watch noted previously, have at all times during the exercise at least two additional personnel on watch as lookouts.

8. Personnel on lookout and officers on watch on the bridge will have at least one set of binoculars available for each person to aid in the detection of marine mammals.

9. On surface vessels equipped with MFAS, pedestal mounted “Big Eye” (20x110) binoculars will be present and in good working order to assist in the detection of

marine mammals in the vicinity of the vessel.

10. Personnel on lookout will employ visual search procedures employing a scanning methodology in accordance with the Lookout Training Handbook (NAVEDTRA 12968-B).

11. After sunset and prior to sunrise, lookouts will employ Night Lookouts Techniques in accordance with the Lookout Training Handbook.

12. Personnel on lookout will be responsible for reporting all objects or anomalies sighted in the water (regardless of the distance from the vessel) to the Officer of the Deck, since any object or disturbance (e.g., trash, periscope, surface disturbance, discoloration) in the water may be indicative of a threat to the vessel and its crew or indicative of a marine species that may need to be avoided as warranted.

III. Operating Procedures

13. A Letter of Instruction, Mitigation Measures Message or Environmental Annex to the Operational Order will be issued prior to the exercise to further disseminate the personnel training requirement and general marine mammal protective measures.

14. Commanding Officers will make use of marine species detection cues and information to limit interaction with marine species to the maximum extent possible consistent with safety of the ship.

15. All personnel engaged in passive acoustic sonar operation (including aircraft, surface ships, or submarines) will monitor for marine mammal vocalizations and report the detection of any marine mammal to the appropriate watch station for dissemination and appropriate action.

16. During MFAS operations, personnel will utilize all available sensor and optical systems (such as Night Vision Goggles to aid in the detection of marine mammals.

17. Navy aircraft participating in exercises at sea will conduct and maintain, when operationally feasible and safe, surveillance for marine species of concern as long as it does not violate safety constraints or interfere with the accomplishment of primary operational duties.

18. Aircraft with deployed sonobuoys will use only the passive capability of sonobuoys when marine mammals are detected within 200 yards of the sonobuoy.

19. Marine mammal detections will be immediately reported to assigned Aircraft Control Unit for further dissemination to ships in the vicinity of the marine species as appropriate where it is reasonable to conclude that the course of the

ship will likely result in a closing of the distance to the detected marine mammal.

20. Safety Zones - When marine mammals are detected by any means (aircraft, shipboard lookout, or acoustically) within 1,000 yards of the sonar dome (the bow), the ship or submarine will limit active transmission levels to at least 6 dB below normal operating levels.

    (i) Ships and submarines will continue to limit maximum transmission levels by this 6-dB factor until the animal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 1,000 yards beyond the location of the last detection.

    (ii) Should a marine mammal be detected within or closing to inside 500 yards of the sonar dome, active sonar transmissions will be limited to at least 10 dB below the equipment's normal operating level. Ships and submarines will continue to limit maximum ping levels by this 10-dB factor until the animal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 1,000 yards beyond the location of the last detection.

    (iii) Should the marine mammal be detected within or closing to inside 200 yards of the sonar dome, active sonar transmissions will cease. Sonar will not resume until the animal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 1,000 yards beyond the location of the last detection.

    (iv) Special conditions applicable for dolphins and porpoises only: If, after conducting an initial maneuver to avoid close quarters with dolphins or porpoises, the Officer of the Deck concludes that dolphins or porpoises are deliberately closing to ride the vessel's bow wave, no further mitigation actions are necessary while the dolphins or porpoises continue to exhibit bow wave riding behavior.

    (v) If the need for power-down should arise as detailed in “Safety Zones” above, Navy shall follow the requirements as though they were operating at 235 dB - the normal operating level (i.e., the first power-down will be to 229 dB, regardless of at what level above 235 sonar was being operated).

21. Prior to start up or restart of active sonar, operators will check that the Safety Zone radius around the sound source is clear of marine mammals.

22. Sonar levels (generally) - Navy will operate sonar at the lowest practicable level, not to exceed 235 dB, except as required to meet tactical training objectives.

23. Helicopters shall observe/survey the vicinity of an ASW exercise for 10 minutes before the first deployment of active (dipping) sonar in the water.

24. Helicopters shall not dip their sonar within 200 yards of a marine mammal and shall cease pinging if a marine mammal closes within 200 yards after pinging has

begun.

25. Submarine sonar operators will review detection indicators of close-aboard marine mammals prior to the commencement of ASW operations involving active mid-frequency sonar.

26. Increased vigilance during major ASW training exercises with tactical active sonar when critical conditions are present.

Navy should avoid planning major ASW training exercises with MFAS in areas where they will encounter conditions which, in their aggregate, may contribute to a marine mammal stranding event. Of particular concern are beaked whales, for which strandings have been associated, in theory, with MFAS operations.

The conditions to be considered during exercise planning include:

(1) Areas of at least 1000 m depth near a shoreline where there is a rapid change in bathymetry on the order of 1000-6000 meters occurring across a relatively short horizontal distance (e.g., 5 nm).
(2) Cases for which multiple ships or submarines (≥ 3) operating MFAS in the same area over extended periods of time (≥ 6 hours) in close proximity (≤ 10NM apart).
(3) An area surrounded by land masses, separated by less than 35 nm and at least 10 nm in length, or an embayment, wherein operations involving multiple ships/subs (≥ 3) employing MFAS near land may produce sound directed toward the channel or embayment that may cut off the lines of egress for marine mammals.
(4) Though not as dominant a condition as bathymetric features, the historical presence of a strong surface duct (i.e. a mixed layer of constant water temperature extending from the sea surface to 100 or more feet).

If the major exercise must occur in an area where the above conditions exist in their aggregate, these conditions must be fully analyzed in environmental planning documentation. Navy will increase vigilance by undertaking the following additional protective measure:
A dedicated aircraft (Navy asset or contracted aircraft) will undertake reconnaissance of the embayment or channel ahead of the exercise participants to detect marine mammals that may be in the area exposed to active sonar. All safety zone power down requirements described above apply.

IV. Coordination and Reporting

27. Navy will coordinate with the local NMFS Stranding Coordinator for any unusual marine mammal behavior and any stranding, beached live/dead or floating marine mammals that may occur at any time during or within 24 hours after completion of mid-frequency active sonar use associated with ASW training activities.

28. Navy will submit a report to the Office of Protected Resources, NMFS, within 120 days of the completion of a Major Exercise. This report must contain a discussion of the nature of the effects, if observed, based on both modeled results of real-time events and sightings of marine mammals.

29. If a stranding occurs during an ASW exercise, NMFS and Navy will coordinate to determine if MFAS should be temporarily discontinued while the facts surrounding the stranding are collected.

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Appendix (B)

RIMPAC 2006
NEARSHORE MONITORING
FIELD REPORT

JULY 2006

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INTRODUCTION

In support of RIMPAC 2006, nearshore monitoring for marine mammals and sea turtles was conducted during July 16-20 from Kekaha Beach, Kauai, Hawaii and July 24-26 from Mahukona and Kapa`a Beach Park, Kohala Coast, Hawaii. The locations were chosen based upon their proximity to the Kalaukahi (between Kauai and Ni`ihau) and Alanuihaha (between Hawaii and Maui) Channels. The purpose of the monitoring was to 1) provide the Navy ships with information on species in the nearshore waters, 2) provide observations of marine mammal behavior before, during and after swept-channel (choke point) exercises, and 3) to monitor the beach and nearshore waters for marine species exhibiting abnormal behavior (offshore animals nearshore, congregations of offshore animals, strandings, etc).

METHODS

Shore-based monitoring was conducted from 0700 to 1830 hours with two observers using hand-held 10x42 binoculars and un-aided eye. Monitoring schedule corresponds to one day before and after each planned swept-channel exercise, two in the Kalaukahi channel and one in the Alanuihaha Channel. All observations were conducted by one experienced Navy marine mammal observer and one field assistant.

Kekaha Beach observations were conducted essentially at sea level. The sandy beach allowed for observers to walk the length of the beach north to the PMRF, Barking Sands Boundary and south to the end of Kehaka Beach (3 miles). Walks were conducted between two and four times per day. One observer would remain on station (near the lifeguard tower) as the other walked up the beach. The horizon from sea level is a distance of approximately 5 km.

Observations were conducted from Mahukona on July 23rd from 0700 to 1200 hours, but Kapa`a Beach Park was chosen for the rest of the 2.5 days since it offered a better view of the Alanuihaha Channel. Kapa`a Beach Park is a boulder beach, and observations were conducted at approximately 7m above sea level (horizon distance approximately 5 miles). A point to the north of the beach park resulted in a consistently lower sea state close to shore than in the open channel. On two days, portions of the coastline to the north of Kapa`a Beach Park (between Upolu Point and Mo`okini Heiau) was driven using a 4x4 vehicle to check the boulder beaches for stranded or distressed animals.

Data were collected on visibility, Beaufort sea state, marine mammals observed, sea turtles observed, and Navy ships/operations observed. While at Kehaka, data were also collected on commercial tour boats that were observed interacting with resident spinner dolphins.

RESULTS

Table 1 provides daily observation information. Only two species of marine mammals were observed, spinner dolphins (*Stenella longitrostris*) and bottlenose dolphins (*Tursiops aduncus*). Both are typically nearshore species. Two species of sea turtles were observed – green (*Chelonia mydas*) and leatherback (*Dermochelys coriacea)*. All were observed exhibiting normal behaviors.

The following is provided as a summary of marine mammals and sea turtles observed during the two nearshore monitoring periods.

Kekaha:

16 July 2006: A school of approximately 100 spinner dolphins (*Stenella longirostris*) are observed approximately 300m offshore (0747 hrs). Animals are slowly heading south and are being followed by a catamaran. When first vessel leaves, a series of RHIBs and catamarans stop and follow animals, one after the other. Animals are last seen at 0826 hrs approximately 0.5 miles offshore. Behavior overall is slow travel to south, with several spins. This is largest group that was seen during the five day period.

16 July 2006: A turtle (presumed green) is seen surfacing approximately 100m offshore.

17 July 2006: A school of approximately fifteen spinner dolphins is observed heading slowly south (0830 hrs) being followed by a tour catamaran. Dolphins are last observed at 0910 hrs. Behavior overall is slow travel to south, with several aerial spins.

17 July 2006: Green sea turtle is observed approximately 4 m offshore.

18 July 2006: A small school of ten to fifteen spinner dolphins are observed approximately 0.25 miles offshore, with two tour boats (0835 hrs). Dolphins are very low in the water and would be very difficult to see without boats as “cue”. Dolphins not seen after boats leave at 0845 hrs.

19 July 2006: Unidentified dolphins, cue is splash and idling tour boat, at horizon (0715 hrs.).

19 July 2006: Unidentified dolphins (presumed spinners) observed at southwestern horizon splashing, heading north (0858 hrs.).

19 July 2006: Spinner dolphins observed heading north towards Barking Sands (0922 hrs.). They continue to north out of view.

20 July 2006: Spinner dolphins observed in resting mode about 400m off southern shore of Kekaha Beach. Group size is approximately 20 animals, and they are milling at 0730 hrs. At 0745 hrs, they are traveling slowly to the north towards Barking Sands. They bowride as a boat approaches and follows them. Dolphins last seen at 0847 hrs.

Mahukona:

(0730 hrs to 1300 hrs.)

24 July 2006: Leatherback turtle (*D. coriacea)* observed approximately 300m offshore. Turtle is identified as a leatherback based upon very large carapace size (estimated 5-6 ft across) and huge rounded head. Back and head were seen simultaneously at the animal breathed. Turtle was observed at the surface for 1-2 minutes then dove (0759 hrs).

Kapa`a Beach Park:

24 July 2006: Group of approximately 20 bottlenose dolphins (*Tursiops aduncus*) are observed, first seen heading southwest (1630 hrs). A third of the group are calves. Animals travel steadily to the SW, except stopping to mill for about 3 minutes near a group of shearwaters and tuna feeding on bait fish. Dolphins contour shoreline to the south and disappear from view at 1646 hrs.

Bottlenose dolphins reappear from the south, heading west (1725 hrs). The dolphins are much more surface-active during this sighting, porpoising and leaping out of the water. At 1749 hrs, after a long dive (5 minutes), they resurface with obvious blows and change direction to the southwest and appear to be feeding along the edge of a large aggregation of shearwaters, tuna and bait fish.

25 July 2006: Small turtle (green?) observed just offshore (0858 hrs).

26 July 2006: Small green turtle observed hugging coastline and "riding" the surge (1415 hrs).

DISCUSSION AND CONCLUSIONS

All marine mammals and turtles were observed exhibiting normal behavior. No adverse behavior, strandings, or offshore species were observed.

Land based, stationary monitoring has known deficiencies. The low height of eye above water provides a limited distance to the horizon and species identification can be difficult as there is no option to approach animals. However, given the purpose of this project, the goals were achieved. This monitoring gathered adequate data on the lack of behavioral change exhibited by resident groups of spinner dolphins at Kekaha, Kauai and Kohala, Hawaii. Additionally, we were able to monitor the length of Kekaha Beach, by foot, for stranded or distressed animals. The Kohala coast presented more of a challenge as it was comprised of boulder beaches. However, a 4x4 vehicle was utilized to access areas to the North (towards the channel) from the monitoring station at Kapa`a Beach.

Additionally, anecdotal data collected on interactions between commercial tour catamarans and RHIBs might prove to be useful to regulatory agencies such as the State of Hawaii and National Oceanographic and Atmospheric Association.

TABLE 1

Date 2006	**Location**	**Time (24 hr)**	**Beaufort Sea State**	**Species**	**Observations**
7/16	Kekaha	0700	2		Begin watch. Great visibility, overcast skies
	Kekaha	0747		*S. longirostris*	Spinners with catamaran. Slowly bowriding on vessel (Aladin?). Couple of spins seen after cat leaves. Located about 300m offshore, moving south. Group size ~100.
7/16	Kekaha	0750		*S. longirostris*	Catamaran leaves dolphins
7/16	Kekaha	0755		*S. longirostris*	RHIB runs up to animals and follows them
7/16	Kekaha	0759		*S. longirostris*	RHIB leaves dolphins
7/16	Kekaha	0809		*S. longirostris*	Still heading slowly S
7/16	Kekaha	0826			Two new RHIBs with S.l., about 0.5 mile offshore
7/16	Kekaha	0850		*C. mydas*	Green turtle seen about 100m offshore
7/16	Kekaha	1230	3		Sea state change
7/16	Kekaha	1430	4		Occasional rain squalls passing over
7/16	Kekaha	1600	3		Squalls clear. Navy ship seen on horizon heading from N coast to the S
7/16	Kekaha	1655	2		Sea state change
7/16	Kekaha	1745			Complete watch
7/17	Kekaha	0700	3		Begin watch, sunny skies, good visibility
7/17	Kekaha	0745			Two helicopters and 3 Navy ships seen on horizon. Helos ahead of ships along with three small red RHIBs inshore of ships
7/17	Kekaha	0815			Three Navy ships seen N of Barking Sands and head SW

Date 2006	**Location**	**Time (24 hr)**	**Beaufort Sea State**	**Species**	**Observations**
					through the channel, one right after the other.
7/17	Kekaha	0830		*S. longirostris*	Spinners seen bowriding on catamaran. Cat is heading N but stops and does u-turn through spinners and follows them south for ~ 5 min.
7/17	Kekaha	0835		*S. longirostris*	Just as cat leaves dolphins, a RHIB goes through them while heading N.
7/17	Kekaha	0850	4	*S. longirostris*	Na Pali Kai III catamaran seen doing u-turn and following dolphins to S. They stay with the dolphins heading S until 0910 hrs. Few spins from dolphins. Visibility changes to moderate due to higher Beaufort.
7/17	Kekaha	1015	4		Glare, moderate visibility. Have lost sight of dolphins due to sea conditions.
7/17	Kekaha	1053	3=inshore 4=offshore		Visibility improves as wind dies down.
7/17	Kekaha	1345	4		Sea state change
7/17	Kekaha	1612	4	*C. mydas*	Turtle seen at surface about 4 m offshore.
7/17	Kekaha	1830			Complete watch
7/18	Kekaha	0700	1		Begin watch
7/18	Kekaha	0835		*S. longirostris*	Small group of spinners (~15 animals) observed ~.25 miles offshore. One RHIB and one cat stop with dolphins and proceed slowly through them.
7/18	Kekaha	0845		*S. longirostris*	Boats leave dolphins and head N
7/18	Kekaha				Catamaran seen stopping ~ 0.5 miles offshore towards N. Can't see dolphins but assume that is why they are stopping.
7/18	Kekaha	1005	3		Still sunny…
7/18	Kekaha	1700			Cruise ship comes from N, heads through channel and continues to the S over horizon

Date 2006	**Location**	**Time (24 hr)**	**Beaufort Sea State**	**Species**	**Observations**
7/18	Kekaha	1830			Complete watch
7/19	Kekaha	0700	1		Begin watch, swell 2-3 ft.
7/19	Kekaha	0715		Unidentified dolphin	Catamaran and two RHIBs are stopped on horizon. Appear to be slowly following marine mammals, but other than one splash, I cannot identify them to species.
7/19	Kekaha	0858		Unidentified dolphin	School of dolphins (presumed spinners) seen at SW horizon, splashing, heading N
7/19	Kekaha	0922		*S. longirostris*	Spinners seen heading N off Kekaha. Catamaran comes up to them and slowly moves through them. Group size ~20.
7/19	Kekaha	0955	3		Sea state change
7/19	Kekaha	1515			Three red RHIBs head out of Portlock heading N through channel (we are later told these are part of RIMPAC ops).
7/19	Kekaha	1530	2		Swell 1-2 ft.
7/19	Kekaha	1644			1st Navy destroyer enters channel. Second one ~1 mile behind it. Helo overhead and doing sweeps ahead of ships (and has been for about an hour over the horizon). Ships appear to be moving slowly through channel.
7/19	Kekaha	1703			Second ship leaves channel. Helo has been dipping sonar ahead of 2nd ship. 1st ship N of Lehua and over horizon.
7/19	Kekaha	1706			2nd ship passes Lehua heading N and goes over horizon.
7/19	Kekaha				3 red Navy RHIBs pass Kekaha.
7/19	Kekaha	1800			Complete watch
7/20	Kekaha	0700	1		Begin watch with great visibility, partly cloudy.
7/20	Kekaha	0715		*S. longirostris*	Spinners in resting mode about 400m offshore, off southern shore of beach. Milling

Date 2006	**Location**	**Time (24 hr)**	**Beaufort Sea State**	**Species**	**Observations**
					behavior, group size ~20. No boats with dolphins, the boats appear to not see them.
7/20	Kekaha	0730		*S. longirostris*	Spinners are now just N of lifeguard tower heading N.
7/20	Kekaha	0753		*S. longirostris*	Tour boat Makana stops with dolphins and they slowly bowride.
7/20	Kekaha	0800	0		Sea state change
7/20	Kekaha	0804		*S. longirostris*	Makana still slowly following spinners to the N, then S. They are really staying with them longer than most boats do, following the milling dolphins back and forth.
7/20	Kekaha	0811		*S. longirostris*	Makana leaves dolphins
7/20	Kekaha	0814		*S. longirostris*	Tour RHIB runs up on dolphins, then u-turns and follows them.
7/20	Kekaha	0820		*S. longirostris*	As RHIB leaves, catamaran "Lucky Lady" comes slowly up to them and sits with dolphins.
7/20	Kekaha	0828		*S. longirostris*	"Lucky Lady" leaves dolphins
7/20		0840		*S. longirostris*	Another cat on spinners, N of Kehaka. Does u-turns and runs through them a few times at slow speed.
7/20	Kekaha	0847	1	*S. longirostris*	Cat leaves dolphins, heads N
7/20	Kekaha	1234	2		Overcast skies, great visibility
7/20	Kekaha	1800			Complete watch. Total beach monitored with 2-3 beach walks daily is 3 miles (includes all of Kekaha Beach to Barking Sands boundary)
7/24	Mahukona	0730	2=inshore 3=offshore		Begin watch. Walked up to point north of harbor for better view of channel and Maui. Partly cloudy skies, good visibility.

Date 2006	Location	Time (24 hr)	Beaufort Sea State	Species	Observations
7/24	Mahukona	0759		*D. coriacea*	Leatherback turtle observed. Carapace was 5-6 ft across and a huge rounded head, which is seen simultaneously during surfacing. (There is a kayaker offshore of turtle which we used for a size comparison). Turtle is observed breathing at surface for about 1 minute, then dives.
7/24	Mahukona	0951	4=offshore 3=inshore		Sea state change
7/24	Kapa`a Beach Park	1330	2=inshore 4=offshore		Change monitoring station to Kapa`a Beach Park, which is just N of Mahukona towards Hawi. It offers a better view of the channel, Maui and provides a protected inshore area with better viewing conditions. Cloud cover is 90%.
7/24	Kapa`a	1630		*T. aduncus*	Group of ~ 20 bottlenose dolphins are observed heading SW, about 400m offshore. Does not appear to be mixed species, however, about 1/3 of the group are calves. Group is traveling slowly and steadily to the SW, except for stopping for about 3 minutes near a group of shearwaters and tuna feeding on bait fish. Group stayed about the same distance offshore and heads SW out of view (at 1646 hrs.)
7/24	Kapa`a	1725		*T. aduncus*	Group of ~20 bottlenose dolphins are observed again, coming from around the point where they were last seen. They are heading to the W. They are moving more quickly this time, porpoising out of the water. As they lift heads higher to prepare for a dive, several of

Date 2006	Location	Time (24 hr)	Beaufort Sea State	Species	Observations
					them flip their tails up. Reappear after five minutes with very visible blows.
7/24	Kapa`a	1749		*T. aduncus*	Ta change direction to SW and appear to be feeding. They are working the margin of a large school of tuna and shearwaters which feeding on bait fish. The dolphins behavior includes direction change, leaps out of the water, and a few tail slaps. The group is a little more spread out too, than before. They continue this behavior for about 5 minutes, then regroup and head slowly offshore to the SW out of sight.
7/24	Kapa`a	1800			Complete watch. Drive up 4x4 road towards Hawi to check coastline for any strandings or other animals that might be out of sight.
7/25	Kapa`a Beach Park	0715	2=inshore 4=offshore		Begin watch. Three Navy ships and one other unid ship are observed over horizon towards Maui, in the channel. They are heading W.
7/25	Kapa`a	0745			Ships have disappeared over W horizon
7/25	Kapa`a	0858		*C. mydas* ?	Small turtle (green?) seen just off cove, about 100m offshore.
7/25	Kapa`a	0917	3=inshore 4=offshore		Sea state change
7/25	Kapa`a	1200			Leave beach park to drive up to Upolu Point and down to Mookini Heiau and Kam I birthplace to monitor other boulder beaches closer to channel.
7/25	Kapa`a	1300			Return to Kapa`a Beach Park
7/25	Kapa`a	1400	4=inshore 5=offshore		Sea state change

Date 2006	**Location**	**Time (24 hr)**	**Beaufort Sea State**	**Species**	**Observations**
7/25	Kapa`a	1830			Complete watch for the day.
7/26	Kapa`a	0700	2=inshore 3/4offshore		Begin watch, excellent visibility inshore. Mostly sunny skies.
7/26	Kapa`a	1200	3=inshore 4=offshore		Sea state change
7/26	Kapa`a	1415		*C. mydas*	Small green turtle observed hugging coastline. Observed for about 30 minutes riding the surge back and forth around the rocks. Last seen at 1445 hrs. Lots of glare inshore.
7/26	Kapa`a	1630	4=inshore 5=offshore		Continues to be lots of glare, covering approximately 1/3 of viewing range.
7/26	Kapa`a	1800			Complete watch (head to airport).

Appendix C

Results of 2006 RIMPAC Surveys of Marine Mammals in Kaulakahi and Alenuihaha Channels

Final Report Submitted by:
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Date:

August 25, 2006

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Results of 2006 RIMPAC Surveys of Marine Mammals in Kaulakahi and Alenuihaha Channels

Abstract

A total of six aerial surveys of marine mammals were performed on dates corresponding with scheduled dates for "choke point" maneuvers of the "Rim of the Pacific" (RIMPAC) joint military exercises in Hawaiian waters. Three surveys were performed in the vicinity of the Kaulakahi Channel (between Kauai and Niihau) (July 16, 17 and 20) and three were performed in the Alenuihaha Channel (between Hawaii and Maui) (July 24-26). The mission of the surveys was to detect, locate and identify all marine mammal species in the target areas using methods consistent with modern distance sampling theory. Marine mammals were sighted on four of the six surveys, comprising a total of 13 groups. All sightings consisted of small to medium-sized odontocetes (toothed cetaceans), including one sighting each of bottlenose dolphins, spotted dolphins, Cuvier's beaked whale, false killer whale, unidentified beaked whale and eight sightings of unidentified delphinid species. Encounter rates of odontocete sightings (sightings/km surveyed) in this series were identical to those seen during earlier survey series (1993-03) albeit at different times of the year. No unusual observations (e.g., sightings of stranded or dead animals) were noted during the total of ca. 18 hrs of survey effort.

Background

During the summer of 2006, The United States Pacific Command hosted the joint "Rim of the Pacific Exercises" (RIMPAC) military exercises in the Hawaiian Islands. Due to concerns over possible responses of marine mammal species to sonar and other aspects of the naval operations (e.g., ICES, 2005), aerial surveys were scheduled for dates before, during and after scheduled "choke point" maneuvers. Specifically this involved the Kaulakahi Channel, between the islands of Kauai and Niihau, on July 16, 17 and 20; and the Alenuihaha Channel, between the islands of Hawaii and Maui, on July 24, 25 and 26. The mission of the surveys was to detect, locate and identify all marine mammals in these channel areas, as well as to report any unusual behavior, including sightings of stranded or dead cetaceans.

Since the month of July falls outside the normal seasonal residency of humpback whales (Jan-Apr) (Mobley 2004), the less abundant odontocete species (toothed cetaceans) were the target species in the present survey series. Shallenberger (1981) described 15 odontocete species as resident in Hawaii. Based on aerial surveys conducted between 1993-98, Mobley et al. (2000) estimated abundance for 11 odontocete species for the waters within 25 nautical miles (nmi) of the major Hawaiian Islands based on surveys conducted during Jan-Apr of 1993-98. An updated summary of aerial survey results for near-shore Hawaiian waters conducted from 1993-2003 identified a total of 15 odontocete species (Mobley, unpublished data, Appendix A). Barlow (2006) provided abundance estimates for 21 cetacean species, including 18 odontocetes, based on shipboard transect surveys conducted in Aug-Nov 2002 in the Hawaiian Exclusive Economic Zone (EEZ).

Method

Three surveys were performed in each of the Kaulakahi (July 16, 17 and 20) and Alenuihaha (July 24, 25, 26) channels for a total of six surveys. Survey protocol was based on distance sampling methods, which is the standard accepted approach for estimating abundance of free ranging animal populations (Buckland et al. 2001).

Surveys in both regions followed pre-determined tracklines constructed to optimize area sampled within range limits of the aircraft (Figures 1 & 2). For the Kaulakahi Channel surveys, tracklines ran mostly north-south and were spaced 7.5 km apart comprising a total length of ca 556 km.[1] For the Alenuihaha surveys, tracklines ran from northeast to southwest and were spaced 15 km apart and comprised a total length of ca. 740 km. Starting longitudes in both regions were randomly chosen per distance sampling methodology (Buckland et al. 2001) so that the exact trackline configuration varied slightly for each survey.

The survey aircraft for the first survey (July 16) was a single-engine Cessna 177RG Cardinal[1]. For the remaining five surveys a twin-engine Piper PA34 Seneca was used. Both aircraft flew at a mean ground speed of 100 knots and an average altitude of 244m (800 ft). Two experienced observers made sightings of all marine mammal species, one on each side of the aircraft. Sightings were called to a data recorder who noted the species sighted, number of individuals, presence or absence of a calf, angle to the sighting (using hand-held Suunto clinometers), and any apparent reaction to the aircraft. Additionally, GPS locations and altitude were automatically recorded onto a laptop computer at 30-sec intervals, as well as manually whenever a sighting was made. Environmental data (seastate, glare and visibility) were manually recorded at the start of each transect leg and whenever conditions changed. The two data sources (manual and computer) were later merged into a single data file. Species identifications were typically made by orbiting an initial sighting until sufficient diagnostic features were discernible to permit positive identification. When the initial sighting could not be recaptured upon orbiting, the species was recorded as “unidentified.”

[1] Due to PMRF Range Ops on July 16, 2006, flying in the Kaulakahi Channel region was not permitted. We therefore surveyed an adjacent region off the central and southwest coast of Kauai in order to avoid the warning area on that date.

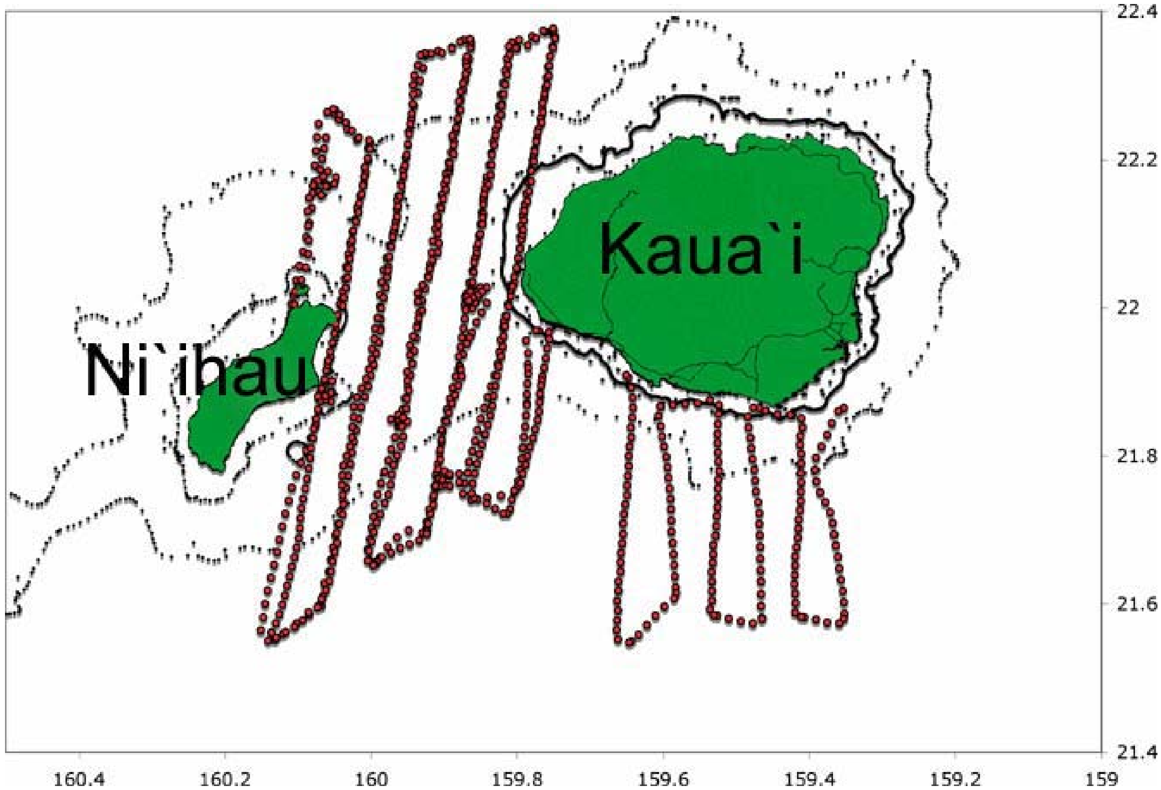

Figure 1. Survey effort for Kaulakahi Channel. GPS data (red lines) for surveys performed on July 16,17 and 20. Tracklines were 7.5 km apart and extended 13 km past the 1000 fathom contour. Total transect length was ca. 556 km. The tracklines to the south of Kauai were flown on July 16 only, when the waters of Kaulakahi Channel were closed due to scheduled operations of the Pacific Missile Range Facility (PMRF) at Barking Sands, Kauai.

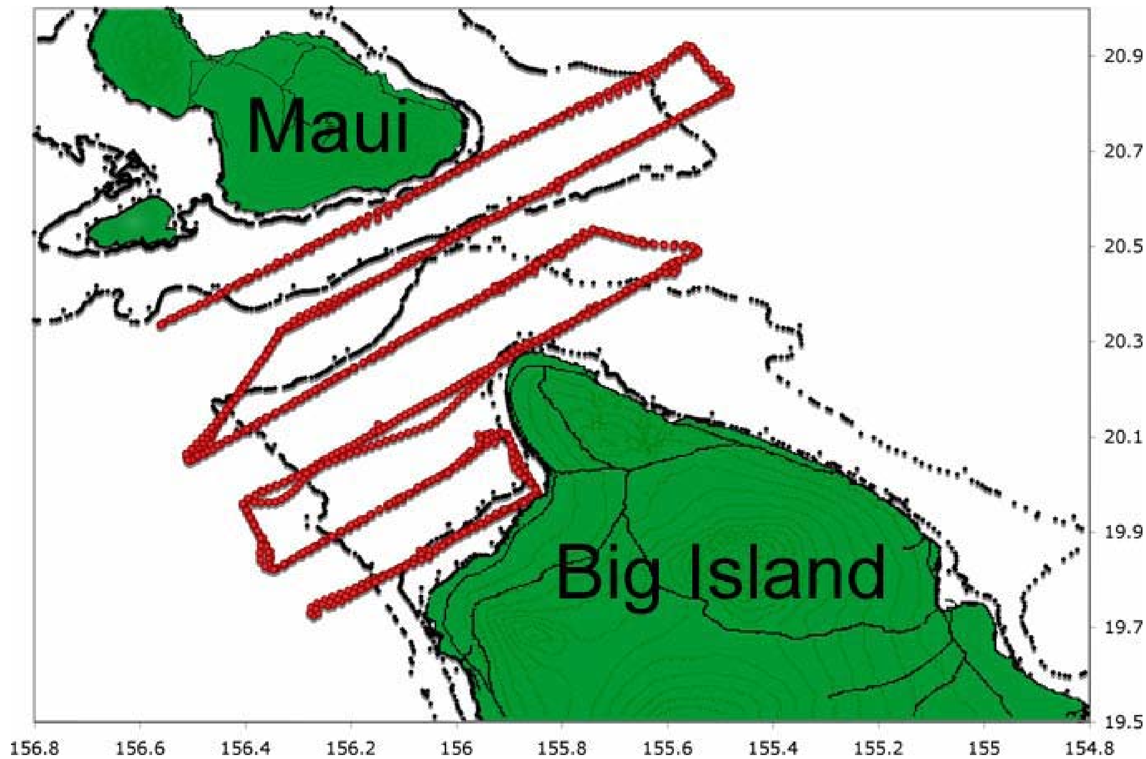

Figure 2. Survey effort for Alenuihaha Channel. GPS position data (red lines) are shown for July 24-26 surveys. Tracklines were 15 km apart and extended 13 km past the 1000 fathom limit. Total trackline distance for each survey was approximately 740 km.

Results

Overview. The six surveys comprised a total of ca. 18 hrs and ca. 3300 km of linear survey effort (Table 1). The number of sightings as well as the ability to identify species was generally hampered by poor seastate conditions that prevailed on all but one of the survey dates (July 20) (Table 1, Figure 3). Seastate is the primary factor affecting the ability to detect marine mammals (Buckland et al. 2001).

Summary of sightings. Cetacean species were detected on five of the six surveys (Table 1), including four identified species (bottlenose dolphins, spotted dolphins, false killer whales and Cuvier's beaked whale), one unidentified beaked whale species (likely *Mesoplodon densirostris*) and eight unidentified delphinid species (Table 2, Figures 4 & 5). All four of the identified species are among those typically seen in nearshore Hawaiian waters (Mobley et al. 2000; Shallenberger 1981). No unusual behavior or activity (e.g., stranded or dead animals) was observed during the six surveys.

Encounter rate comparison. One method of normalizing sightings for performing comparisons is to calculate encounter rates (groups sighted/km surveyed) (Buckland et al.

2001). In the present series a total of 13 sightings were made across ca. 3,334 km of survey effort which corresponds to an encounter rate of .0004 sightings/km. This rate is identical with the encounter rate for all odontocetes combined observed during the 1993-2003 survey series for inshore waters around the main Hawaiian Islands during the months Jan-Apr (Mobley, unpublished data, Appendix A). Therefore, the densities of marine mammal species reported here is identical with that normally seen for the Hawaiian Islands, albeit at different times of the year.

Table 1. Summary of Survey Effort and Sightings

Region	Date	No. of sightings	Survey effort (hrs)	Mean Beaufort seastate
Kaulakahi Channel	July 16	0	1.25	4.38
	July 17	2	3.96	4.06
	July 20	3	3.08	1.47
Alenuihaha Channel	July 24	1	3.28	4.36
	July 25	5	3.33	4.17
	July 26	2	3.02	4.80
	Total:	13	17.92	

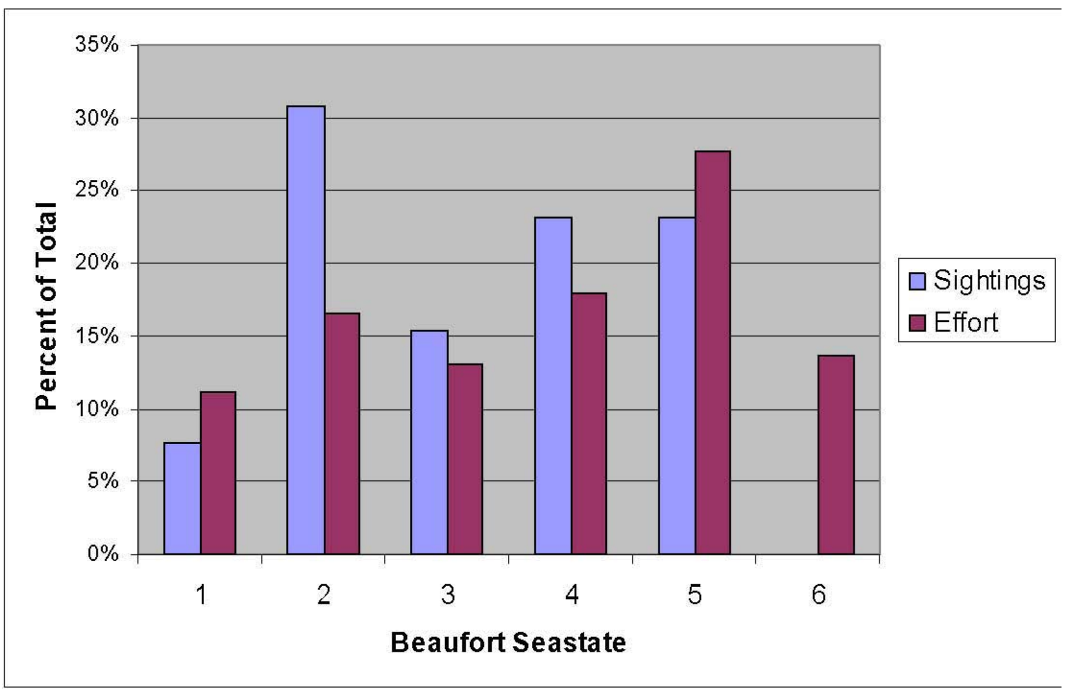

Figure 3. Summary of Beaufort Seastate Conditions. Beaufort seastate is one of the main factors affecting the ability to detect marine mammals. Normally, the ability to detect drops substantially beyond Beaufort 3. As shown, the majority of survey effort occurred in Beaufort 5, whereas the greater number of sightings occurred in Beaufort 2.

Table 2. Summary of Species Sightings by Region

Region / Species	No. groups	No. individuals
Kaulakahi Channel:		
Spotted dolphins (*Stenella attenuata*)	1	14
Unidentified delphinid species	4	21
Alenuihaha Channel:		
Bottlenose dolphin (*Tursiops truncatus*)	1	1
False killer whales (*Pseudorca crassidens*)	1	4
Cuvier's beaked whale (*Ziphius cavirostris*)	1	1
Unidentified beaked whale	1	1
Unidentified delphinid species	4	29

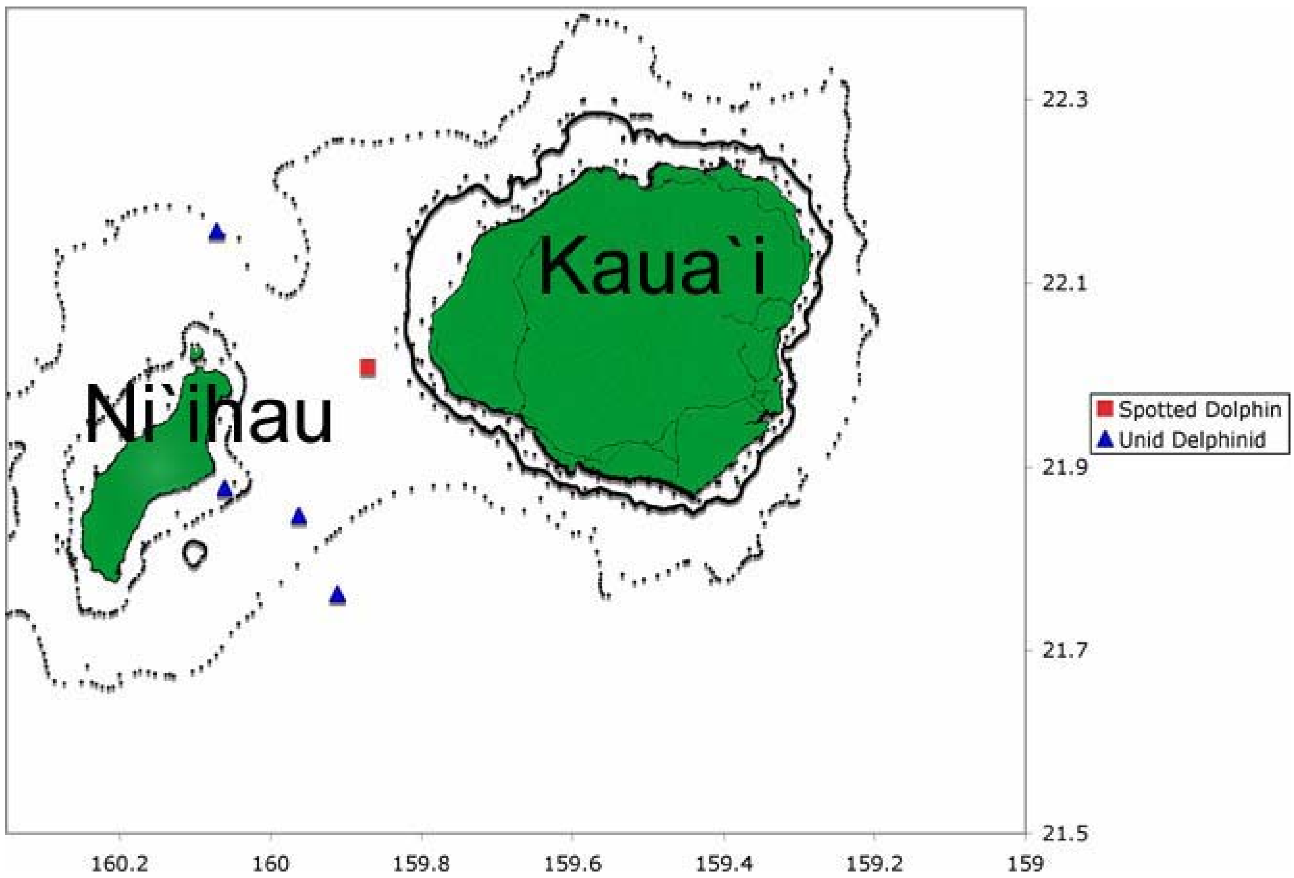

Figure 4. Kaulakahi Channel sightings. A total of five sightings occurred in the Kaulakahi Channel including one pod of spotted dolphins and four of unidentified delphinid species. Inner and outer bathymetry lines refer to 100 and 1000 fathom contours, respectively.

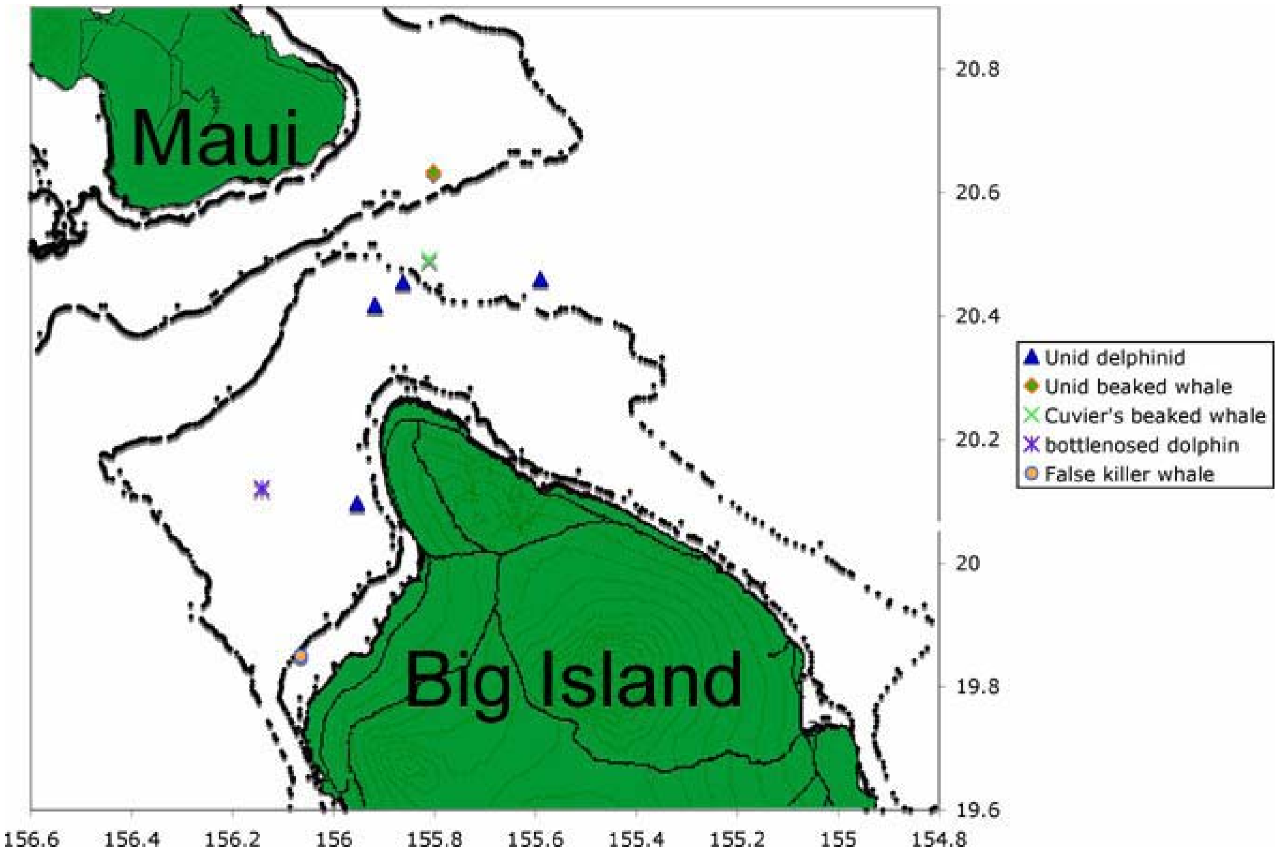

Figure 5. Alenuihaha Channel sightings. A total of 8 sightings occurred in the Alenuihaha Channel, including one pod of each of the following species: bottlenose dolphin, false killer whale, Cuvier's beaked whale and an unidentified beaked whale species (likely *Mesoplodon densirostris*). Additionally four pods of unidentified delphinids were sighted. Inner and outer bathymetry lines refer to the 100 and 1000 fathom contours, respectively.

Discussion

From the total of 13 sightings only four (31%) were positively identified to species. One sighting in the Alenuihaha Channel was identified as a beaked whale (likely Blainville's beaked whale, *M. densirostris*) but was not resighted upon orbiting, thus obviating positive species identification. The low rate of species identification was likely due to the poor seastate conditions that prevailed on all but one of the six surveys (Table 1, Figure 3) thereby making it difficult to recapture the sighting when orbiting.

The sighting of a group of four false killer whales (*Pseudorca crassidens*) was significant given recent concerns over the possible decline in their population around the Hawaiian Islands, possibly due to fisheries interactions (Baird and Gorgone 2005). In the 1993-03 aerial survey series, false killer whales were not seen after 1998 (Mobley, unpublished data), so the current sighting is the first aerial sighting since that time, though shipboard observations have been recorded (e.g., Barlow 2006).

Similarly, the sighting of a single Cuvier's beaked whale (*Ziphius cavirostris*), also in the Alenuihaha Channel, was significant given the fact that previous reports of adverse reactions to mid-range sonar primarily involved this species (ICES, 2005). It was sighted on 25July when RIMPAC activities were scheduled to occur in the channel, and was sighted mid-channel in waters deeper than 1000 fathoms (Figure 5).

As noted, the encounter rate for sightings in the present survey series (.0004 sightings/km surveyed) was identical to that recorded for odontocete species during the 1993-03 aerial survey series for the months Jan-Apr (Mobley 2004). This suggests that densities in the Kaulakahi and Alenuihaha Channels were no more or less than those normally seen throughout Hawaiian waters, albeit at different times of the year. Barlow (2006) commented on the low densities of odontocete species noted during 2002 shipboard surveys of the Hawaiian Exclusive Economic Zone (EEZ), noting them to be lower than most warm-temperate and tropical locations worldwide. He attributed this low density to the low productivity of the subtropical gyre that affects Hawaiian waters.

In conclusion, these surveys provided no evidence of impact of RIMPAC activities on resident populations of cetaceans in the Kaulakahi and Alenuihaha Channels. No differences in cetacean densities were detected, and no unusual behavior or event (e.g., unusual aggregations or near strandings) was observed. This statement should not be interpreted as evidence of no impact, merely that no such evidence was detected during these 18 hrs of surveys.

Acknowledgements

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Appendix A

1993 - 2003 Hawaiian Islands Aerial Survey Results

Species Name	No. pods	No. indiv.
Humpback whale (*Megaptera novaeangliae*)	2352	3907
Spinner dolphin (*Stenella longirostris*)	52	1825
Spotted dolphin (*Stenella attenuata*)	31	1021
Short-finned pilot whale (*Globicephala macrorhynchus*)	73	769
Melon-headed whale (*Peponocephala electra*)	6	770
Bottlenosed dolphin (*Tursiops truncatus*)	54	492
False killer whale (*Pseudorca crassidens*)	18	293
Sperm whale (*Physeter macrocephalus*)	23	106
Rough-toothed dolphin (*Steno bredanensis*)	8	90
Blainville's beaked whale (*Mesoplodon densirostris*)	9	32
Pygmy or dwarf sperm whale (*Kogia* spp.)	4	28
Striped dolphin (*Stenella coeruleoalba*)	1	20
Pygmy killer whale (*Feresa attenuata*)	2	16
Cuvier's beaked whale (*Ziphius cavirostris*)	7	13
Risso's dolphin (*Grampus griseus*)	1	8
Killer whale (*Orcinus orca*)	1	4
Fin whale (*Balaenoptera physalus*)	1	3
Unid. Dolphin	96	452
Unid. Stenella spp.	11	196
Unid. Whale	28	39
Unid. beaked whale	9	23
Unid. Cetacean	14	27
Totals:	2801	10134

Prepared for
National Marine Fisheries Service
Office of Protected Resources

Prepared by
Department of the Navy

In accordance with
National Defense Exemption 23 January 2007
Biological Opinion 23 January 2007

Department of the Navy HAWAII UNDERSEA WARFARE TRAINING EXERCISE (USWEX) After Action Report For Exercises in April 2007

FINAL

10 August 2007

Abstract

This report presents an analysis of the effectiveness of the mitigation and monitoring measures as required under the Biological Opinion on the U.S. Navy's Proposed Undersea Warfare Training Exercises In the Hawai'i Range Complex From January 2007 to January 2009

AND

Discussion of the nature of effects, if observed, under the National Defense Exemption from the Requirements of the Marine Mammal Protection Act (MMPA) for Mid-Frequency Active Sonar

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INTRODUCTION

This report is presented to fulfill Navy and Pacific Fleet written reporting requirements conditional to the 23 January 2007 National Defense Exemption (NDE) from the Requirements of the MMPA for Certain DoD Military Readiness Activities That Employ Mid-Frequency Active Sonar (MFAS) or Improved Extended Echo Ranging Sonobuoys. In addition, as these NDE mitigation measures are included in the 23 January 2007 *Biological Opinion (BO) on the U.S. Navy's Proposed Undersea Warfare Training Exercises (USWEX) In The Hawai'i Range Complex From January 2007 to January 2009*, reporting under the BO also fulfills reporting requirements for the NDE.

REPORT ORGANIZATION

This report, which contains only unclassified material, provides the information and analyses for two Hawaii Range Complex at-sea major exercises, and is submitted in fulfillment of NDE and BO written requirements.

The report is organized by section in the following order:

Section 1 Exercise Summaries provides exercise specific summary including the starting and ending dates, the number of ships and aircraft participating, and the number of hours of active sonar used.

Section 2 Observations and Mitigation Effectiveness provides an estimated number of marine mammals observed during Undersea Warfare Training Exercise (USWEX) 07-02, and USWEX 07-03 potentially affected or not affected by Anti-submarine Warfare (ASW) operations, noting the nature of any observed effects where possible. In addition, Section 2 assesses the effectiveness of the NDE and BO mitigation and monitoring measures required during exercises with regard to minimizing the use of MFAS in the vicinity of marine mammals.

Appendices contain tables and figures (**Appendix A**), and other supplementary information (**Appendix B**).

BACKGROUND

USWEXs are advanced ASW exercises conducted by the U.S. Navy's Carrier Strike Groups (CSG) and Expeditionary Strike Groups (ESG) while in transit from the west coast of the United States to the western Pacific Ocean. As a combined force, submarines, surface ships, and aircraft will conduct anti-submarine warfare exercises (ASW) against submarine targets representing an opposing force. Submarine targets would include real submarines, target drones that simulate the operations of an actual submarine, and virtual submarines interjected into the training events by exercise controllers. The primary event of each exercise involves from one to five surface ships equipped with sonar, with one or more helicopters, and a P-3 aircraft searching for one or more submarines.

Two USWEXs were conducted in the waters off Hawaii on 10-11 April and 17-18 April 2007 (**Table A-1 Appendix A**). The types of ASW training conducted during USWEX involved the use of ships, submarines, aircraft, non-explosive exercise weapons, and other training related devices within portions of the Hawaii Range Complex (**Figure A-1 Appendix A**).

USWEX 07-02 and USWEX 07-03 were planned and prepared by the U.S. Navy prior to receiving the Terms and Conditions of the BO on 23 January 2007. This includes coordinating the logistical arrangements for these advanced training events, ensuring marine species awareness training was provided to exercise participants, and preparation and distribution of the Letter of Instruction (LOI) (**Appendix B**) which reiterates the applicable mitigation measures and explains procedures for reporting marine mammal sightings discussed in Section 2.

The U.S. Navy continues to make improvements to its Fleet instructions to collect relevant data to more fully address the exact language of the Terms and Conditions of the USWEX BO. The Office of Protected Resources (OPR), National Marine Fisheries Service (NMFS) and the U.S. Navy have been coordinating to improve data objectives, data quality, and reporting requirements to assist in the analysis for future USWEXs. This has been a continual, iterative dialog leading to integration of additional monitoring techniques and procedures that will help to advance the state of knowledge on marine mammal distribution and potential MFAS effects or, lack of effects, within the Hawai'i Range Complex. The U.S. Navy will explore establishment of new metrics and processes based on these enhancements to the exercise monitoring program, and plans to integrate new results into future reports.

MFAS equipped platforms participating in USWEX include Ticonderoga-class guided missile cruisers (CG) and Arleigh Burke-class guided missile destroyers (DDG) surface combatants with AN/SQS-53C sonar and associated aviation assets (SH-60B/F/R with AN/AQS-13F or AQS-22 dipping sonar, and AN/SSQ-62B/C/D/E Directional Command Activated Sonobuoy System -DICASS), and P-3 Maritime Patrol Aircraft (MPA) (DICASS sonobuoy).

Total numbers of ASW capable aviation assets participating in a given exercise varies based on maintenance ready aircraft and ship configuration. For instance, early versions of the DDG destroyers, the newest Navy surface combatant, do not have onboard hangers for helicopters. Later versions have hangars and up to two SH-60B/F/Rs. Of more importance than actual aircraft numbers however, is that active sonar use by aviation assets is captured and added to sonar totals reported in this document. MFAS on Los Angeles-class (SSN) submarines (AN/BQQ-5) is seldom used in tactical training scenarios, where passive sonar use is the preferred system in order to maximize the stealth aspects of undersea operations.

SECTION 1 EXERCISE SUMMARIES

EXERCISE SPECIFICS

USWEX 07-02 was conducted from 10-11 April 2007 and involved a CSG (**Table A-1 Appendix A**). Ships assigned to this CSG included: (1) non-MFAS equipped ship and (5) MFAS equipped ships. Other participating units representing support and opposition forces included (2) submarines and (3) MFAS equipped ships, although there was no active sonar use by these supporting platforms. Based on the DDG ships participating in JTFEX 07-03, there were approximately of 8-12 ASW SH-60s helicopters available.

USWEX 07-03 was conducted from 17-18 April 2007 and involved an ESG (**Table A-1 Appendix A**). Ships assigned to this ESG included: (3) non-MFAS equipped ships and (3) MFAS equipped ships. Other participating units representing support and opposition forces included (2) submarines and (2) MFAS equipped ships, although there was no active sonar use by these supporting platforms. Based on DDG ships participating in USWEX 07-03, there were approximately six ASW SH-60s helicopters participating.

MITIGATION MEASURES PERFORMED

All mitigations measures as stated in the 23 January 2007 NDE were adhered both of the Hawaii USWEXs. These 29 NDE measures include specific details for Personnel Training, establish Lookout and Watchstander Responsibilities, mandate specific Operating Procedures, and describe Coordination and Reporting requirements. Observation data from Navy lookout sightings for each exercise is described in Section II.

SECTION 2 OBSERVATIONS AND MITIGATION EFFECTIVENESS

MARINE MAMMALS AND OCEANOGRAPHIC CONDITIONS

Section 2 provides estimated numbers of marine mammals observed in Hawaii waters during USWEX 07-02 and USWEX 07-03. This information is based on analysis of actual events and sightings of marine mammals reported by exercise participants noting the nature of any observed effects. **Table A-2** lists sighting information and **A-4 Appendix A** lists possible marine mammal species occurring in Hawaii waters, highlights the Endangered Species Act (ESA) listed species described in the BO, and shows results for both annual acoustic exposure estimates from DoN (2007) and single USWEX estimated potential exposures.

All detections were made by standard Navy surface ship lookout reporting procedures as detailed in a Commander, THIRD Fleet LOI issued to each CSG and ESG prior to participation in a USWEX (**Appendix B**). No marine mammal sightings were reported by helicopters or P-3s.

Ocean Sea Surface Temperatures (SST) ranged from 22-26°C and general ocean currents in the vicinity of the main Hawaiian Islands were typical for this season (**Figures A-2** and **A-4 in Appendix A**).

The National Data Buoy Center maintains an oceanographic monitoring buoy 170 nm northwest of Kauai (http://mob.ndbc.noaa.gov). Based on data reported from this buoy, wind speeds during the day from 10 to 11 April 2007 (USWEX 07-02) were between 5.6 and 9.2 meters/sec (m/s) (11-18 knots). Wave heights were between 1.9 to 2.4 m (6 to 8 feet). During the day from 17 to 18 April 2007 (USWEX 07-03), wind speeds were between 7.8 to 11.5 m/s (15-22 knots) and wave heights between 2.8 to 3.5 m (9 to 11 feet).

EXERCISE MARINE MAMMAL SIGHTINGS

USWEX 07-02 Observations

During the two days of USWEX 07-02, there were no reported sightings of marine mammals. There were no sightings of floating dead animals, nor reports of concurrent strandings.

A Navy contractor marine mammal biologist was allowed to fly onto the aircraft carrier for USWEX 07-02 as an additional monitoring protocol. While MFAS is only installed on CG and DDG class vessels, the carrier does serve as the information hub for the exercise. The biologist was able to observe the Navy lookouts and procedures over eight non-consecutive hours from 10 to 11 April. Weather conditions during this period were clear with approximately 12 miles (19 km) visibility, swell was about eight feet (2.5 meters), wind was 17.5-22.4 knots (7.1-9.2 meter/second). Air temperature was 74.5-79.2°F (23.6-26.2°C). Neither Navy watchstanders on the carrier nor the biologist reported any marine mammal sightings during this period (**Appendix C**).

USWEX 07-03 Observations

Table A-2 provides a detailed timeline of marine mammal observations made by Navy exercise participants for USWEX 07-03. During the two days of USWEX 07-03, there was only one marine mammal sightings for an estimated total of one large whale. While not geographically plotted, the sighting location was approximately 30 nm northwest of the island of Kauai. There were no sightings of floating dead animals, nor reports of concurrent strandings.

MITIGATION AND MONITORING ASSESSMENT

OVERVIEW

The NDE calls for the U.S. Navy to submit a report to NMFS that includes a discussion of the nature of the effects, if observed, based on modeling results and marine mammal sightings. In addition, the BO Terms and Conditions require a report that evaluates the mitigation measures and details results from the U.S. Navy's exercise monitoring program. In this case, the mitigation measure under the BO are the NDE measures, therefore the discussion is presented together in this section.

This section of the report, therefore, provides an assessment of the effectiveness of the mitigation and monitoring measures. It must also be recognized that ASW proceeds slowly and requires careful development of a tactical frame of reference over time as data is integrated from a number of sources and sensors. Once MFAS is turned off for a period of time, turning it back on later does not usually allow a Commander to simply continue from the last frame of reference. Thus, lost MFAS time not only equates to lost exercise time but should be considered in the fuller context of its overall impact on the tempo and development of a "tactical picture" shared among exercise participants as they trained toward the goal of improving ASW skills in general.

Passive Sonar

Passive sonar involves acoustic listening to underwater sounds and does not involve transmitting active sound into the water column. Passive sonar use is driven by the tactical nature of an ASW or training event, and should be assumed to be employed whenever possible. Given the nature of passive sonar technology and underwater sound propagation, localizing or determining absolute position of an object is more difficult than active sonar.

The U.S. Navy does not have a reporting system to capture the amount of passive sonar employed within a given geographic region. For USWEX 07-02 and USWEX 07-03, there were no reports of passive acoustic detections of marine mammals by exercise participants. Future reports will explore whether metrics for passive acoustic use can be generated, and if marine mammal detections are occurring.

PMRF Acoustic Monitoring

Underwater acoustic recordings of marine mammal vocalization were conducted for a limited time set at the Pacific Missile Range Facility north of Kauai after USWEX 07-03. **Appendix D** contains a detailed description of the program and data results from April 2007 monitoring. The science behind the use of underwater hydrophones for localizing marine mammal is relatively new, and the technologies and techniques described in **Appendix D** will continue to be refined in collaboration with other academic and NMFS-Navy efforts.

Active Sonar

Typically, there are no measurements (calibrated or otherwise) of actual sound levels made during an exercise and none were made during USWEX 07-02 and USWEX 07-03. Source levels, numbers of sources, and frequencies are classified since that information would provide potential adversaries with important tactical data. An explanation of sonar hours as presented in this report is also warranted. Total active sonar hours represent a sum of the total time from a number of individual training events during an USWEX. This value does not represent actual total sonar ping hours. In other words, the ship logs when the sonar was turned on at the beginning of a training event, and reports time until the event is finished. During this period, the MFAS only puts active sound into the water at discrete intervals. Sonar signals are not a continuous source of acoustic energy. For example, surface ship sonar signal consists of a pulse (i.e.

ping) less than two seconds long with approximately a minimum of 30 seconds between successive pings (NMFS 2007).

Given that mitigation measures are designed to minimize interactions between Navy assets and marine mammals, the observations of marine mammals by Navy assets only occurred as infrequent and very brief encounters, the majority of which occurred when there was no MFAS in use.

USWEX 07-02 Assessment

During USWEX 07-02, 265.5 hours of MFAS use was reported.

MFAS is only used during carefully reviewed scenarios and for only a small subset of any given exercise time frame.

There were no reports of ship strikes on marine mammals, and no reports of a vessel maneuvering to avoid the path of a marine mammal.

There was one report of a stranded marine mammal four days after the exercise, but this event can not be associated with MFAS nor other Navy operations. In an email dated 05 July 2007 received from Mr. David Schofield, Marine Mammal Response Network Coordinator NOAA Pacific Islands Regional Office, National Marine Fisheries Service, Mr. Schofield asked if any “naval activities” occurred prior to or on 15 April when a pygmy sperm whale was found stranded at a remote beach off Lanai City, Lanai. While USWEX 07-02 was conducted from 10 to 11 April, this was at least four days prior to the pygmy sperm whale stranding. The closest MFAS use was actually on 10 April, and greater than 100 nm away from the stranding site and geographically closer to Kauai. **No other Navy MFAS was operating within the Hawaiian operating area after 12 April. Finally, pygmy sperm whales and spinner dolphins are the most commonly stranded species within the Hawaiian Islands, and the islands of Oahu, Maui, and Lanai, have the highest reported proportion of these cetacean strandings** (Mazzuca et al., 1999; Maldini et al., 2005).

Therefore sonar use <u>can not</u> be associated with this reported Hawaii stranding based on both time and distance considerations mentioned previously, as well as given typical marine mammal stranding patterns for the region.

USWEX 07-03 Assessment

During USWEX 07-03, 50.1 hours of MFAS use was reported.

MFAS is only used during carefully reviewed scenarios and for only a small subset of any given exercise time frame. During USWEX 07-03 there were no reported sightings of marine mammals concurrent with MFAS operation, and no reports of MFAS having to be secured due to the presence of marine mammals.

Based on limited visual sightings, there were no reported potential marine mammal exposures at 200, 500, 1,000 yards (**Table A-3**).

There were no instances where marine mammals behaved in any erratic, unusual, or anything other than apparently normal manner. There were no reports of ship strikes on marine mammals, and one report of a vessel maneuvering to avoid the path of a marine mammal.

Modeling Estimates Applicable to USWEX 07-02 and 07-03

Table A-4 in **Appendix A** shows estimated marine mammal acoustic exposures from model derived calculations based on regional marine mammal densities, USWEX operational parameters, sound transmission loss, and potential energy accumulated (DoN, 2007). The left hand columns in **Table A-4** are from the USWEX OEA for Alternative 1, which forecast annual impacts from six USEWXs (Table 4-in DoN, 2007). Species order was changed from the original table to highlight ESA listed species first, followed by an alphabetical list of remaining species. The columns to the right in **Table A-4** are a rough approximation of predicted exposures from a single exercise calculated for this report (i.e. animal exposure # divided by 6). In total, acoustic impact modeling predicts an estimated 5,116 Level B sub-TTS and an estimated 37 Level B TTS exposures. However, these numbers of animals were not observed within the Hawaiian Islands operating area by exercise participants.

NDE AND BO ASSESSMENT

All 23 Jan 2007 NDE measures promulgated in the *Mid-Frequency Active Sonar Mitigation Measures during Major Training Exercises or within Established DoD Maritime Ranges and Established Operating Areas* (NDE) section were implemented for COMPTUEX 07-02, JTFEX 07-03, and JTFEX 07-05.

In addition to the above assessment of the NDE, the BO calls for a report that evaluates the effectiveness of the U.S. Navy's exercise mitigation measures. As described previously, the three categories of measures, Personnel Training, Lookout and Watchstander Responsibilities, and Operating Procedures as outlined in the NDE, appear effective in detecting and responding appropriately to the presence of marine mammals, when observed. For instance, one BO Term and Condition requests the U.S. Navy to estimate the number of ESA listed marine mammals that may have been exposed to received energy level equal to or greater than 173 dB re 1 $\mu Pa^2 \cdot s$.

Since there was only one marine mammal observation during two separate USWEX, and MFAS was not in use at that time, then it would be accurate to state that no observed marine mammal or ESA species were exposed to received energy levels greater than 173 dB re 1 $\mu Pa^2 \cdot s$.

The U.S. Navy acknowledges that this discussion does not account for potential marine mammal species not observed, which is a difficult determination even for the marine mammal scientific community, and is seeking to address this issue as discussed below.

As to the effect of MFAS power reduction and securing due to the presence of marine mammals, there is no additional information that can be added at this time as to the operational effect of these events. There is an effort underway within the operational community to try and articulate exactly what kind of relative effect MFAS mitigation measures have on ASW training.

In regards to impacts not associated with MFAS such as ship strikes, the U.S. Navy has a robust ship strike reporting program and reports from USWEX 07-02 and 07-03 of no ship strikes and of maneuvering to avoid animals provides some evidence that these avoidance measures are effective.

Data Limitations and Improvements

The U.S. Navy is committed to development of robust exercise and long-term range complex monitoring plans that will integrate multiple tools in order to provide better assessment of marine mammal occurrence and possible MFAS effects, or lack of effects.

There may be several reasons for the limited number of marine mammal sightings during the two USWEXs. Actually, the two groups involved in USWEX 07-02 and 07-03, a CSG and an ESG, were the exact same ones in the recently submitted SOCAL AAR report, so the participating vessel count should be similar and individual ships familiar with marine mammal mitigation and reporting requirements.

Reasons for fewer sightings in USWEX (1 sighting) than reported for SOCAL exercises (28-61 sightings) can include:

1) Duration- The shorter duration of each USWEX (2-days) vice the longer JTFEX and COMPTUEX in SOCAL (1-week and 2-3 weeks) means that less time was available for reporting marine mammal sightings. Even for the longer Southern California exercises (two JTFEX and one COMPTUEX), typically only about two to 12 sightings per day were reported during each exercise.

2) Density- There may be potentially lower marine mammal densities, in general, within the Hawaiian operating area. However, fewer Hawaii marine mammal density surveys have been conducted compared to the greater frequency of marine mammal surveys within Southern California waters. The fine-scale distribution of Hawaii's marine mammal populations is less well detailed although some populations are under study (Baird et al. 2005, NCCOS 2005, Baird et al. 2006, Barlow 2006, Chivers et al. 2007, Forney 2007, McSweeney 2007). There is, of course, a significant body of information on the broad seasonal movements of the humpback whales between northern feeding areas and Hawaiian breeding grounds. Although late in the season, April is within the time for humpback whales to be present. Many of the documents toothed whale species in Hawaii seem to be year-round, where in SOCAL there are general seasonal species composition shifts due to water temperature preference and prey availability.

3) Weather- Weather conditions, at least as can be determined from the monitoring buoy northwest of Kauai, indicated that it was possible that moderate sea states during the two USWEX may in some cases made visual sighting of marine mammals more difficult due to sea states conditions. Small deep-diving and cryptic species are typically more difficult to observe when sea states get to and above sea state 3 (Barlow and Gisiner 2006, Taylor et al. 2007). Wind speed and wave heights for 10-11 April were between 11-18 knots and 6-8 feet, while for 17-18 April wind speed and wave heights were between 15-22 knots and 9-11 feet). Given these values, approximate sea states were likely between 2 to 4. **Appendix E** shows the relationships between wind speeds and ocean conditions.

Future reporting requirements will collect more detailed descriptions on marine mammal behavioral observations by Navy lookouts for validation by NMFS. Improvements to reporting requirements are planned for the remaining 2007 and 2008 exercises to better incorporate non-subjective categories of behavioral description, and instead report "what the observer saw", and how long the observation continued. Adding sea state and visibility reports at the time of sighting may result in a better determination of the effective visual monitoring ranges being reported. While identification to species-level would be optimal, that level of detail may not be immediately obtainable from U.S. Navy lookout reports without further training and testing of alternative methodologies to supplement existing shipboard reports. In accordance with the BO, data collection needs to address these questions will be incorporated into future exercises as the U.S. Navy's exercise monitoring program evolves.

There is no information from which to assess how many, if any, animals not observed by Navy lookouts may or may not have been exposed to MFAS received levels greater than 173 dB re 1 $\mu Pa^2 \cdot s$. Data collection needs to address this question. It remains a problematic science issue for even non-Navy marine mammal surveys.

Although not conducted specifically for these April 2007 exercises, ship based and aerial monitoring designed in support of future exercise monitoring and future range complex monitoring is being developed by the U.S. Navy. The USWEX Monitoring Plan is being reviewed and enhanced for FY08 implementation. New information on the scope and results from any exercise monitoring will be provided in subsequent U.S. Navy After Action Reports. The U.S. Navy is looking to integrate additional monitoring tools and techniques in future exercises as the exercise and range complex monitoring plans are designed and implemented.

CONCLUSIONS AND SUMMARY

- Marine mammals were sighted only one time for a total of one large whale over two separate USWEX events of two-days each.
- The one sighting event was during a period when no MFAS was operating, and therefore no exposures to marine mammals occurred based on visual sightings.
- In the one reported sighting, the marine mammal was detected by Navy watchstanders in accordance with Navy standard operational procedures and as reiterated by NDE mitigation measures.
- There were no ship strikes on marine mammals during these exercises and one instance where U.S. Navy vessel maneuvered to avoid crossing a marine mammal's path and increase the separation between the ship and animal.
- Since MFAS was not secured in USWEX 07-02 or 07-03, there were no lost ASW training opportunities.
- Improvements to the U.S. Navy lookout reporting procedures will be implemented for future exercises to better capture metrics on weather conditions during the sighting, and more detailed observations of animal behavior.
- The U.S. Navy is committed to development of robust exercise and long-term range complex monitoring plans that will integrate multiple tools in order to provide better assessment of marine mammal occurrence and possible MFAS effects, or lack of effects. FY08 plans may include various mixes of ship and aerial surveys independent of exercise participants, validation by experienced biologist(s) on lookout effectiveness in observing marine mammals, and use of new research and development technologies to advance the state of marine mammal monitoring.

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APPENDIX A- TABLE AND FIGURES

INTRODUCTION

This Appendix contains material supporting the discussion in the U.S. Navy's combined USWEX After Action Report. It is divided into two Appendices. Appendix A contains tables and figures referred to in the main Report. Appendix B contains the THIRD FLEET Letter of Instruction (LOI) directing exercise participants to comply with NDE and BO conditions, and specifies the exact marine mammal sighting reporting language ships are responsible for providing after the exercise.

Table A-1. Hawaii USWEXs in April 2007.

CSG/ESG	Event Name	Dates	MFAS Use Reported (hours)
CSG	USEX 07-02	10-11 Apr 2007	265.5 hrs
ESG	USWEX 07-03	17-18 Apr 2007	50.1 hrs

Table A-2. Marine mammal sightings and actions by exercise participants during USWEX 07-03. Text in red **Bold** indicate events when MFAS was in use and secured due to marine mammal mitigation. Red text in *Italics* indicates when MFAS was in use, but mitigation other than securing sonar enacted.

Date-Time (local)	Ship Type	Description of Actions Taken	# of animals	MFAS status
04/17-1345	MFAS ship	Surface ship sights 1 "large whale" traveling at 300 yards. **Ship changes course** to open distance between whale and vessel.	1	Not in Use
	1	= total sighting events total number of animals =	**1**	

Table A-3. Sightings during USWEX 07-03 where MFAS mitigation occurred.

Assessment by Range			
Range	**ESA species (potential)**	**MMPA species**	**Comments**
200 yards- Sonar secured (turned off)	0	0	
500 yards- Sonar reduced -10 dB	0	0	
1000 yards- Sonar reduced -6 dB	0	0	

Table A-4. Total annual exposures for sonar and underwater detonations (*left*) from DoN 2007 based on 6 exercise per year (USWEX EA/OES Table 4.3), and estimated exposures per exercise (*right*).

Species	Occurrence Status Within Hawaiian Waters	Annual USWEX potential exposures n =6 exercises (DoN, 2007)		Estimated singe exercise exposures	
		Level B Sub TTS	Level B TTS	Level B Sub TTS	Level B TTS
ESA-listed					
Blue whale	Rare	0	0	0	0
Fin whale	Rare	48	0	8	0
Humpback whale	Seasonal, Nov-Apr	10,273	49	1,712	8
Sei whale	Rare	21	0	4	0
Sperm whale	Regular, Year round	905	3	151	1
Non-ESA listed				0	0
Blainville's beaked whale	Regular, Year round	285	1	48	0
Bottlenose dolphin	Regular, Year round	775	7	129	1
Bryde's whale	Regular, Year round	96	0	16	0
Cuvier's beaked whale	Regular, Year round	1,490	6	248	1
Dwarf sperm whale	Regular, Year round	2,182	12	364	2
False killer whale	Regular, Year round	109	2	18	0
Fraser's dolphin	Regular, Year round	2,045	20	341	3
Killer whale	Infrequent, Year round	71	1	12	0
Longman's beaked whale	Regular, Year round	85	0	14	0
Melon-headed whale	Regular, Year round	408	2	68	0
Minke whale	Seasonal, Nov-Apr	0	0	0	0
Pygmy killer whale	Regular, Year round	106	2	18	0
Pygmy sperm whale	Regular, Year round	839	5	140	1
Pantropical spotted dolphin	Regular, Year round	2743	26	457	4
Risso's dolphin	Regular, Year round	276	2	46	0
Rough-toothed dolphin	Regular, Year round	2,832	41	472	7
Short-finned pilot whale	Regular, Year round	1,849	12	308	2
Spinner dolphin	Regular, Year round	1,957	18	326	3
Striped dolphin	Regular, Year round	1,303	13	217	2
Monk seal	Regular, Year round	0	0	0	0
TOTAL:		30,699	222	5,116	37

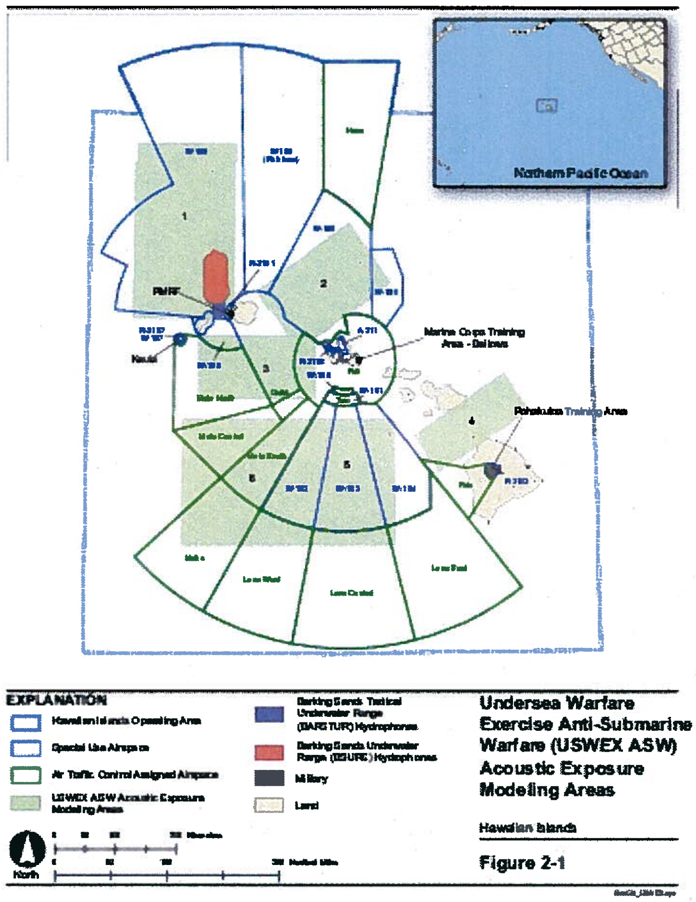

Figure A-1. Hawaii Range Complex and ocean areas associated with USWEX (figure from DoN 2007).

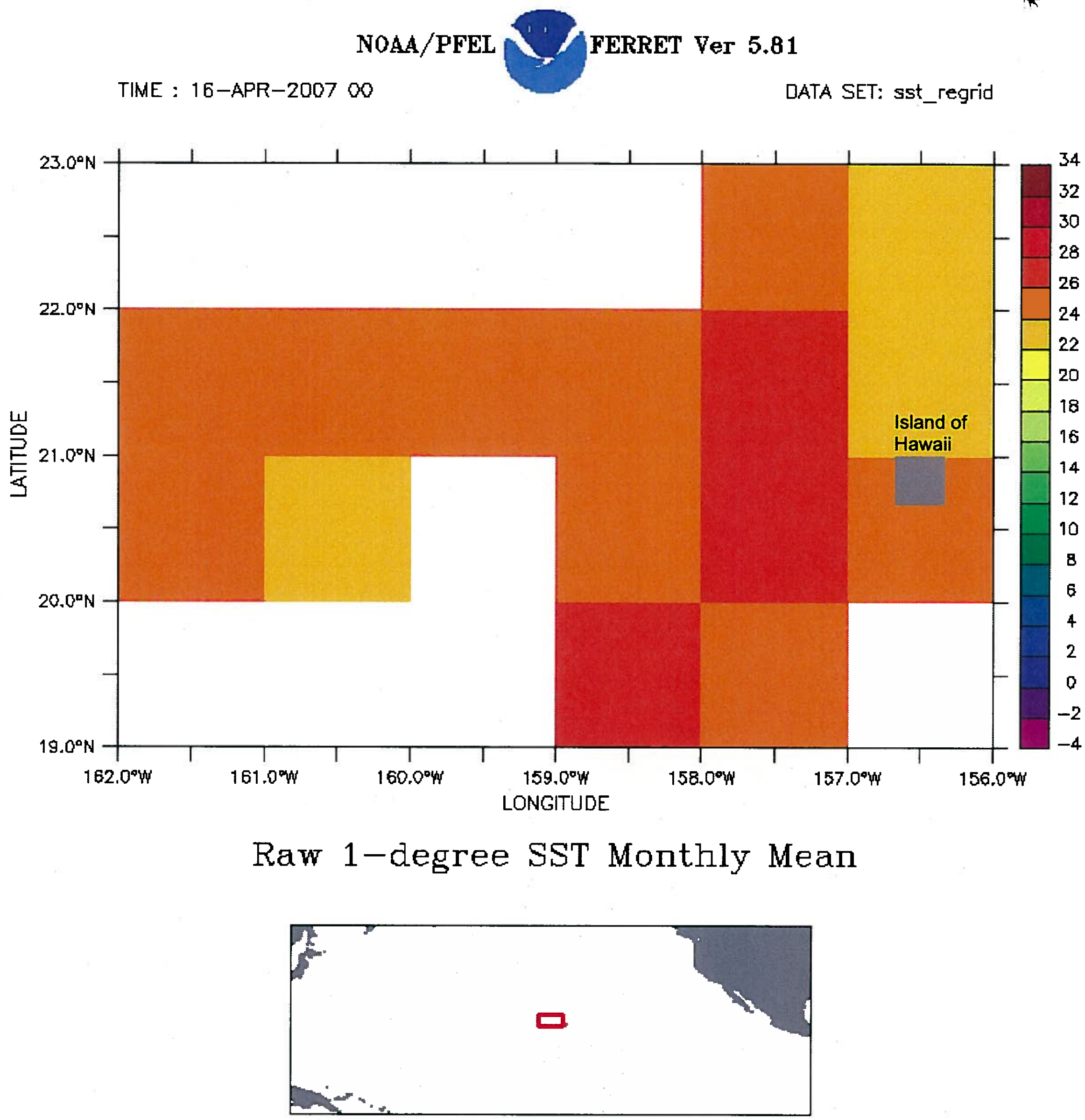

Figure A-2. Monthly mean Sea Surface Temperature (SST) by 1°-latitude increments near the main Hawaiian Island for period of 16 April 2007.
Source: Pacific Fisheries Environmental Laboratory Live Access Server
http://www.pfeg.noaa.gov

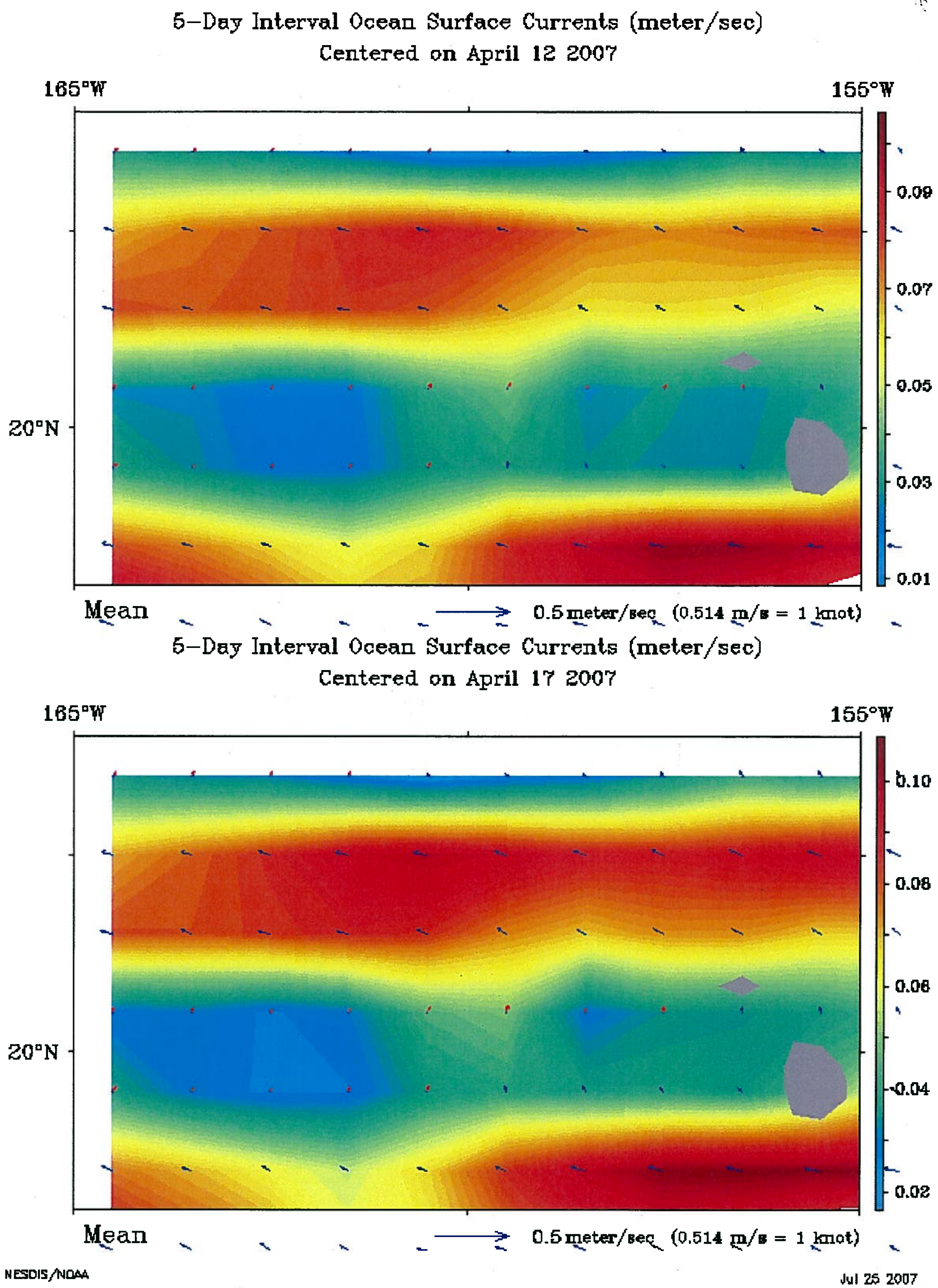

Figure A-4. Ocean surface currents (5-day interval) in vicinity of main Hawaiian Islands for 12 April 2007 (top) and 18 April 2007 (bottom).

APPENDIX B- NDE CONDITIONS AND LETTER OF INSTRUCTION

NDE

NDE mitigation measures include:

I. General Maritime Protective Measures: Personnel Training:

1. All lookouts onboard platforms involved in ASW training events will review the NMFS approved Marine Species Awareness Training (MSAT) material prior to use of mid-frequency active sonar.
2. All Commanding Officers, Executive Officers, and officers standing watch on the bridge will have reviewed the MSAT material prior to a training event employing the use of MFAS.
3. Navy lookouts will undertake extensive training in order to qualify as a watchstander in accordance with the Lookout Training Handbook (NAVEDTRA 12968-B).
4. Lookout training will include on-the-job instruction under the supervision of a qualified, experienced watchstander. Following successful completion of this supervised training period, Lookouts will complete the Personal Qualification Standard program, certifying that they have demonstrated the necessary skills (such as detection and reporting of partially submerged objects). This does not preclude personnel being trained as lookouts counted as those listed in previous measures so long as supervisors monitor their progress and performance.
5. Lookouts will be trained in the most effective means to ensure quick and effective communication within the command structure in order to facilitate implementation of protective measures if marine species are spotted.

II. General Maritime Protective Measures: Lookout and Watchstander Responsibilities:

6. On the bridge of surface ships, there will always be at least three people on watch whose duties include observing the water surface around the vessel.
7. In addition to the three personnel on watch noted previously, all surface ships participating in ASW exercises will have at all times during the exercise at least two additional personnel on watch as lookouts.
8. Personnel on lookout and officers on watch on the bridge will have at least one set of binoculars available for each person to aid in the detection of marine mammals.
9. On surface vessels equipped with MFAS, pedestal mounted "Big Eye" (20x110) binoculars will be present and in good working order to assist in the detection of marine mammals in the vicinity of the vessel.
10. Personnel on lookout will employ visual search procedures employing a scanning methodology in accordance with the Lookout Training Handbook (NAVEDTRA 12968-B).
11. After sunset and prior to sunrise, lookouts will employ Night Lookouts Techniques in accordance with the Lookout Training Handbook.
12. Personnel on lookout will be responsible for reporting all objects or anomalies sighted in the water (regardless of the distance from the vessel) to the Officer of the Deck, since any object or disturbance (e.g., trash, periscope, surface disturbance, discoloration) in the water may be indicative of a threat to the vessel and its crew or indicative of a marine species that may need to be avoided as warranted.

III. Operating Procedures

13. A Letter of Instruction, Mitigation Measures Message or Environmental Annex to the Operational Order will be issued prior to the exercise to further disseminate the personnel training requirement and general marine mammal protective measures.

14. Commanding Officers will make use of marine species detection cues and information to limit interaction with marine species to the maximum extent possible consistent with safety of the ship.

15. All personnel engaged in passive acoustic sonar operation (including aircraft, surface ships, or submarines) will monitor for marine mammal vocalizations and report the detection of any marine mammal to the appropriate watch station for dissemination and appropriate action.

16. During MFAS operations, personnel will utilize all available sensor and optical systems (such as Night Vision Goggles to aid in the detection of marine mammals.

17. Navy aircraft participating in exercises at sea will conduct and maintain, when operationally feasible and safe, surveillance for marine species of concern as long as it does not violate safety constraints or interfere with the accomplishment of primary operational duties.

18. Aircraft with deployed sonobuoys will use only the passive capability of sonobuoys when marine mammals are detected within 200 yards of the sonobuoy.

19. Marine mammal detections will be immediately reported to assigned Aircraft Control Unit for further dissemination to ships in the vicinity of the marine species as appropriate where it is reasonable to conclude that the course of the ship will likely result in a closing of the distance to the detected marine mammal.

20. Safety Zones - When marine mammals are detected by any means (aircraft, shipboard lookout, or acoustically) within 1,000 yards of the sonar dome (the bow), the ship or submarine will limit active transmission levels to at least 6 dB below normal operating levels.

    (i) Ships and submarines will continue to limit maximum transmission levels by this 6 dB factor until the animal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yards beyond the location of the last detection.

    (ii) Should a marine mammal be detected within or closing to inside 500 yards of the sonar dome, active sonar transmissions will be limited to at least 10 dB below the equipment's normal operating level. Ships and submarines will continue to limit maximum ping levels by this 10 dB factor until the animal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yards beyond the location of the last detection.

    (iii) Should the marine mammal be detected within or closing to inside 200 yards of the sonar dome, active sonar transmissions will cease. Sonar will not resume until the animal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yards beyond the location of the last detection.

    (iv) Special conditions applicable for dolphins and porpoises only: If, after conducting an initial maneuver to avoid close quarters with dolphins or porpoises, the Officer of the Deck concludes that dolphins or porpoises are deliberately closing to ride the vessel's bow wave, no further mitigation actions are necessary while the dolphins or porpoises continue to exhibit bow wave riding behavior.

(v) If the need for power-down should arise as detailed in "Safety Zones" above, Navy shall follow the requirements as though they were operating at 235 dB - the normal operating level (i.e., the first power-down will be to 229 dB, regardless of at what level above 235 sonar was being operated).

21. Prior to start up or restart of active sonar, operators will check that the Safety Zone radius around the sound source is clear of marine mammals.

22. Sonar levels (generally) – The ship or submarine will operate sonar at the lowest practicable level, not to exceed 235 dB, except as required to meet tactical training objectives.

23. Helicopters shall observe/survey the vicinity of an ASW exercise for 10 minutes before the first deployment of active (dipping) sonar in the water.

24. Helicopters shall not dip their sonar within 200 yards of a marine mammal and shall cease pinging if a marine mammal closes within 200 yards after pinging has begun.

25. Submarine sonar operators will review detection indicators of close-aboard marine mammals prior to the commencement of ASW operations involving active mid-frequency sonar.

26. Increased vigilance during major ASW training exercises with tactical active sonar when critical conditions are present.

Based on lessons learned from strandings in Bahamas 2000, Madeiras 2000, Canaries 2002, and Spain 2006, beaked whales are of particular concern since they have been associated with MFAS operations. Navy should avoid planning major ASW training exercises with MFAS in areas where they will encounter conditions which, in their aggregate, may contribute to a marine mammal stranding event.

The conditions to be considered during exercise planning include:

(1) Areas of at least 1000 m depth near a shoreline where there is a rapid change in bathymetry on the order of 1000-6000 meters occurring across a relatively short horizontal distance (e.g., 5 nm).

(2) Cases for which multiple ships or submarines (≥ 3) operating MFAS in the same area over extended periods of time (≥ 6 hours) in close proximity (≤ 10NM apart).

(3) An area surrounded by land masses, separated by less than 35 nm and at least 10 nm in length, or an embayment, wherein operations involving multiple ships/subs (≥ 3) employing MFAS near land may produce sound directed toward the channel or embayment that may cut off the lines of egress for marine mammals.

(4) Although not as dominant a condition as bathymetric features, the historical presence of a significant surface duct (i.e. a mixed layer of constant water temperature extending from the sea surface to 100 or more feet).

If the major exercise must occur in an area where the above conditions exist in their aggregate, these conditions must be fully analyzed in environmental planning documentation. Navy will increase vigilance by undertaking the following additional protective measure:

A dedicated aircraft (Navy asset or contracted aircraft) will undertake reconnaissance of the embayment or channel ahead of the exercise participants to detect marine mammals that may be in the area exposed to active sonar. Where practical, advance survey should occur within about two hours prior to MFA sonar use, and periodic surveillance should continue for the duration of the exercise. Any unusual conditions (e.g., presence of sensitive species, groups of species milling out of habitat, any stranded animals) shall be reported to the Officer in Tactical Command (OTC), who should give consideration to delaying, suspending or altering the exercise.

All safety zone requirements described in Measure 20 apply.

The post-exercise report must include specific reference to any event conducted in areas where the above conditions exist, with exact location and time/duration of the event, and noting results of surveys conducted.

IV. Coordination and Reporting

27. Navy will coordinate with the local NMFS Stranding Coordinator for any unusual marine mammal behavior and any stranding, beached live/dead or floating marine mammals that may occur at any time during or within 24 hours after completion of mid-frequency active sonar use associated with ASW training activities.

28. Navy will submit a report to the OPR, NMFS, within 120 days of the completion of a Major Exercise. This report must contain a discussion of the nature of the effects, if observed, based on both modeled results of real-time events and sightings of marine mammals.

29. If a stranding occurs during an ASW exercise, NMFS and Navy will coordinate to determine if MFAS should be temporarily discontinued while the facts surrounding the stranding are collected.

LETTER OF INSTRUCTION FOR USWEX EXERCISES

SUBJ/MARINE MAMMAL AND ENDANGERED SPECIES LETTER OF INSTRUCTION (LOI) /IN SUPPORT OF xxxxx07-xx//

REF/A/DOC/16USC1361-1372/-/1972//

REF/B/DOC/16USC1531-1544/-/1973//

REF/C/INST/OPNAVINST 5090.1B CH-3/01NOV1994//
REF/D/MSG/SECNAV/181634ZNOV2005//

REF/E/LTR/DOD/23JAN2007//

NARR/REF A IS THE MARINE MAMMAL PROTECTION ACT. REF B IS THE ENDANGERED SPECIES ACT. REF C IS THE ENVIRONMENTAL AND NATURAL RESOURCES PROGRAM MANUAL. REF D IS ALNAV REQUIRING RETENTION OF ALL MID-FREQUENCY ACTIVE SONAR USE LOGS AND MATERIALS RELATED TO MID-FREQUENCY ACTIVE SONAR DUE TO ONGOING LITIGATION IN US FEDERAL COURT. REF E IS NATIONAL DEFENSE EXEMPTION FROM REQUIREMENTS OF THE MARINE MAMMAL PROTECTION ACT FOR CERTAIN DOD MID-FREQUENCY ACTIVE SONAR ACTIVITIES.//

GENTEXT/REMARKS/1. (U) DUE TO POSSIBLE PRESENCE OF PROTECTED MARINE SPECIES WITHIN xxxxx 07-xx OPERATING AREA AND POTENTIAL EFFECTS ON THESE SPECIES FROM USE OF MID-FREQUENCY ACTIVE SONAR, THE FOLLOWING GUIDANCE IS PROVIDED FOR EXERCISE CONDUCT AND REPORTING. THE MAJORITY OF THE GUIDANCE AND INFORMATION IN THIS MESSAGE IS COMPILED FROM EXISTING LAWS AND REGULATIONS FOUND IN REFS A-E.

1.A. (U) MARINE MAMMALS. REF A PROHIBITS HARASSING, CAPTURING, INJURING OR KILLING ANY MARINE MAMMAL (INCLUDING WHALES, DOLPHINS, SEALS AND PORPOISES) IN U.S. WATERS OR ON THE HIGH SEAS. THE TERM HARASS IS INTERPRETED BROADLY AND INCLUDES ACTS OF PURSUIT, TORMENT OR ANNOYANCE WHICH HAVE THE SIGNIFICANT POTENTIAL TO INJURE A MARINE MAMMAL IN THE WILD OR WHICH DISTURBS OR IS LIKELY TO DISTURB A MARINE MAMMAL IN THE WILD BY CAUSING DISRUPTION OF NATURAL BEHAVIORAL PATTERNS, INCLUDING, BUT NOT LIMITED TO, MIGRATION, SURFACING, NURSING, BREEDING, FEEDING OR SHELTERING, TO A POINT WHERE SUCH BEHAVIORAL PATTERNS ARE ABANDONED OR SIGNIFICANTLY ALTERED.

1.B. (U) ENDANGERED SPECIES. REF B PROHIBITS THE TAKING (HARASSING, HARMING, PURSUING, HUNTING, SHOOTING, WOUNDING, KILLING, TRAPPING, CAPTURING OR COLLECTING OR TO ATTEMPT TO DO SO) OF ANY FEDERALLY PROTECTED ENDANGERED OR THREATENED SPECIES UPON THE HIGH SEAS, WITHIN THE UNITED STATES OR IN THE TERRITORIAL SEA OF THE UNITED STATES.

2. (U) REF E SPECIFIES NEW REQUIREMENTS EFFECTIVE THROUGH 23 JANUARY 2009 WHEN USING MID FREQUENCY ACTIVE (1kHz-10kHz) SONAR (MFAS) (E.G. SHIP AND SUB HULL MOUNTED SONAR, HELO DIPPING SONAR AND DICASS SONOBUOYS) DURING MAJOR EXERCISES OR WHEN TRAINING OR CONDUCTING MAINTENANCE WITHIN ESTABLISHED OPERATING AREAS.

2.A. (U) THESE REQUIREMENTS APPLY:

2.A.1. (U) DURING XXXXX 07-0X TRAINING EXERCISES.

2.A.2. (U) TO THE USE OF MFAS SYSTEMS FOR THE PURPOSE OF SEARCHING FOR AND TRACKING OF SUBMARINES AND MINES.

2.B. (U) THESE REQUIREMENTS DO NOT APPLY TO:

2.B.1. (U) OPERATIONAL USE, INCLUDING FORCE PROTECTION AND SAFETY OF NAVIGATION.

2.B.2. (U) UNDERWATER COMMUNICATION SYSTEMS AND FATHOMETERS.

3. (U) A COORDINATED CUSFFC/CPF GUIDANCE MESSAGE WILL BE RELEASED IN THE NEAR FUTURE TO ENSURE COMPLIANCE WITH REF E REQUIREMENTS. IN THE INTERIM, FOR THE PURPOSES OF xxxxxx 07-xx, THE FOLLOWING ACTIONS ARE DIRECTED.

3.A. (U) PERSONNEL TRAINING.

3.A.1 (U) ALL SURFACE SHIP LOOKOUTS AND TOPSIDE WATCHSTANDERS (I.E., OODS, JOODS) AS WELL AS MPA AIRCREWS AND ASW/MIW HELICOPTER AIRCREWS MUST COMPLETE MARINE SPECIES AWARENESS TRAINING (MSAT) BY VIEWING THE U.S. NAVY MSAT DVD. MSAT TRAINING MUST BE REVIEWED PRIOR TO USE OF MFA SONAR. THESE PERSONNEL ARE NOT SOLELY MARINE MAMMAL OBSERVERS AND CAN PERFORM OTHER DUTIES (E.G., LOOKOUT, JOOD).

UNITS SHOULD ALREADY HAVE A COPY OF THE MSAT DVD, WHICH WAS DISTRIBUTED IN AUGUST 2006. IF NOT RECEIVED, CONTACT xxxxxx, TEL: xxx-xxx-xxxx, NIPRNET EMAIL: xxxxxxxxx TO OBTAIN A COPY. THE MSAT TRAINING CAN BE FOUND ON HTTPS:/MMRC.TECQUEST.NET/. IN ADDITION, MARINE MAMMAL TRAINING SLIDES ARE AVAILABLE ON THE xxxxxxx WEBSITE AT xxxxxxx.

3.B. (U) AVIATION UNITS.

3.B.1 (U) MPA AND OTHER AIRCRAFT PARTICIPATING IN ASW EVENTS AND FLYING LOW ENOUGH TO REASONABLY SPOT MARINE MAMMALS SHALL MONITOR FOR MARINE MAMMALS PRIOR TO AND DURING THE EVENT AND REPORT SIGHTINGS TO xxxxxx. IF SONAR IS SECURED (I.E. DICASS SONOBUOY) DUE TO PRESENCE OF MARINE MAMMALS WITHIN 200 YARDS, THEN REPORTING REQUIREMENT DESCRIBED IN PARA 4.A.2 APPLY.

3.C. (U) SONAR OPERATORS.

3.C.1 (U) SUB OPERATORS WILL CHECK FOR PASSIVE INDICATION OF MARINE MAMMALS CLOSE ABOARD PRIOR TO USE OF MFAS. CLOSE ABOARD IS DEFINED AS VISIBLE BEARING RATE ON DIMUS DISPLAY. SHIP OPERATORS WILL CHECK FOR PASSIVE INDICATION OF MARINE MAMMALS ON THE UNDERWATER TELEPHONE IOT ALERT LOOKOUTS PRIOR TO USE OF MFAS. IF MFAS SONAR IS SECURED DUE TO PRESENCE OF MARINE MAMMALS, THEN REPORTING REQUIREMENTS DESCRIBED IN PARA 4.A.2 APPLY AS APPLICABLE AND CAN BE DETERMINED.

3.D. (U) MFAS OPERATIONS.

3.D.1. (U) OPERATE MFAS AT LOWEST PRACTICABLE LEVEL, NOT TO EXCEED 235 DB, EXCEPT FOR OCCASIONAL SHORT PERIODS OF TIME TO MEET TACTICAL TRAINING OBJECTIVES. USE OF MFAS AT SOURCE LEVELS ABOVE 235 DB SHALL BE LOGGED AND REPORTED IAW PARA 4.

3.D.2. (U) PRIOR TO START-UP OR RESTART OF ACTIVE SONAR, OPERATORS WILL CHECK THAT THE BUFFER ZONE DESCRIBED BELOW IN PARA. 3.E IS CLEAR OF MARINE MAMMALS.

3.D.3. (U) HELICOPTERS SHALL OBSERVE/SURVEY THE VICINITY OF EACH ASW EVENT LOCATION FOR 10 MINS PRIOR TO COMMENCEMENT OF THE PROSECUTION (BEFORE DEPLOYING ACTIVE (DIPPING) SONAR). HELICOPTERS SHALL NOT DEPLOY THEIR SONAR WITHIN 200 YARDS OF A MARINE MAMMAL AND WILL SECURE ACTIVE TRANSMISSIONS IF A MARINE MAMMAL CLOSES WITHIN 200 YARDS. IF SONAR IS SECURED DUE TO PRESENCE OF MARINE MAMMALS WITHIN 200 YARDS, THEN REPORTING REQUIREMENT DESCRIBED IN PARA 4.A.2 APPLY.

3.E. (U) HULL MOUNTED MFAS BUFFER ZONES.

3.E.1. PRIOR TO START-UP OR RESTART OF MFAS, OPERATORS WILL CHECK THAT SAFETY ZONES IN PARA 3.E.2-4 ARE CLEAR OF MARINE MAMMALS.

3.E.2. (U) 1000 YARDS. WHEN MARINE MAMMALS ARE DETECTED BY ANY MEANS (AIRCRAFT, LOOKOUT, OR AURALLY) WITHIN 1000 YARDS OF THE SONAR DOME, THE SHIP OR SUBMARINE WILL LIMIT ACTIVE TRANSMISSION LEVELS TO AT LEAST 6 DB BELOW THE EQUIPMENT NORMAL OPERATING LEVEL FOR SECTOR SEARCH MODES. SHIPS AND SUBMARINES WILL CONTINUE TO LIMIT MAXIMUM PING LEVELS BY THIS 6 DB FACTOR UNTIL THE ANIMAL HAS BEEN SEEN TO LEAVE THE AREA, HAS NOT BEEN SEEN FOR 30 MINUTES, OR THE VESSEL HAS TRANSITED MORE THAN 2000 YARDS BEYOND THE LOCATION OF THE LAST SIGHTING.

3.E.3. (U) 500 YARDS. SHOULD THE MARINE MAMMAL BE DETECTED WITHIN OR CLOSING TO INSIDE 500 YARDS OF THE SONAR DOME, ACTIVE SONAR TRANSMISSIONS WILL BE LIMITED TO AT LEAST 10 DB BELOW THE EQUIPMENT'S NORMAL OPERATING LEVEL FOR SECTOR SEARCH MODES. SHIPS AND SUBMARINES WILL CONTINUE TO LIMIT MAXIMUM PING LEVELS BY THIS 10 DB FACTOR UNTIL THE ANIMAL HAS BEEN SEEN TO LEAVE THE AREA, HAS NOT BEEN SEEN FOR 30 MINUTES, OR THE VESSEL HAS TRANSITED MORE THAN 2000 YARDS BEYOND THE LOCATION OF THE LAST SIGHTING.

3.E.4. (U) 200 YARDS. SHOULD THE MARINE MAMMAL BE DETECTED WITHIN OR CLOSING TO INSIDE 200 YARDS OF THE SONAR DOME, ACTIVE SONAR TRANSMISSIONS WILL CEASE. WHEN A MARINE MAMMAL IS DETECTED CLOSING TO INSIDE APPROXIMATELY 200 YARDS OF THE SONAR DOME, THE PRINCIPAL RISK BECOMES POTENTIAL PHYSICAL INJURY FROM COLLISION. ACCORDINGLY, IF THE MARINE SPECIES CLOSES WITHIN 200 YARDS, SHIPS AND SUBMARINES SHALL MANEUVER TO AVOID COLLISION TO THE GREATEST EXTENT POSSIBLE, WITH SAFETY OF THE VESSEL BEING PARAMOUNT. ACTIVE SONAR WILL NOT RESUME UNTIL THE ANIMAL HAS BEEN SEEN TO LEAVE THE AREA, HAS NOT BEEN SEEN FOR 30 MINUTES, OR THE VESSEL HAS TRANSITED MORE THAN 2000 YARDS BEYOND THE LOCATION OF THE LAST SIGHTING.

3.E.5. (U) SPECIAL CONDITIONS APPLICABLE TO DOLPHINS AND PORPOISES

ONLY: IF, AFTER CONDUCTING AN INITIAL MANEUVER TO AVOID CLOSE QUARTERS WITH DOLPHINS OR PORPOISES, THE OFFICER OF THE DECK CONCLUDES THAT DOLPHINS OR PORPOISES ARE DELIBERATELY CLOSING TO RIDE THE VESSEL BOW WAVE, NO FURTHER MITIGATION ACTIONS ARE NECESSARY WHILE THE DOLPHINS OR PORPOISES CONTINUE TO EXHIBIT BOW WAVE RIDING BEHAVIOR.

3.F. (U) LOOKOUTS

3.F.1. (U) ON THE BRIDGE OF SURFACE SHIPS, THERE WILL BE AT LEAST THREE PEOPLE ON WATCH WHOSE DUTIES INCLUDE OBSERVING THE WATER SURFACE AROUND THE VESSEL. IN ADDITION TO THE THREE PERSONNEL ON WATCH, ALL SURFACE SHIPS PARTICIPATING IN ASW EXERCISES WILL HAVE AT ALL TIMES DURING THE EXERCISE AT LEAST TWO ADDITIONAL PERSONNEL ON WATCH AS LOOKOUTS. EACH PERSON ON WATCH WILL HAVE A SET OF BINOCULARS TO AID IN DETECTION OF MARINE MAMMALS. ON SURFACE VESSELS EQUIPPED WITH MFAS, PEDESTAL-MOUNTED BIG EYE (20 X 110) BINOCULARS WILL BE USED TO ASSIST IN DETECTION OF MARINE MAMMALS IN THE VICINITY OF THE VESSEL.

3.F.2. (U) DURING MFAS OPERATIONS, PERSONNEL WILL UTILIZE ALL AVAILABLE SENSOR AND OPTICAL SYSTEMS (SUCH AS NIGHT VISION GOGGLES) TO AID IN DETECTION OF MARINE MAMMALS.

3.F.3. (U) PERSONNEL ON LOOKOUT WILL EMPLOY VISUAL SEARCH PROCEDURES EMPLOYING A SCANNING METHODOLOGY IAW LOOKOUT TRAINING HANDBOOK (NAVEDTRA 12968-B).

3.F.4 (U) AFTER SUNSET AND PRIOR TO SUNRISE, LOOKOUTS WILL EMPLOY NIGHT LOOKOUT TECHNIQUES IN ACCORDANCE WITH LOOKOUT TRAINING HANDBOOK.

4. (U) REPORTS AND DATA COLLECTION.

4.A. (U) ALL UNITS WILL CONTINUE TO SEND SPORTS MESSAGES.

4.A.1. (U) ALL UNITS EMPLOYING MFAS ARE REQUIRED TO SUBMIT AN AFTER ACTION REPORT (AAR), CLASSIFIED AS CONFIDENTIAL. XXXX STRIKE GROUP COMMANDER SHALL CONSOLIDATE ALL REPORTS INTO A FINAL REPORT AND FORWARD TO xxxxxxx, INFO CHAIN OF COMMAND, WITHIN 10 DAYS OF COMPLETION OF THE EXERCISE. THIS TIMELINE IS REQUIRED DUE TO REGULATORY REQUIREMENTS THAT NAVY VERBALLY REPORT MARINE MAMMAL SIGHTING INFORMATION AND IMPACTS TO MFAS OPS TO NATIONAL MARINE FISHERIES SERVICES WITHIN 15 BUSINESS DAYS FROM EXERCISE COMPLETION.

4.A.2. (U) THE FINAL REPORT (SUBJ: MFA MARINE MAMMAL REPORT FOR EXERCISE xxxxx 07-xx) WILL BE COMPRISED OF TWO PARTS. PART ONE WILL REPORT ALL MARINE MAMMALS SIGHTED DURING THE EXERCISE, AND WILL INCLUDE THE DATA LISTED BELOW:

A.DTG OF INITIAL SIGHTING.

B. UNIT AND POSIT (UNIT NAME AND LAT/LONG). NOTE, IF REPORT IS FOR ASW HELO ASSIGNED TO VESSEL, THIS MUST BE REPORTED SEPARATELY FROM SURFACE SHIP REPORTS.

C. DESCRIPTION OF ANIMAL BY SPECIES IF KNOWN, OTHERWISE SPECIFY: DOLPHIN, SM WHALE (SMALL WHALE), LG WHALE (LARGE WHALE), SEAL/SEALION.

D. ESTIMATED NUMBER OF ANIMALS.

E. TRUE BEARING AND RANGE FROM UNIT.

F. ANIMALS BEHAVIOR AT TIME OF SIGHTING: RESTING, TRAVELING (NOTE DIRECTION IN RELATION TO SHIP COURSE), BOW-RIDING, FEEDING/ERRATIC, MILLING (I.E., STAYING IN SAME AREA), JUMPING CLEAR OUT OF WATER, FLIPPER/TAIL SLAPPING, OTHER, OR UNKNOWN).

G. ACTION TAKEN: NONE, ALTER COURSE TO AVOID, MFAS POWER DOWN, MFAS SECURED (I.E. CEASE ACTIVE SONAR TRANSMISSION).

ONLY IN CASES WHERE MFAS IS POWERED DOWN OR SECURED, THE FOLLOWING ADDITIONAL INFORMATION IS REQUIRED IN ORDER TO FORWARD POST-EXERCISE IMPACT ASSESSMENT TO CPF AND NATIONAL MARINE FISHERIES SERVICE:

H. UNIT COURSE AND SPD.

I. ANIMAL COURSE AND EST SPD.

J. ACTION TIMELINE: LENGTH OF TIME MFAS POWERED DOWN, OR SECURED.

K. ACTION IMPACT (I.E. TACTICAL DEGRADATION ASSESSMENT): NONE, SLIGHT, MODERATE, SEVERE.

- REPEAT PARAS. A-L AS NECESSARY TO REPORT ADDITIONAL SIGHTINGS.

SIGHTING SHALL BE IN FORMAT:

A. DTG/ B. UNIT-POSIT/C. DESCRIPT/ D. # ANIMAL/ E. BRNG-RNG/ F. BEHAV/ G. ACTION TAKEN/H. UNIT CRS-SPD/ I. ANIMAL CRS/ J. ACTION TIME/

PART TWO OF THE REPORT WILL PROVIDE A COMMANDER'S ASSESSMENT OF EFFECTIVENESS OF THE MITIGATION MEASURES IMPLEMENTED IN REF E, MAKE RECOMMENDATIONS TO IMPROVE THESE MEASURES, AND REPORT ANY IMPACT TO TRAINING FIDELITY CAUSED BY THESE MEASURES (E.G., SONAR POWER REDUCTION

CAUSED BY MARINE MAMMAL ENTERING BUFFER ZONE). IT IS PARTICULARLY IMPORTANT TO CAPTURE THE IMPACT THAT THESE MEASURES MAY HAVE ON OPERATIONS AND TRAINING.

5. (U) ENSURE WATCHSTANDERS ARE BRIEFED ON THE POSSIBLE PRESENCE OF MARINE MAMMALS AND THAT ALL SIGHTINGS ARE REPORTED TO THE BRIDGE. NOTE, WHALES OFTEN TRAVEL IN GROUPS AND A SIGHTING INDICATES THE POSSIBILITY OF OTHER WHALES IN THE VICINITY.

5.A. (U) UPON SIGHTING A WHALE, ADJUST COURSE AND SPEED AS NECESSARY TO MAINTAIN A SAFE DISTANCE CONSISTENT WITH PRUDENT SEAMANSHIP.

5.B. (U) SIGHTINGS OF ALL WHALES SHALL BE PASSED VIA CHAIN OF COMMAND TO THE CFMCC BATTLE WATCH CAPTAIN IOT ALERT OTHER SHIPS IN THE AREA TO THE POSSIBILITY OF THE WHALES' PRESENCE.

5.C. (U) IN THE EVENT OF A WHALE COLLISION. IF POSSIBLE, TAKE VIDEO AND/OR PHOTOGRAPHS OF THE STRICKEN WHALE.

5.C.1. (U) ATTEMPT TO IDENTIFY DISTINGUISHING CHARACTERISTICS OF THE WHALE INVOLVED. THE "WHALE WHEEL," A DEVICE THAT LISTS VARIOUS SPECIES OF WHALES AND THEIR IDENTIFYING FEATURES, CAN ASSIST IN THIS REGARD.

5.D. (U) REPORTING REQUIREMENTS FOR A WHALE COLLISION. CHAPTER

19-11.3.2 OF REF C PROVIDES GUIDANCE CONCERNING WHALE STRIKES.

5.D.1. (U) IN THE EVENT OF A COLLISION WITH A WHALE OR ON SIGHTING A MARINE MAMMAL FLOATING CARCASS DURING xxxxxx 07-0X, AN APPROPRIATE UNIT SITREP/OPREP MESSAGE MUST CONTAIN THE FOLLOWING ADDRESSEES AND INFORMATION:

A. DATE, TIME AND LOCATION.

B. VESSEL'S COURSE AND SPEED.

C. OPERATIONS BEING CONDUCTED BY THE VESSEL.

D. WEATHER CONDITIONS, VISIBILITY AND SEA STATE.

E. DESCRIBE THE ANIMAL IN AS MUCH DETAIL AS POSSIBLE; E.G., LENGTH, COLOR, CONDITION OF BODY, OTHER DISTINGUISHING FEATURES. DO NOT SPECULATE.

F. NARRATIVE OF INCIDENT, INCLUDING RELATIVE POSITION AND MOVEMENTS OF SHIP AND WHALE.

G. INDICATE IF PICTURES/VIDEOS WERE TAKEN FROM FLIGHT DECK CAMERAS OR OTHER INSTALLED OR PORTABLE CAMERAS.

5.D.2. (U) A VOICE REPORT (VIA ISIC) TO xxxxxx IS ALSO REQUIRED. IF VOICE COMMUNICATIONS ARE NOT AVAILABLE, MAKE REPORT VIA CHAT.

6. (U) ALL UNITS THAT EMPLOY MFAS SHALL ENSURE THEY FULLY UNDERSTAND AND IMPLEMENT THE MITIGATION AND REPORTING REQUIREMENTS PROMULGATED IN THIS MESSAGE.

6.A. (U) COMMANDING OFFICERS SHALL THOROUGHLY REVIEW THIS GUIDANCE WITH KEY PERSONNEL AND WATCHSTANDERS TO ENSURE FULL SITUATIONAL AWARENESS AND COMPLIANCE.

7. (U) REMINDER, NOTHING IN THIS MESSAGE RESTRICTS THE AUTHORITY OF A COMMANDING OFFICER FROM TAKING SUCH MEASURES DEEMED NECESSARY FOR OPERATIONAL FORCE PROTECTION AND SAFETY OF NAVIGATION PURPOSES.//

APPENDIX C- REPORT OF NAVY CONTRACTOR BIOLOGIST EMBARKED ABOARD CVN DURING USWEX 07-02 10-11 APRIL

10 April 2007

10:45 (all times are given as local Hawaii Standard Time): Arrived USS Nimitz aboard C2 Grayhound. Circled for about 20 minutes near the Nimitz prior to landing. No marine mammals or sea turtles observed from the aircraft.

10:45-12:00: Orientation, meeting with the Captain

12:00-17:30: Tour of the watch stander positions with the ANAV officer.

Observations were conducted from the flag bridge using Zeiss 10x42 binoculars. Several big eye binoculars (25x150) were available for use and two watchstander look outs were at approximately the same location with one on the port side and one on the starboard side of the ship. Two watchstander look outs were also stationed on the stern of the ship. Aircraft operations were conducted through most of this time, mostly consisted of F/A 18 launch and recovery with some helicopter operations.

Weather conditions were clear with approximately 12 miles (19 km visibility, swell was about eight feet (2.5 meters), wind was 17.5-22.4 knots (7.1-9.2 meter/second) for a Beaufort sea state of 4-5. Air temperature was 74.5-79.2°F (23.6-26.2°C).

No marine mammals or sea turtles were observed by myself or the watchstander look outs, including the watchstander look outs on the stern of the ship.

17:30-19:50: Observations made from the navigation bridge and "Vultures Row" until darkness. No marine mammals observed by myself and the watchstanders.

At times, the ships conducting ASW activities and surrounding the carrier, were visible in the distance. The ship several hundred miles south-west of Oahu but due to security the exact location was not given.

11 April 2007

07:00-10:15: Observations from the same location as 10 April, the flag bridge using Zeiss 10x42 binoculars. Several big eye binoculars (25x150) were available for use and two watchstanders were at approximately the same location with one on the port side and one on the starboard side of the ship.

Weather conditions were clear with approximately 12 miles (19 km) visibility, swell was about eight feet (2.5 meters), wind was 17.5-25.1 knots (7.1-10.2 meters/second) for a Beaufort sea state of 4-6. Air temperature was 74.5-79.2°F (23.6-26.2°C).

No marine mammals observed by myself and the watchstander look outs.

At times, the ships conducting ASW activities and surrounding the carrier, were visible in the distance. Air operations were being conducted through most of the observation period.

11:15: Departed the USS Nimitz and returned to Hickam Air Force Base.

APPENDIX D- ACOUSTIC SNAPSHOP ANALYSIS FOR MARINE MAMMALS USING PACIFIC MISSILE RANGE FACILITY BOTTOM MOUNTED HYDROPHONES FOR APRIL 2007 AND APRIL 2006

Initial acoustic snapshot analysis results for marine mammal species using Pacific Missile Range Facility bottom mounted hydrophones for April 2007 and April 2006.

Summary:

There is a growing body of research on the use of passive acoustics, both alone and in conjunction with traditional visual surveys, for density estimation for cetaceans. The bulk of this research has been focused on towed hydrophones which are increasingly being used in conjunction with visual line transect surveys. Fixed, bottom mounted hydrophones, such as those at US Navy instrumented ranges; pose different challenges in estimating densities using the accepted distance sampling methodology. A new research effort, described in the next section, is underway to develop sound statistical methods for estimating cetacean densities using bottom mounted hydrophones, which will utilize acoustic hydrophone data from two US Navy instrumented ranges in case studies. Bottom mounted Pacific Missile Range Facility (PMRF) hydrophones operate from as low as 60 Hz to up to 48 kHz and are well suited for detection of multiple species, genera, or families of cetaceans with relatively well understood characteristic acoustic signatures (e.g. humpback whales via their song, Minke whales via their 'boing' sound, and sperm and beaked whales via their echolocation clicks). Other cetacean species are present at PMRF (Baird et. al. 2006, Barlow 2006, Barlow et. al. 2004), but are more difficult to identify solely by acoustic techniques (i.e. various species of *Delphinidae*, *Kogia* and other Mysticeti).

Currently, limited information is available relative to marine mammal species present on, or near, the PMRF underwater ranges at the various times of the year. The best estimates for marine mammal species present in the area come from aerial surveys (Mobley 2005), however minke whales were never sighted during the aerial surveys, while they have been acoustically detected and localized. Acoustic data has been collected from PMRF hydrophones for selected days every year since 2002 and continues today at the rate of two days of acoustic recordings every month. Prior reporting (Tiemann et. al. 2006) dealt with sperm whale localization and automatic (not species specific) detection results. To gain more insight into species present in the area, manual aural and spectrographic analysis of limited amounts of acoustic data has been conducted. Manual analysis is employed, as current automated techniques do not provide reliable species identification. This analysis is being conducted by a US Navy trained acoustic intelligence specialist with over 42 years of experience in sonar analysis. Various automation tools are currently being utilized (e.g. spectrograph display and localization software) and additional efforts are underway to obtain time difference of arrival data via an automated system output (Moretti et. al. 2002). These efforts are being pursued to make the manual analysis more efficient, and eventually allow fully automated analysis for large amounts of data when sufficient marine mammal species classifiers are available.

The current analysis are termed 'acoustic snapshots' with the goal of determining the numbers of, and when possible locations of, readily acoustically identifiable marine mammal species in an area using two dozen or more bottom mounted hydrophones. Snapshot refers to a short duration time window (Buckland et. al. 2001), such that movement of observed species over the duration of the time window is not a major factor. The current manual analysis process is very laborious in nature and requires significant effort to generate results for each 10-minute acoustic snapshot. The short 10 minute snapshot temporal window is known to under-sample the foraging dive patterns of both Sperm and Beaked whales, however if these signals are detected it does confirm presence of a species in the area. While results from a handful of these 'acoustic snapshots' do provide some new information, such as numbers of different species present in the snapshot, the results are insufficient to understand normal variations in species present. Larger sample sizes are needed to gain some level of understanding of what constitutes normal variations (within a day, over days, weeks, months, seasons and years).

Results for three of these ten-minute 'acoustic snapshots' for multiple range hydrophones (either 24 or 31 phones) are presented. A single snapshot is provided for 15 April 2007 and two snapshots (taken 90 minutes apart) for 18 April 2006, all occurring late in the afternoon. Keeping in mind the very limited sample size and uncertainty in what constitutes normal variations, initial results of the analysis show three species, and a member of the Ziphiidae family, of marine mammals detected on 15 April 2007 (humpback, minke, sperm and beaked whales) and for 18 April 2006 the three species were detected (humpback, minke, and sperm whales). Localized humpback whale individuals are shown overlaid on charts for each of the three acoustic snapshots, along with localization of minke whales and a local area indicated for a single beaked whale for the 15 April 2007 snapshot. Tabular data of vocalizations logged for each species are also presented. Description of the data and analysis methods are provided, along with discussion of the results.

Introduction:

The Pacific Missile Range Facility (PMRF), located off of the western coast of Kauai, Hawaii, is one of the US Navy's instrumented test ranges. Part of PMRF's mission is to utilize passive acoustics to detect, localize and track objects of interest. PMRF's organic assets of bottom mounted underwater hydrophones allow the tracking of objects of interest in real time to support US Navy Pacific Fleet training requirements.

Twenty-four broad bandwidth PMRF hydrophones have been recorded as part of an 2002 – 2006 acoustic monitoring program under Office of Naval Research sponsorship. This ONR effort was concentrated during the winter months of February and March, which coincides with the peak of the humpback whales wintering in the area (Au et. al. 2000). In addition, the ONR effort acoustic data was specifically recorded simultaneously with aerial surveys conducted by Dr. J. Mobley (Mobley 2005) as part of separate ONR effort (North Pacific Acoustic Laboratory). Several days of acoustic recordings are available for a typical year with a limited effort at obtaining out of season acoustic data in the year 2002. The ONR funded acoustic recordings were comprised of the 24 broadband hydrophones available on the range sampled at 44.1 kHz (preserving approximately 20 kHz of bandwidth). At the conclusion of the ONR effort, Pacific Fleet sponsorship continued the acoustic data collection effort at a rate of up to two recordings per month for 2006 and 2007. In 2006 the recordings were sampled at a higher rate (96 kHz) in order to obtain bandwidths of up to 48 kHz on six of the twenty-four hydrophones specifically in response to new information regarding beaked whale echolocation signal frequencies (Johnson et. al. 2004). The twenty-four broadband hydrophones have spacing which vary from no closer than two nautical miles apart to over nine nautical miles separation. This spacing is significantly more than hydrophones available at the US Navy Atlantic Undersea Test and Evaluation Center (AUTEC) instrumented range in the Bahamas. In March 2007 an additional 7 high pass filtered (8 kHz) hydrophones, with response up to 48 kHz, were added in an attempt to improve the opportunity of detecting beaked whale echolocation signals. These additional seven hydrophones were concentrated (spacing less than 2 nautical miles) in areas around broadband hydrophones on which beaked whales were previously detected and fit with known beaked whale habitat information (MacLeod et. al. 2006, McSweeney et. al. 2007).

Each day of recorded data consists of from 4 hours per day (early year efforts to coincide with aerial over flights) to over 22 hours of continuous monitoring (post 2006) of acoustic data. This data is streamed in real-time to hard disk drives for later duplication, archiving and analysis.

Many marine mammal species are known to reside in the areas around the Hawaiian Islands (Barlow 2004 and 2006). These include species which are recognizable from their known acoustic signatures: Humpback whale song (Payne and McVay 1971); Minke 'boing' sound (Rankin and Barlow 2005); Sperm whale echolocation clicks (Watkins and Schevill 1977); and two species of beaked whale echolocation clicks (Johnson et. al. 2004 and 2006). Other species of marine mammals are more difficult to acoustically identify (e.g. the various dolphins and other small toothed whales) which are also known to occupy the waters around the Hawaiian Islands.

The accepted method for determining marine mammal species densities is based upon distance sampling (Buckland 2001), and typically utilized in visual surveys from surface ships and aircraft. This method is based upon the statistics of the probability of detection function being a known, monotonically decreasing function of distance (horizontal distance off of a track line for line transects or radial distances for point transects). There is no standardized, accepted statistical method current existent for acoustically determining the relative, or possibly even absolute, abundance from multiple fixed, bottom mounted acoustic sensors. However, in 2007 a new start National Oceanographic Partnership Program titled "Density Estimation for Cetaceans from Passive Acoustic Fixed Sensors (DECAF)" is being lead by Dr. Len Thomas, of the University of St. Andrews. The DECAF efforts include co-principal investigators from US Academia (Tyack and Mellinger) and the US Navy (Moretti and Martin), with well-known advisors (Buckland, Barlow and Zimmer). The three-year DECAF effort will be addressing many open issues in dealing with the statistics of marine mammal density estimation using fixed acoustic sensors.

This analysis utilizes what are termed 'acoustic snapshots' for initial investigation. This entails analysis of relatively short period of time, 10 minutes in this case, to obtain a 'snapshot' picture of marine mammal species present as sensed by the hydrophones. Snapshot methods are used for density estimates of terrestrial animals (Buckland et. al. 2001) and 5 to 10 minute windows typically employed. By using the snapshot method, one is able to minimize complications such as accounting for animal movement over observation time. The disadvantage of snapshots are that it only provides indication of the situation at that point in time, and requires many snapshot results in order to say anything about changes over time (short, mid and long term time periods).

The 10-minute 'acoustic snapshot' analysis window is known to temporally under sample sperm, and beaked whale deep foraging dive cycles. These whales utilize echolocation to find prey, such as squid, during these dives. Recent tagging data (Johnson et. al. 2004 and 2006) has shown two species of beaked whales producing clicks during each deep foraging dive, and very low (essentially no) click production when either on the surface, or while performing shallow dives. Deep dive cycle times average 121 minutes for the Cuvier's beaked whale (*Ziphius cavirostris*) with 58 min average dive time off the coast of Italy, and 139 minutes for the Blainville's beaked whale (*Mesoplodon densirostris*) with 47 minute average dive time in the Canary Islands (Tyack et. al. 2006). Tagged data (no acoustics) for these two species measured in the Hawaiian Island waters agrees favorably with these dive times, with average deep dive times of 68 min for Cuvier's beaked whales and 48 minutes for Blainville's beaked whales (Baird et. al. 2006). Sperm whale deep dives times have been reported from 30 to 50 minutes with a nine-minute inter dive interval (Watwood et. al. 2006). Thus, one can easily miss detection of these species (false dismissal) with a single, or small sample size of, 10-minute snapshot(s). The 10-minute analysis window is currently driven by: the preference to utilize snapshot type analysis until better methods are developed; the high cost of manual analysis; and the desire to get insight into multiple days of acoustic analysis results. As automation efforts improve and the analysis effort continues, additional 10-minute acoustic snapshots will become available which should allow some statistical inferences. Increasing the analysis window to longer periods of time, to better sample the foraging dives would introduce new issues such as animal movement over time.

Humpback whales (one of the more extensively studied whale species) are known to winter in the Hawaiian waters but little is known of many of the other species found in the general area. Beaked whales have been studied off of the big island (Hawaii) using time/depth tags (no acoustics) and are known to have deep dive cycles similar to those reported elsewhere (Baird et. al. 2006). A photographic analysis of ten years of beaked whale data off of the island of Hawaii (McSweeney et. al. 2007) suggests resident populations of beaked whales in the area. The Minke whale is difficult to visually observe and typically found far offshore which accounts for limited knowledge of this species. A visual transect survey utilizing passive acoustics (Rankin et. al. 2005) recently coupled the long known, but unidentified source of, the 'boing' sound to the Minke whales. Subsequent surveys have detected many more Minke acoustically well offshore of the Hawaiian Islands (Rankin et. al. 2007). However, the purpose of the Minke 'boing' sound is still unknown, as is much about the Minke whale in general. Data from the PMRF analysis effort also show that the Minke whales are commonly acoustically detected in the deeper, more offshore, hydrophones via the 'boing' sound during the winter months. Humpbacks detected using the PMRF hydrophones are more commonly found more near shore in shallower waters. Sperm whales appear to be detected throughout the year, while beaked whales have, to date, only been detected a few times.

Methods:

A personal computer based data acquisition system was developed late in 2001 to record up to 32 channels of analog data at sample rates up to 1 MHz. A COTS (Commercial Off-The-Shelf) A/D (Analog to Digital) board samples all 32 channels simultaneously to 16 bits of resolution and data is streamed to hard drive for storage. Recordings conducted from 2002 through 2005 were sampled at 44,100 Hz, while subsequent recordings are sampled at 96,000 Hz. The increase in sample rate was done primarily in effort to better detect Beaked whale echolocation signals, which are now known to have primary energy peaks over 20 kHz (Johnson 2004).

Recordings through 2006 consisted of the twenty-four broadband hydrophones and an IRIG B time signal. Sixteen of the twenty-four broadband hydrophones provide a bandwidth of between approximately 60 Hz up to 20 kHz, while the remaining six hydrophones have an upper receive limit of 48 kHz. In 2007, an additional seven high pass filtered (8 kHz) hydrophones with an upper receive limit of 48 kHz were added to the data collection effort to better sample for beaked whale echolocation signals.

The acoustic analysis is conducted by an individual with 20 years of service in the US Navy, including duty as a qualified Acoustic Intelligence (ACINT) Specialist certified by the Office of Naval Intelligence (Navy enlisted classification 0416 of which very few individuals have been qualified). The ACINT Specialist worked an additional 22 years after retiring from active duty, as a civilian contractor conducting research for various Navy advanced acoustic programs. The analyst is extremely qualified in infrasonic, sonic, ultrasonic acoustic signals analysis and has had to deal with bioacoustics throughout his career.

Acoustic data is continuously recorded (no gaps) to hard disk drive, along with IRIG time code, for a single recording session conducted in a day. For data management purposes, the data are organized as sequential 10-minute files (to keep each file size under 4Gbytes). Each 10-minute file contains either 24 hydrophones of data (2002 through 2006), or 31 hydrophones of data beginning in 2007. Several computerized tools are utilized in the analysis of the recorded acoustic data. Commercial off the shelf software for audio and spectrogram review of single channels of data (Adobe Audition), and custom developed software for review of 32 channels of data at once. A spreadsheet log is created for each 10-minute file containing the following for each hydrophone; Time of the detected event, Species (or unidentified), Type of sound, Spectral Characteristics, Temporal Characteristics and Comments. The analyst then reviews adjacent hydrophones searching for that identical sound. If the sound is present on at least two additional hydrophones a TDA (time-difference-of-arrival) is then calculated for that sound. The TDAs, to the nearest millisecond resolution, are inserted into a MATLAB based tool to compute the location of the individual which generated the sound. The MATLAB routine was provided by the Naval Undersea Warfare Center, Newport, Rhode Island and includes precise hydrophones locations in x, y, and z, and utilizes a historic sound velocity profile. Source depth is modeled to be at 30 feet for the localization (reasonable for humpbacks, but significantly off for deep diving echo locators such as sperm whales and beaked whales). The longitude, latitude and PMRF Range Coordinates from the localizations are also inserted into the spreadsheet.

For each hydrophone, the analyst must review the same single channel of acoustic data at least three times in order to fully search the spectral data between 60 Hz and up to 48 kHz. Current practice requires nominally 80 hours of analyst effort for each 10 minutes of data for 24 or 31-hydrophone format (including documentation into the spreadsheet). As additional automated techniques become available and are utilized, it will continue to make this process more efficient. Adding to the complexity of this analysis is the fact that when humpbacks are most prevalent, such as in Feb, March and April months, the background noise is essentially the humpback whales song (Au et. al. 2000) being over 15 dB louder than other times of the year. This makes the process of locating the identical sounds of individual humpback whales on adjacent phones difficult, and could also mask other sounds in the same frequency bands.

Results:

Acoustic snapshot results are provided for two separate days, 15 April 2007 and 18 April 2006. The acoustic snapshot for 15 April 2007 was centered at 16:58 Hawaiian standard time (16:53-17:03). Two separate acoustic snapshots were analyzed on 18 April 2006 – one centered at 17:04 and one 90 minutes later at 18:34. This analysis is providing insight into the marine mammal situation that exists on, or near, the PMRF underwater ranges for these three separate points in time during these days. This few of samples are insufficient to statistically say anything relative to normal variations, which may exist over the course of a day, let alone weeks, months or years.

Results are presented in two formats. First, nautical charts of the area are utilized to overlay locations of the five categories (humpback, minke, sperm, beaked whales and unidentified mammals) of localized individuals. Beaked whale detections are also plotted on the charts, as this species is expected to have a detection distance on the order of 4 km from bottom-mounted hydrophones (Tyack et. al. 2006). Sperm whale detections are not plotted in a similar manner due to the fact that the Sperm whale could be tens of miles distant from the hydrophone they are detected on due to the differences in click frequency content and source levels. Sperm whale localizations are obtained occasionally, but none were obtained on these three days. Due to the fact that some marine mammal presence in areas is related to bottom depth and topography, nautical charts with bathymetry contours (soundings in fathoms with lines drawn for each 100 fathom depth increase) are utilized for plotting results. Secondly, tabular data is included to summarize the number of sounds logged in each category and number of localizations obtained for each snapshot analyzed. The tabular data captures detection of species of marine mammals not localized, and therefore not plotted on the charts.

Figure 1 provides a section of a nautical chart for the area overlaid with dots (color coded to species) indicating the location of separate individuals of three marine mammal species (humpback, minke and beaked whales) localized on 15 April 2007 at 16:58 (+/- 5minutes). The scale of the chart covers nearly 55 minutes of longitude and over a degree of latitude. Given this scale the dots indicating marine mammal locations represent an area well over one half minute in diameter (over one half of a nautical mile). There are a total of 19 separate individual humpbacks localized, the majority near the western most tip of Kauai, one localized north of Niihau and one localized south west of Kauai. Eight minke whales are localized scattered throughout the northern (BSURE) range, including localizations off range one to the north and one to the west (plotted at the edges of **Figure 1**). The single beaked whale shown actually represents un-localized data and is plotted near the single hydrophone it was detected on. The nature of the beaked whale sounds compares favorably with *Mesoplodon densirostris* (Johnson 2004, Zimmer 2005). The single localized unidentified marine mammal sound logged consisted of 82 Hz pulses of 227 milliseconds in duration. It is uncertain if these sounds are from a Humpback whale, or some other baleen whale (analysis continues). The only other cetacean species positively identified from this acoustic snapshot are sperm whales. A single detection of sperm whale echolocation clicks was logged, however as no localizations were obtained it was not plotted on figure 1 due to the large area of uncertainty associated with the sperm whale click detection (up to tens of nautical miles).

Figure 2 provides plotted results for localized humpback whale individuals on 18 April 2006 at 17:04 (+/- 5 minutes). A total of 27 humpback whales were localized for this snapshot, and no other localizations obtained. A majority of the humpback whales are within the 100-fathom contour off of the western end of Kauai. The whales are located in a few groups, with some localization posits within a few hundred yards of other individuals. Two clusters of humpbacks are observed between the 300 and 400-fathom contours (this area of the figures does show finer resolution contour lines). Three separate individuals are also seen in the area between Kauai and Niihau. Localizations, which lie within tens of yards of others, are treated as a single individual (potential negative bias on counts). Localizations, which are hundreds of yards apart and based upon the characteristics of the sounds, are treated as unique individuals. Given the scale of the figure the localization dots can significantly overlap.

Figure 3 also provides plotted results of localized humpback whale individuals localized on 18 April 2006, at 18:34 HST (+/- 5 minutes), or 90 minutes later than results shown in figure 2. While the number of humpback whales agrees favorably to that at 17:04 (26 individuals compared to 27 earlier) their spatial distribution is observed to be different. It is indeterminate from this analysis if some whales stopped vocalizing and other whales initiated vocalizations, or if the spatial distribution represents movement of the same whales, or a combination of these factors. The 18:34 distribution is such that a dozen localizations are within the 100-fathom bathymetry contour. The other 14 localizations lie between the 200 fathom and 1000 fathom contour lines, with an apparent clustering similar to the observation of clusters in figures 1 and 2. One unidentified localization is also plotted in the under 100 fathom waters offshore of Kauai in the vicinity of 4 localized humpback whales (suspect to be a tail fluke, or pectoral fin, slap).

Figures 1 through 3 provide previously unavailable information (numbers and locations of specific marine mammal species on, or near, the PMRF underwater test range). However, keep in mind this is for three snapshots in time and normal variations over time are currently unknown due to the limited sample size. It is also important to understand that these figures do not convey the fact that both minke and sperm whales were detected in all three acoustic snapshots, based upon the presence of their characteristic sounds (only Minke were localized and in only one snapshot). The presence of all species is summarized in tabular format in **Table 1**.

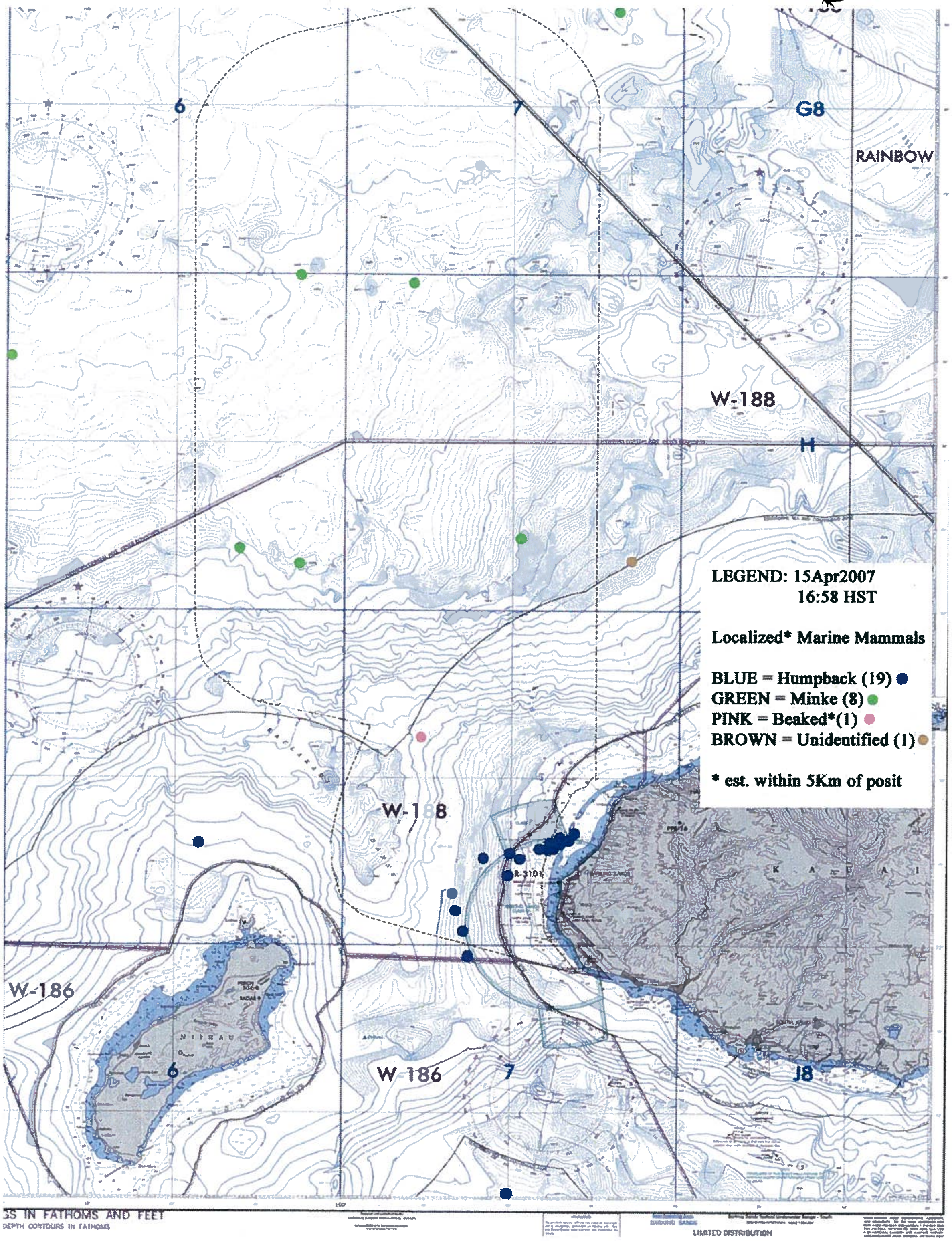

Figure 1 – Localizations using acoustic data on 15 April 2007 between 16:53 and 17:03 Hawaiian standard time using PMRF hydrophones. *The beaked whale posit was not localized, it is plotted as due to it's acoustics and it is certainly within 5 km of the hydrophone it was detected on.*

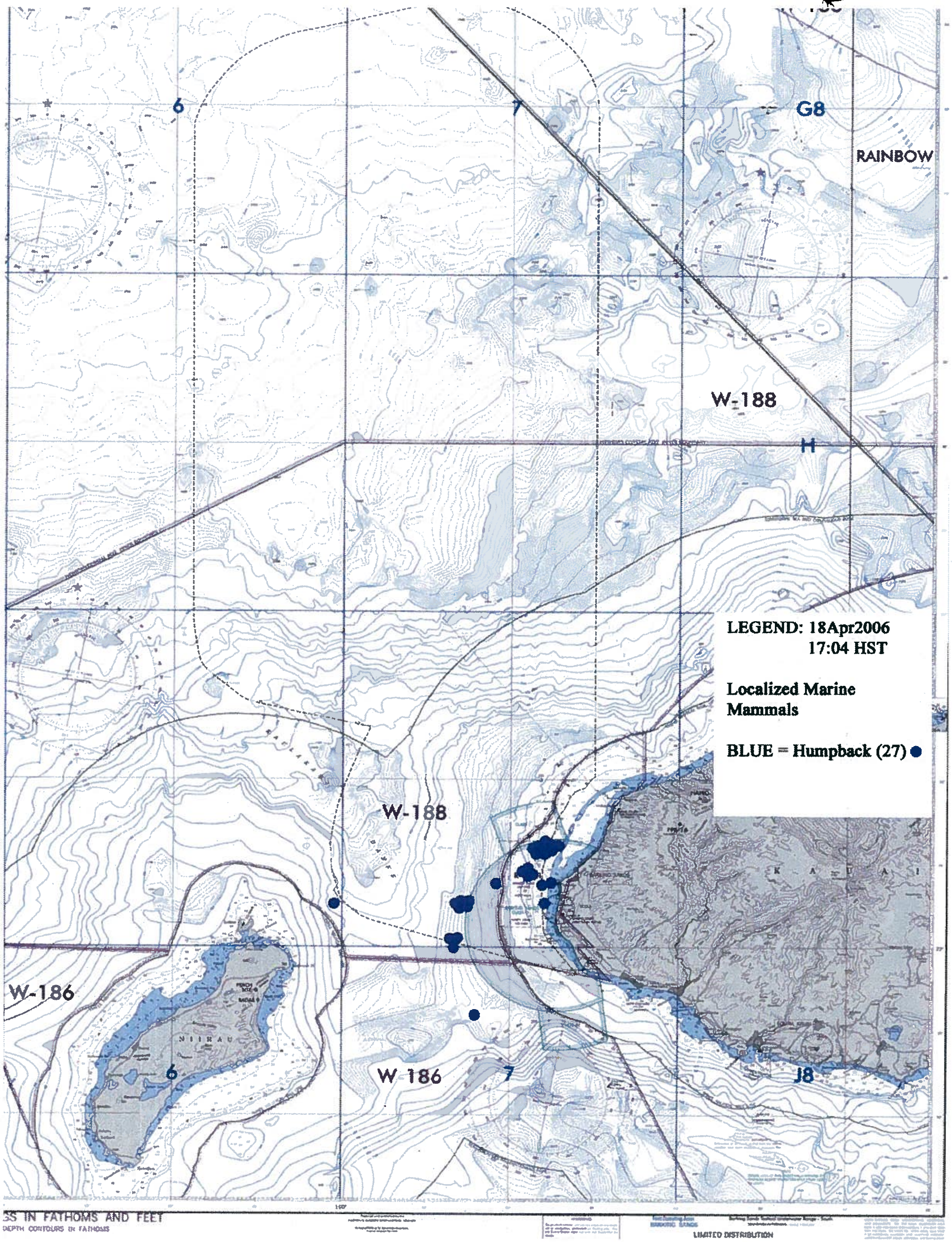

Figure 2 – Localizations using acoustic data on 18 April 2006 between 16:59 and 17:09 Hawaiian standard time using PMRF hydrophones. *Not plotted due to lack of localization are both sperm whales and minke whale characteristic sounds.*

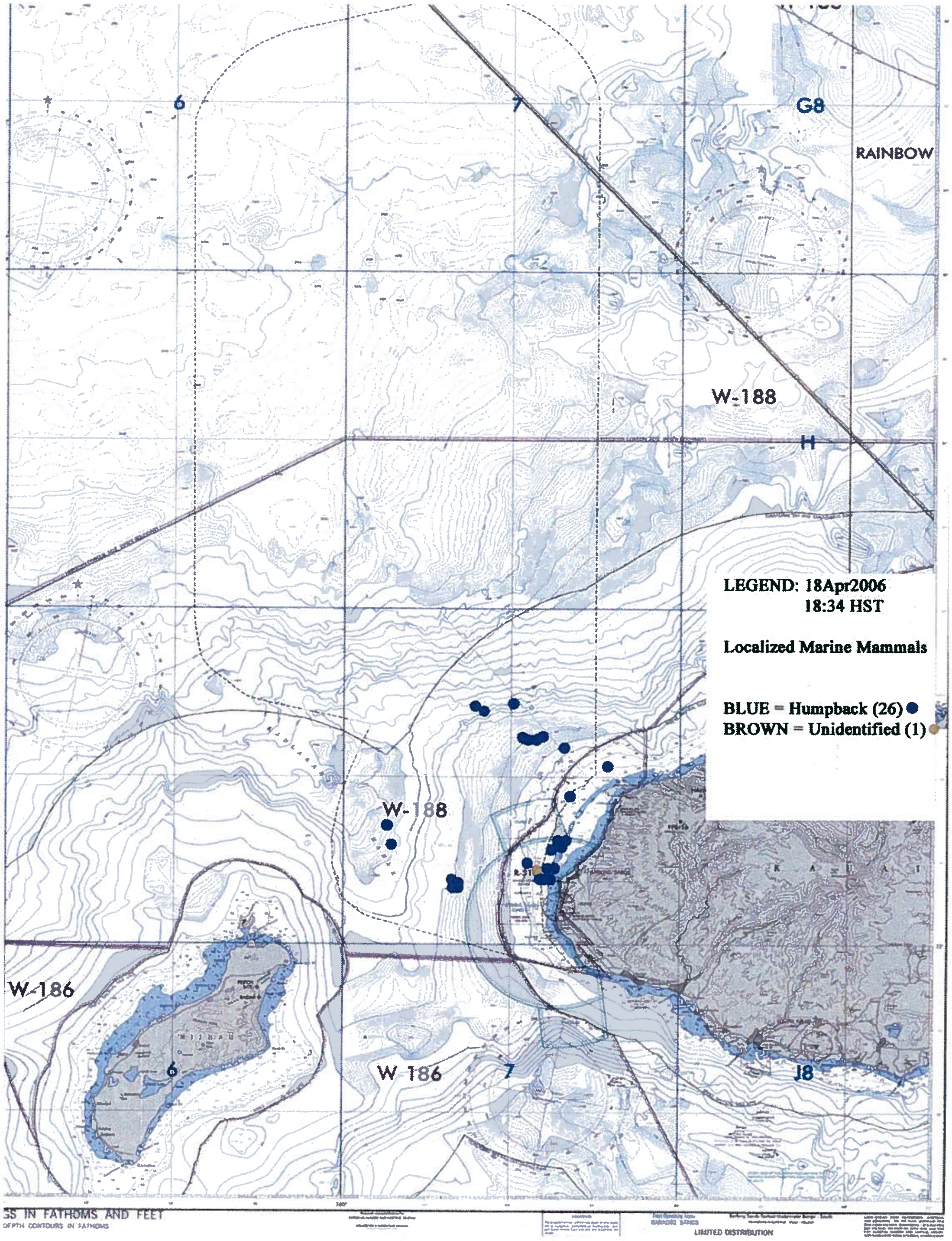

Figure 3 – Localizations using acoustic data on 18 April 2006 between 18:29 and 18:39 Hawaiian standard time using PMRF hydrophones. *Not plotted due to lack of localization are both sperm whales and minke whale characteristic sounds. The unidentified single point is believed to be a tail slap.*

Table 1 provides a summary for each of the three acoustic snapshots reported herin. The analysis results are summarized into five categories (humpback, minke, sperm, beaked whale and unidentified mammal). The numbers of sounds attributed to each category (acoustic cues) logged in the analysis are provided along with the number of individuals localized. The sperm and beaked echolocation clicks are logged as sequences, vice individual clicks. The minke 'boing' call count for the two time periods on 18 April 2006 show an increase of 79% at 18:34 vice 17:04. Insufficient information is currently available to base any hypothesis for this increase in 90 minutes, as the normal variations are unknown. The 102 minke 'boing' sounds logged, with eight individuals localized, on 15 April 2007 is higher than observed for either snapshot on 18 April 2006. While snapshot sample sizes are to small to understand normal variations, the analyst did comment that the 15 April 2007 boing sounds were not only more prevalent, but also of higher signal to noise ratio. This is logical in that the 15 April 2007 Minke boing situation would allow more localizations, indicating the animals are closer to the range, while the lower signal to noise ratio situation in April 2006 are consistent with the animals located off range at greater distances (lower signal to noise ratios and unable to localize individuals).

The humpback results in table 1 show the largest numbers of calls, 107, were logged on 18 April 2006 @ 18:34, while the largest number of individuals localized, 27, occurred on 18 April 2006 @ 17:04. The April 2007 call count (72) and localized individuals (19) are lower than numbers for April 2006. Humpbacks are known to begin their outward migration back to feeding grounds around this timeframe, which should be taken into consideration. It must be reiterated that these three snapshots in time are insufficient to allow any level of understanding of the normal variations. More results are needed to understand short term, mid-term and long term variations.

Table 1 – Summary results for two separate days (15 April 2007 @ 16:53-17:03, 18 April 2006 @ 16:59-17:09 and @ 18:29-18:39). Five categories provided (minke, humpback, sperm, beaked whale and un-identified mammals). Call counts logged (acoustic cues) and number of localized individuals shown. Future efforts may better identify some of the currently unidentified species sounds logged.

Sound source / Date & time	15-Apr-2007 16:53-17:03	18-Apr-2006 18:29-18:39	18-Apr-2006 16:59-17:09
Minke Whale (*Balaenoptera acutorostrata*)			
Call count logged in 10 minute period	102	29	16
Number of localized individuals	8	-	-
Humpback Whale (*Megaptera novaeangliae*)			
Call count logged in 10 minute period	72	107	87
Number of localized individuals	19	26	27
Sperm Whale (*Physeter macrocephalus*)			
Call count logged in 10 minute period	1	10	2
Beaked Whale (*Ziphiidae*)			
Call count logged in 10 minute period	2	-	-
Number of individuals located to specific area	1	-	-
Un-identified Mammal			
Call count logged in 10 minute period	30	23	22
Number of localized individuals	1	1	-

Table 1 also shows the very small detection numbers for both sperm whale and beaked whale echolocation click sequences. The limited amount of temporal data analyzed (three 10 minute snapshots) only provides confirmation of the presence of these species at these times due to their signals being detected. Sperm whales have been localized on other days data analysis, indicating that with enough snapshots the under sampling of their acoustic echolocation dive cycles might not be an issue. Beaked whale detections have not allowed localization to date due to the large separation of the originally sampled 24 broad band hydrophones. Some localization might be possible with the seven additional hydrophones added early in 2007 as they are spaced in two tighter clusters.

Discussion and Conclusions:

These results provide initial insight into the marine mammal presence on, or near, PMRF for three short, ten-minute, time periods on two separate days, 15 April 2007 and 18 April 2006. This sample size is extremely small and insufficient to make any generalized statements relative to numbers, and species, of marine mammals in the area on these days (only for these three snapshot points of time). Two periods of analysis were conducted on 18 April 2006 separated by only 90 minutes in time. Differences in spatial distributions are observed, but due to lack of understanding normal variations, no definitive conclusions can be made at this time.

This analysis is a start at providing new information into marine mammal density by species over time, for the waters near the Pacific Missile Range Facility. The limited amount of data analyzed does not currently lend itself to statistical analysis for making focused statements about marine mammal presence in the area. The data does inform us of the presence of three species on, or near, the range for both days with quantitative numbers for calls logged and individuals localized. The acoustic detection of a single beaked whale (suspect to be Blainville's) on 15 April 2007 is also significant, confirming presence of beaked whales in the area.

Additional data collections, and analysis, are required to gain more understanding of the normal variations of marine mammal presence at PMRF. Current methods can be utilized to analyze more acoustic snapshots. Future efforts are both underway, and planned for exploring more efficient ways to analyze data (develop and employ more automation). A close relationship also exists with the 2007 NOPP DECAF new start effort, which is focused on developing the statistical methodology for analysis of this type of data (PMRF humpback whale data is planned to serve as a test case for the DECAF effort).

It cannot be stressed enough that there are a number of caveats, which must be kept in mind when utilizing acoustic techniques such as this, for monitoring for marine mammal species. These caveats include:

1) Passive acoustic detection is only able to detect marine mammals which are emitting acoustic sound, and in the case of the PMRF hydrophones, specifically between 60 Hz and either 20 kHz or 48 kHz (hydrophone and PMRF system limitations) with sufficient acoustic energy to be detected.
2) Some species, such as the humpback whales, which are prevalent in this area between the months of Jan and April, typically only have males making sounds (mating song).
3) Each species has different frequency regions for various sounds, different acoustic beam patterns for emitted sounds, and different source levels. Thus, some sounds can be detected on many hydrophones (e.g. sperm whale slow clicks), while other sounds (such as beaked whale echolocation signals) may only be detected on a single hydrophone.
4) Movement, over time, confounds the technical issues in dealing with estimating species densities using distance sampling methodology. In part, this is one reason 'acoustic snapshots' are utilized in this analysis.
5) Species presence in the area may be seasonal (such as humpbacks), transitory, or they could be resident to the area.

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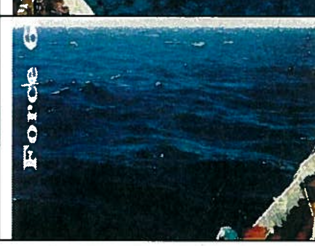
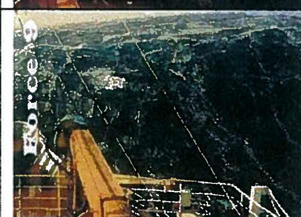
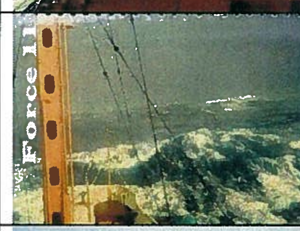
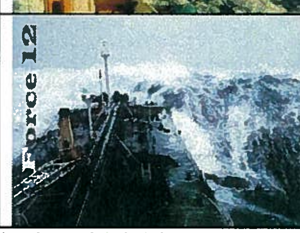
APPENDIX E- U.S. NAVY AND BEAUFORT SEA STATE CODES

Sea State	Beaufort Number	Wind Speed (kts)	Wind description	Beaufort Number Picture
0	0	< 1	Calm	
0	1	1-3	Light air	
1	2	4-6	Light breeze	
2	3	7-10	Gentle breeze	
3	4	11-16	Moderate breeze	
4	5	17-21	Fresh breeze	
5	6	22-27	Strong breeze	

Sea State	Beaufort Number	Wind Speed (kts)	Wind description	Beaufort Number Picture
6	7	28-33	Near gale	
7	8	34-40	Gale	
8	9	41-47	Strong gale	
9	10	48-55	Storm	
9	11	56-63	Violent storm	
9	12	>64	Hurricane	

* Photographs from National Weather Service Observing Handbook No. 1, US National Weather Service.

Prepared for
National Marine Fisheries Service
Office of Protected Resources

Prepared by
Department of the Navy

In accordance with
Biological Opinion 26 September 2007
National Defense Exemption 23 January 2007

U.S. Navy
HAWAII
UNDERSEA WARFARE EXERCISE
After Action Report
13-15 November 2007

SUBMITTED TO
Office of Protected Resources, National Marine Fisheries Service

10 March 2008

Abstract
This report presents an analysis of the effectiveness of the mitigation and monitoring measures as required under the Biological Opinion on the U.S. Navy's Proposed Undersea Warfare Training Exercises In the Hawaii Range Complex From January 2007 to January 2009

AND

Discussion of the nature of effects on marine mammals, if observed, under the National Defense Exemption (NDE) from the requirements of the Marine Mammal Protection Act (MMPA) for Mid-Frequency Active Sonar

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EXECUTIVE SUMMARY

- This report summarizes marine mammal sightings and provides an assessment of mitigation effectiveness for the U.S. Navy's Undersea Warfare Training Exercise conducted by the USS Tarawa Expeditionary Strike Group (ESG) from 13 to 15 November 2007 within the offshore waters of Hawaii.
- Over 216 hours of visual survey were conducted by U.S. Navy lookouts assigned to3 Mid-Frequency Active Sonar (MFAS)-equipped surface ships over the entire course of the exercise (3 days x 24 hrs/day = 72 hrs x 3 ships = 216). Of the 216 hours, 77 hours of MFAS time was reported from all sources including hull-mounted AN/SQS-53C, helicopter dipping sonar, and DICASS sonobuoys. These hours are reflective of MFAS use by various units including three MFAS-equipped ships geographically dispersed throughout the entire exercise area, and are not an indication of consecutive and continuous use.
- There were no sightings of marine mammals within NDE safety zones by U.S. Navy ships during USWEX 08-1. Sea states were high during some of the exercise period which may have limited sightings of smaller marine mammals.
- A dedicated USWEX monitoring program, separate from, but complimentary to the exercise participants, was used during USWEX 08-1. Two civilian (i.e. non-Navy) science teams conducted aerial surveys and a shipboard survey for marine mammals before, during, and after USWEX 08-1.
  - A pre- and post-exercise aerial survey was conducted by a civilian science crew from 11 to 12 November and 15 to 17 November. Over 17 hours of survey time was conducted, involving a linear distance of approximately 1,701 nm, as well as a circumnavigation survey around Oahu and Molokai. There were 26 marine mammal sightings, but only six of these sightings were at sea with the remaining 20 observed nearshore. There were no observations of any stranded or floating dead marine mammals.
  - A civilian science based research vessel conducted a visual monitoring survey for cetaceans and sea turtles from 11 to 17 November 2007. A total of 66 hours and approximately 492 nm were visually surveyed over seven days with a total of eight cetacean groups sighted. One whale was followed and observed during a time when it could have been exposed to MFAS transmission, but no unusual behavior was observed by the trained marine mammal observers on the research vessel.
- Based on the lack of marine mammal sightings from U.S. Navy lookouts during USWEX 08-1, the U.S. Navy's USWEX Environmental Assessment/Overseas Environmental Assessment (EA/OEA) acoustic modeling appears to very conservatively over-estimate the amount of potential acoustic exposures, including those to ESA-listed species. The degree of variability and over-predictive nature inherent within the acoustic impact model is based largely on the significant natural variability within the science of at-sea marine mammal surveys used to derive density estimates, and other model limitations.

INTRODUCTION

This report is presented to fulfill U.S. Navy and U.S. Pacific Fleet written reporting requirements conditional to the 23 January 2007 National Defense Exemption (NDE) from the Requirements of the Marine Mammal Protection Act (MMPA) for Certain DoD Military Readiness Activities that Employ Mid-Frequency Active Sonar (MFAS) or Improved Extended Echo Ranging Sonobuoys. In addition, these NDE mitigation measures are included in the 26 September 2007 *Biological Opinion (BO) on the U.S. Navy's Proposed Undersea Warfare Training Exercises (USWEX) In The Hawaii Range Complex From January 2007 to January 2009*. This report fulfills both the NDE and BO reporting requirements.

Language from USWEX BO (NMFS 2007).

5. Within 120 calendar days of completing an exercise the U.S. Navy shall provide the Chief, Endangered Species Division, Office of Protected Resources (with a copy provided to the Assistant Regional Administrator for Protected Resources in NMFS' Pacific Islands Regional Office) with a written report that shall include the following information:

a. Summary of the exercise (starting and ending date of the exercise, number of ships and aircraft involved in the exercise, and number of hours passive and active sonar was used during the exercise)

b. Specific mitigation measures Navy implemented during exercise;

c. Number of fin whales, humpback whales, sei whales, and sperm whales that (i) **had been detected within 500, 1,000 and 2,000 yards of a sonar dome during an active transmission** and (ii) the Navy's estimate of number of fin whales, humpback whales, sei whales, and sperm whales that had been exposed to MFAS at received levels equal to or greater than 173 dB and 190 dB.

d. Reports of the activity or activities that fin whales, humpback whales, sei whales, and sperm whales had been observed to exhibit while they were within 500, 1,000, and 2,000 yards of a sonar dome that was actively transmitting during exercise. (for example, a report should not identify "playing"; it should identify the behavior that allowed the observer to conclude the animal was "playing")

Reports of observations shall identify date, time, and visual conditions associated (for example, if the observation is produced from a helicopter, the report should identify the speed, vector, and altitude of the airship; the sea state, and lighting conditions) with observation; and how long an observer or set of observers maintained visual contact with a marine mammal;

e. an evaluation of the effectiveness of those mitigation measures at avoiding exposing endangered whales to ship traffic and endangered whales to mid-frequency active sonar. This evaluation shall identify the specific observations that support any conclusion U.S. Navy reaches about the effectiveness of the mitigation measures;

f. an evaluation of monitoring program's ability to detect marine mammals that occur within 500, 1,000, and 2,000 yards of a sonar dome, during an active transmission (or close enough to an exercise to be exposed to mid-frequency sonar at received levels equal to or greater than 173 dB re 1 $\mu Pa^2 \cdot s$) with specific evidence that supports any conclusions U.S. Navy reaches.

REPORT ORGANIZATION

This report contains only unclassified material, provides information and analysis for Undersea Warfare Exercise (USWEX) 08-1, and is submitted in fulfillment of NDE and BO written requirements.

The report is organized by section in the following order:

Section 1- Exercise Summary: provides exercise specific information including the starting and ending dates, the number of ships and aircraft participating, and the number of hours of MFAS used from all emitters.

Section 2- Biological Observations: provides an overview of marine mammal observations, and post-exercise derived remote sensing of potential oceanographic conditions.

Section 3- Mitigation Assessment: provides an estimated number of marine mammals observed during USWEX 08-1 potentially affected or not affected by Anti-submarine Warfare (ASW) operations, noting the nature of any observed effects where possible. Under the BO, this analysis is focused on marine mammal observations within 2,000 yards of a MFAS transmission. In addition, Section 3 assesses the effectiveness of the NDE and BO mitigation and monitoring measures required during the exercise with regard to power down and shut down zones when marine mammals are sighted within the vicinity of ships using MFAS.

Appendix A: lists the 29 NDE mitigation measures.

Appendix B: presents results of an aerial monitoring survey.

Appendix C: presents results of a ship monitoring survey.

BACKGROUND

USWEXs are ASW exercises conducted by the U.S. Navy's Carrier Strike Groups (CSG) and Expeditionary Strike Groups (ESG) while in transit from the west coast of the United States to the western Pacific Ocean. As a combined force, submarines, surface ships, and aircraft conduct ASW against submarine targets representing an opposing force. Submarine targets include real submarines, target drones that simulate the operations of an actual submarine, and virtual submarines interjected into the training events by exercise controllers. The primary event of each exercise involves between one to five surface ships equipped with sonar, with one or more helicopters, and a P-3 aircraft searching for one or more submarines.

Prior to the exercise marine species awareness training was provided to exercise participants. A Letter of Instruction (LOI) which reiterated the applicable NDE mitigation measures was also distributed to participants and explains procedures for reporting marine mammal sightings discussed in Section 2. The NDE measures are presented in **Appendix A**.

MFAS use by surface ships and aviation assets (dipping sonar and DICASS sonobuoys) is captured and added to the total sonar hours reported in this document. MFAS on Los Angeles-class (SSN) submarines is seldom used in tactical training scenarios.

SECTION 1 EXERCISE SUMMARY

EXERCISE PARTICIPANTS

USWEX 08-1 was conducted from 13 to 15 November 2007, and involved the USS Tarawa ESG (**Table 1 and Figure 1**). Participating units included ESG assigned ships (surface combatants, amphibious transport ships, submarines, and supply ships), and MFAS-equipped opposition forces (including submarines). Two SQS-53C MFAS-equipped ships and one SQS-56 MFAS-equipped ship participated in USWEX 08-1. However, there was minimum MFAS use by non-ESG assigned platforms because of either tactical considerations for surface ships and submarines or lack of MFAS capability (amphibious transport ships, supply ships). There were between two to four ASW-capable helicopters with dipping sonar available for training during the exercise on any given day, depending on maintenance availability. The number of helicopters used in any given exercise event is driven by tactical and training objectives. Depending upon the training scenario there were also one or two P-3 maritime patrol aircraft participating.

MITIGATION MEASURES FOLLOWED

All 29 mitigations measures as stated in the 23 January 2007 NDE (**Appendix A** were adhered to during USWEX 08-1. Those NDE measures include specific details for personnel training, established lookout and watchstander responsibilities, specific operating procedures, and described coordination and reporting requirements. Observation data from Navy lookout sightings for USWEX 08-1 is described in Section 2.

Total MFAS Use

During USWEX 08-1, a total 77 hours of MFAS time was reported from all sources including hull mounted, helicopter dipping, and DICASS sonobuoys. Key caveats to the derivation of this total are presented in Section 3.

Table 1. Exercise summary for USWEX 08-1 conducted within Hawaiian water from 13 to 15 November 2007.

Participants	Event Name	Dates	MFAS Use Reported (hours)
USS Tarawa ESG	USWEX 08-1	13-15 Nov 2007	77 hrs
Number of MFAS equipped surface ships:			3
Estimated number of ASW helicopters:			2-4: upper estimate assumes no helicopters down for maintenance; not all helicopters used at same time

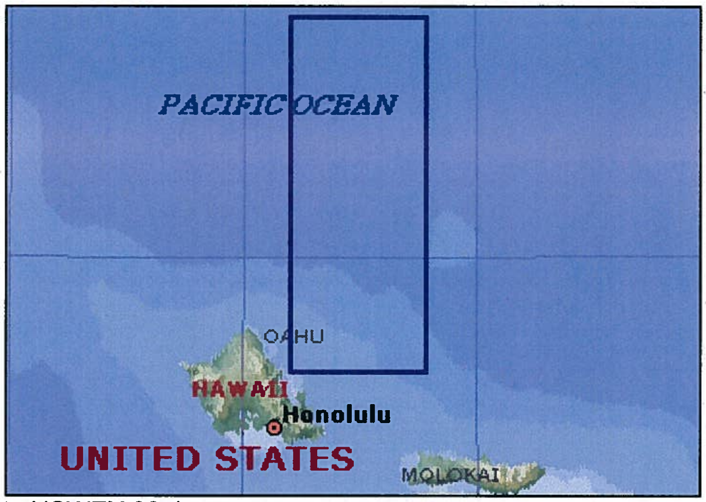

Figure 1. Approximate USWEX 08-1 area. Note: this area represents regions with U.S. Navy visual survey during exercise and does not imply full operational area. Base figure from Microsoft Encarta Map: http://encarta.msn.com/encnet/features/mapcenter/map.aspx

SECTION 2 BIOLOGICAL OBSERVATIONS

Section 2 provides an overview of marine mammal observations that require reporting under the Terms and Conditions of the National Marine Fisheries Service BO (NMFS 2007).

The biological summary in this section includes counts of the total numbers of marine mammals sighted and species guilds, estimates of the number of marine mammals observed within 2,000 yards of sonar source during MFAS transmission, and a science-based discussion on the likely species present in Hawaii during the time of year of this exercise.

USWEX 08-1 BIOLOGICAL OBSERVATIONS

There were no marine mammal sightings by USWEX participants.

Figure 1 shows the approximate area covered by U.S. Navy exercise participants using ship-board lookouts during USWEX 08-1. Given the time of year this exercise occurred (November) likely ESA species present in Hawaii include humpback whales, sei whales, and sperm whales. Blues whales are rare, with only one confirmed fall/winter sighting in Hawaiian waters. Fin whales are not present in high densities, but appear to be seasonal migrants.

MARINE MAMMAL SURVEYS

A dedicated USWEX monitoring program, separate from but complementary to the observations conducted by the exercise participants, was used during USWEX 08-1. Two civilian (non-Navy) science teams conducted aerial surveys and a ship survey for marine mammals before, during, and after USWEX 08-1. Results are described below and in more detail in **Appendix B** and **C**.

Aerial survey- Aerial surveys were performed in support of USWEX 08-1 on November 11 and 12 and from 15 to 17, 2007 (**Figure 2** and **Appendix B**). The purpose of these surveys was to detect, locate, and identify all marine mammals and sea turtles observed within a 2,384 square mile (6,174 km^2) grid; and during circumnavigation of the islands of Oahu and Molokai. For marine mammal species, additional observation time was spent characterizing behavior at the time of sighting. Target species were observed on two of the five survey days, primarily corresponding to those days with more favorable seastate conditions. Some species (e.g., sea turtles) were more easily detected during circumnavigation. For marine mammal species, additional observation time was spent characterizing behavior at the time of sighting. Aerial survey effort comprised of 17 hours of survey time and involved a linear distance of approximately 1,701 nm (3,150 km). A total of 26 sightings of five identified species (green sea turtles, short-finned pilot whales, Hawaiian spinner dolphins, bottlenose dolphins, and Hawaiian monk seals) and four unidentified species (*Stenella* species, unidentified turtle, dolphin, and whale) were recorded. Based on behavioral observation of the marine mammal species, no indications of distressed or unusual behavior were documented. The circumnavigation survey (Nov. 15) yielded no evidence of stranded or near stranded animals.

Ship survey- A civilian research vessel visual survey for cetaceans and sea turtles was conducted from 11 to 17 November 2007 in Hawaiian waters East and Northeast of Oahu (**Figure 3** and **Appendix C**). The purpose of these surveys was to monitor, identify, and report surface behavior of marine mammals observed before, during, and after the scheduled training exercise; particularly any injured or harmed marine mammals and/or any unusual behavior or changes in behavior, distribution, and numbers of animals. Another goal was to attempt to remain within view of any opportunistically encountered Navy vessels while conducting surveys and focal sessions. The ship survey effort was focused in a designated survey box approximately 30 nm wide by 70 nm long (~55 km by ~130 km). To meet the survey's goals, systematic line-transect surveys and focal animal behavior sessions were conducted. The ship survey effort focused on priority species including beaked whales, and federally listed species (e.g., sperm, blue, fin, humpback, and sei whales). Experienced marine mammal observers conducted visual observations in the Survey Box using the naked eye, handheld binoculars, and two sets of "Big Eyes" binoculars. The primary objectives were to collect location data and scan samples of behavior of all cetaceans encountered, and to locate, in particular, priority cetaceans for the purposes of conducting focal behavior follows. Another objective was to collect bathythermograph (XBT) data during the survey.

The survey totaled 66 hours and covered a distance of 492 nm (911 km). Most (90% or 817 km) consisted of line transect survey effort, 57 nm (105 km) of which occurred while Navy vessels were within view. A total of 34 nm (7 % of 63 km) of the total 492 nm consisted of focal animal observations. Navy vessels were opportunistically encountered on 13 and 14 November and were within view for a total of 8 hours at distances of over 3 nm (5.6 km). Beaufort (Bf) sea state ranged from 1 to 6, with most observations conducted in a Bf 5 (40%), followed by Bf 3 (27%) then Bf 4 (23%). A total of eight cetacean groups were sighted during the entire seven-day cruise. No sea turtles were sighted. Five cetacean species were confirmed during the entire survey period: sei whales, Brydes' whale, humpback whales, Risso's dolphins, and spinner dolphins. One unidentified small whale was observed and considered to be a probable Cuvier's beaked whale. In addition, a small group of medium-sized delphinids (considered to be probable pygmy killer whales) were sighted. A total of two sightings of sei whales were made on two different days. Extended focal follows were conducted on four cetacean sightings: a single sei whale, a single Bryde's whale, a group of three subadult sei whales, and a group of three humpback whales. Focal sessions ranged in duration from 50 - 145 minutes, with the longest continuous observation session of 145 minutes occurring with a single sei whale. Because sei and Bryde's whales can easily be confused, the survey team stayed with these focal animals until a positive identification was made and documented with photographs and detailed survey observations on natural history characteristics by senior observers. This included the first verified sighting of a Bryde's whale in the main Hawaiian Islands and sightings of a rare sei whale and subadult sei whales.

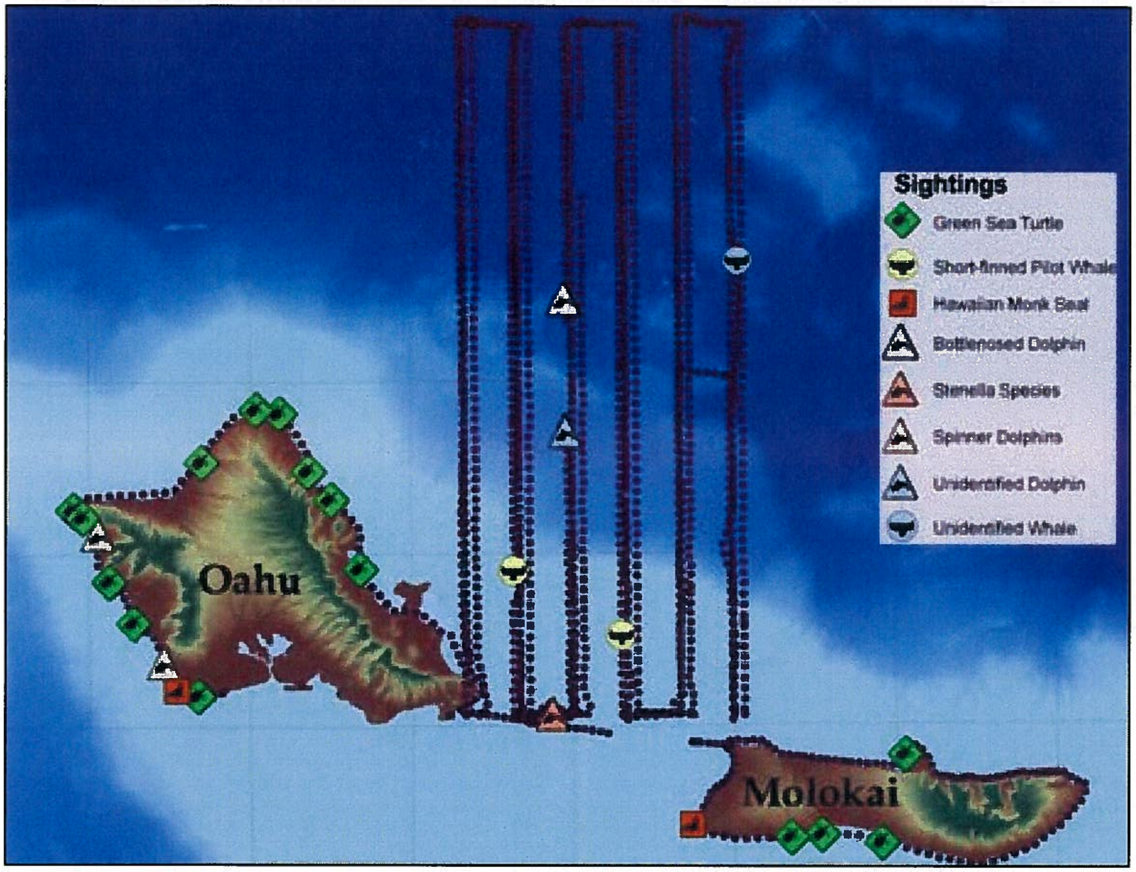

Figure 2. Plot of marine mammal sightings conducted by civilian aerial survey during 11-12 and 15-17 November 2007.

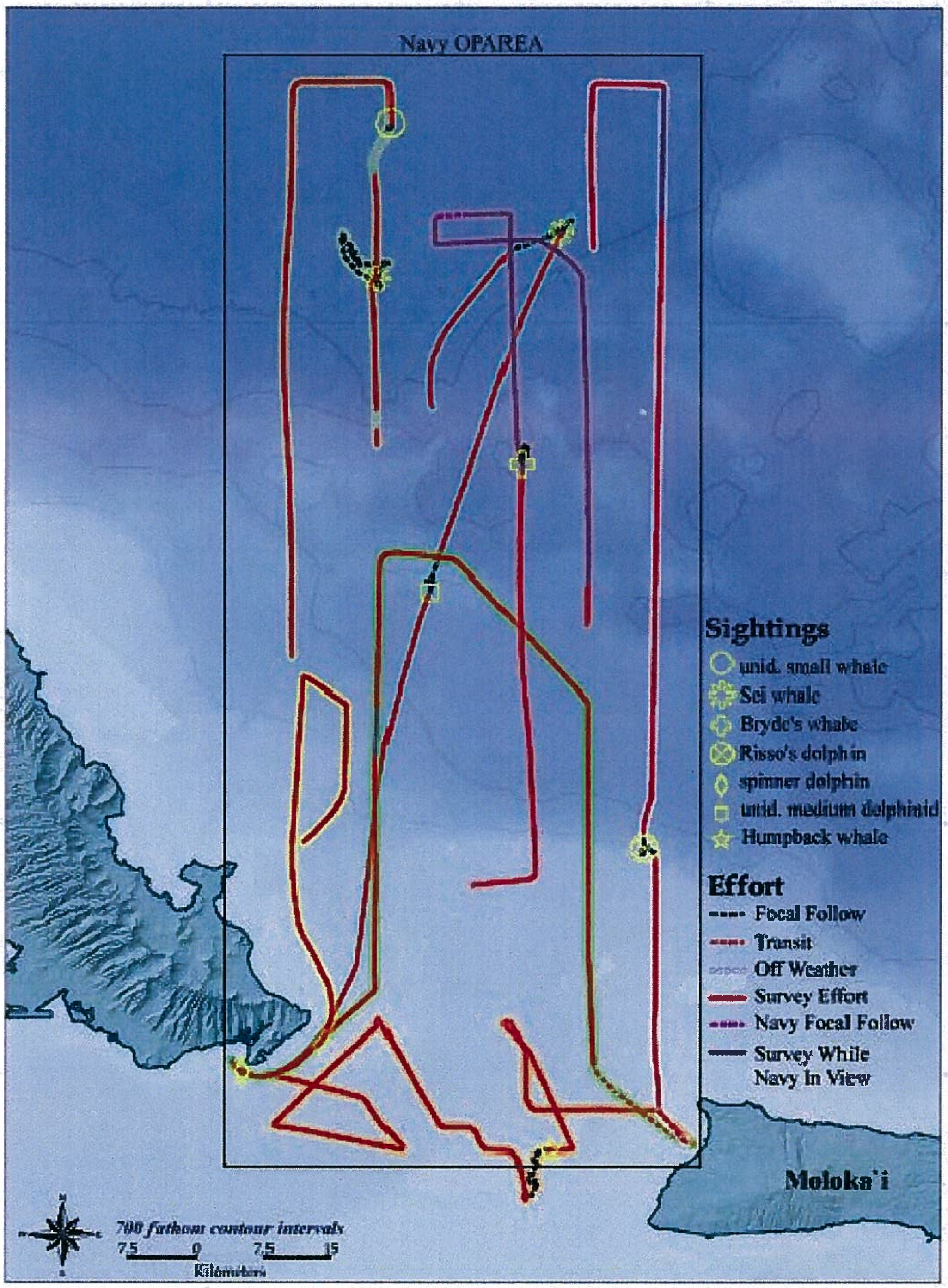

Figure 3. Plot of marine mammal sightings conducted by civilian ship survey during11-17 November 2007.

SECTION 3 MITIGATION ASSESSMENT

USWEX 08-1 ASSESSMENT

OVERVIEW

The NDE calls for the U.S. Navy to submit a report to NMFS that includes a discussion of the nature of any effects or lack of effects based on modeling results and marine mammal sightings. In addition, the BO Terms and Conditions require a report that evaluates the mitigation measures and details results from the U.S. Navy's exercise monitoring and reporting program. In this case, the mitigation measures under the BO are the NDE measures, therefore the discussion is presented together in this section.

This section provides an assessment of the effectiveness of the mitigation and monitoring measures. The section includes discussion of observations during MFAS transmission, limitations of passive sonar detection, other effects (i.e. vessel strikes), comparison of pre-exercise acoustic model impact predictions with actual USWEX 08-1 observations, and NDE and BO conclusions.

ASW proceeds slowly and requires careful development of a tactical frame of reference over time. Data is integrated from a number of sources and sensors. Once MFAS is turned off for a period of time, turning it back on later does not usually allow a commander to simply continue from the last frame of reference. Lost MFAS time not only equates to lost exercise time, but has a broader, overall impact on the tempo and development of a "tactical picture" shared among exercise participants as they train toward the goal of improving ASW skills in general.

Mitigation measures were designed to minimize interactions between marine mammals and Navy assets employing MFAS levels that have potential to result in a Temporary Threshold Shift (TTS) or Permanent Threshold Shift (PTS) as described in DoN 2007. Navy ships were not tasked nor expected to maintain contact with marine mammals sighted for purposes of monitoring requirements. To do so would have unnecessarily interfered with military readiness activities and ma result in concerns that Navy ships were intentionally harassing marine mammals.

MFAS TRANSMISSION

As in any review of the operational aspects of U.S. Navy ASW operations using MFAS, specific source levels, numbers of sources, and frequencies of sonars used during USWEX 08-1 are classified since this information provides potential adversaries with critical tactical data. The following discussion is focused on the 1) amount of time spent visually searching the ocean for marine mammals, 2) the amount of time conducting MFAS (as required to be reported under the NMFS BO), and 3) a discussion of individual events when MFAS was active and marine mammals were spotted within 2,000 yards.

1) Visual sighting effort: Visual sighting effort by ship for USWEX 08-1 can be approximated given the numbers of days this major exercise occurred (3 days), the number of hours per day (24 hours), the normal standard operating procedure for all vessels to have at least 3 lookouts on watch and scanning the ocean at all times (24/7), and the presence of 3 MFAS-equipped vessels. Therefore, 216 hours of MFAS surface ship visual survey effort for marine mammals occurred during USWEX 08-1 (3 days x 24 hrs/day = 72 hrs x 3 ships = 216). This accounts for time conducting both MFAS and non-MFAS events .

2) MFAS use: During USWEX 08-1, 77 hours of MFAS time were reported from all sources including hull-mounted 53C, helicopter dipping sonar, and DICASS sonobuoys (**Table 1**). These hours are reflective of MFAS use by various units geographically dispersed over the entire exercise area (**Figure 1**), and are not an indication of consecutive and continuous use (i.e. NOT 77 hours/24 hours (per day) = 3.2

days; A closer approximation would have to account for potential concurrent use by several units including up to three MFAS ships and aviation units).

It should be noted that MFAS is only used for a relatively small subset of any given major exercise. A USWEX's major focus is short-duration undersea warfare training. Seventy-seven hours of MFAS use represents less than 36% of the total ship visual observation effort (77/216 = 36%). In addition, total active sonar hours, as presented in this report, represent a sum of the total MFAS time from a number of individual training events during USWEX 08-1. Individual units record when MFAS is first used at the beginning of a training event and the time the event is finished. The sonar "on period" is conservative in that it does not account for the time MFAS is to in transmit mode due to tactical or maintenance reasons. Therefore, based on standardized reporting protocols the number of MFAS hours does not represent actual total sonar ping hours. Furthermore, during periods when there is an active transmission, MFAS puts sound into the water at discrete intervals. Sonar signals are not a continuous source of acoustic energy. A surface ship sonar signal consists of a pulse (i.e. ping) significantly less than one to two seconds long with time between successive pings as much as 30 seconds (NMFS 2007). During typical active sonar use, MFAS is silent for the vast majority of the time. This was the case for USWEX 08-1.

Biological Observations During MFAS: The civilian research vessel marine mammal survey described previously and in **Appendix C** followed a Bryde's whale on 13 November while a U.S. Navy ship was visible from the survey ship. However, based on MFAS reports from exercise participants on 13 November, there were NO MFAS transmissions from the ship observed by the survey authors.

There was another exercise participant not visible to the survey ship along a different bearing that did conduct two hours of MFAS transmission on 13 November at approximately the same time as the Bryde's whale sighting. This MFAS-equipped vessel was approximately 50 nm away. Using a VERY CONSERVATIVE approach to open ocean sonar propagation derived from Urick 1983, an estimation of potential transmission loss and therefore potential receive level (RL) at the whale can be made:

TL = 10Log(Range in meters) + 30 + (absorption coefficient in dB/meter x Range in meters)

(see: http://www.fas.org/man/dod-101/navy/docs/es310/SNR_PROP/snr_prop.htm)

Given the nominal 235 dB source level for U.S. Navy hull mounted MFAS and based on the formula above, estimated RL at the animal under observation by the survey ship may have been around 141 dB. It should be noted that this calculation would potentially represent the maximum RL and is not reflective of actual real world oceanographic conditions and their effects on propagation on the 13th. However, no adverse or unusual behavior by the Bryde's whale was observed by the trained marine mammal observers on the civilian survey ship.

3) MFAS Events: There were no instances of MFAS having to be powered down or secured due to sightings of marine mammals within NDE safety zones.

PASSIVE SONAR

Passive sonar involves acoustic listening to underwater sounds and does not involve transmitting active sound into the water column. Passive sonar use is driven by the tactical nature of an ASW or training event, and should be employed whenever possible. Given the nature of passive sonar technology and underwater sound propagation, localizing or determining range and absolute position of a marine mammal is generally not possible or exceedingly difficult with any single ship-based passive sonar.

Also, there is no current technology on U.S. Navy MFAS-equipped ships to easily localize marine mammals in real time using passive detection.

In addition, passive sonar can only detect marine mammals that are actually vocalizing (i.e. making underwater sound as part of communication and echolocation). Marine mammals do not always vocalize based on individual needs at a particular moment, species-level foraging and mating strategies, and other oceanographic or biological factors. Depending on oceanographic conditions and animal source levels, when marine mammals do vocalize, sounds can easily travel 1 to several 10s of kilometers (km) (0.5 nautical mile (nm) to 10s of nm) for some mid-to-low frequency animals, and 10s to 100s of km for very low frequency baleen whales (i.e. blue and fin whales). These ranges demonstrate that even if the marine mammal vocalization can be detected, it does not mean the mammal is necessarily close to a ship or bottom-mounted range hydrophone.

MODELING ESTIMATES APPLICABLE TO USWEX 08-1

For the USWEX EA/OEA (DoN 2007) an estimate of potential acoustic exposures to marine mammals was generated in support of the NEPA process. **Table 2** lists possible marine mammal species occurring in Hawaii based solely on *estimated* distribution and abundance, but does not take into account potential seasonal distribution. This table highlights the ESA-listed species described in the USWEX BO (NMFS 2007), and shows estimated potential acoustic exposures derived from acoustic impact modeling (DoN 2007 USWEX EA/OEA). **Table 2** shows estimated marine mammal acoustic exposures from model-derived calculations based on estimated marine mammal densities, operational parameters, sound transmission loss, and potential energy accumulated based strictly on pre-exercise acoustic impact modeling (DoN 2007). The exercise-specific model estimated total potential exposures over two years of Hawaii USWEXs. Extrapolating for a single exercise as in Table 2 estimates 5,153 Level B potential exposures for all marine mammals (5,116 sub-TTS Level B, 37 TTS Level B).

Given that no marine mammals were visually sighted during USWEX 08-1, no assessment of species exposures can be made, but in comparison with pre-exercise predictions, it's apparent that pre-exercise predictions are exceedingly high and not reflective of actual animal occurrence in the USWEX 08-1 exercise area during November. This is evidenced by the lack of U.S. Navy ship sightings (n= 0 over 3 days) and low at-sea sightings by concurrent civilian science surveys (ship based: n= 9 sightings over 7 days, however, 2 of these 9 sightings were made close to shore where U.S. Navy exercise participants did not travel; aerial based: n= 6 sightings, of which 1 was coastal).

FINAL NDE AND BO ASSESSMENT

1) All measures promulgated in the 23 January 2007 *Mid-Frequency Active Sonar Mitigation Measures during Major Training Exercises or within Established DoD Maritime Ranges and Established Operating Areas* (NDE) were implemented before and during USWEX 08-1.

2) In addition to the above assessment of the NDE, the BO calls for a report that evaluates the effectiveness of the U.S. Navy's exercise mitigation measures. The three categories of measures (Personnel Training, Lookout and Watchstander Responsibilities, and Operating Procedures), as outlined in the NDE, are effective in detecting and responding appropriately to the presence of marine mammals, when visually observed. Fleet commanders and ship watch teams continue to improve individual awareness and enhance reporting through various pre-exercise conferences, lessons learned, and after action reports. The NDE safety zones are adhered to and vessels apply mitigation when marine mammals are visually observed within a zone. The U.S. Navy acknowledges that this discussion does not account for potential marine mammal species not visually observed, which is a difficult determination even within the marine mammal scientific survey community. Deep diving animals, if exposed, may not be exposed to significant sound levels for long periods of time, given the moving nature of ship MFAS use and the limited pings from lower power aviation deployed MFAS systems (dipping sonar, sonobuoys). For instance, during a one hour dive by a beaked whale or sperm whale, a MFAS ship moving at a nominal 10

knot speed would cover about 10 nm from its original location, well beyond ranges predicted to have significant exposures. For cryptic, hard to spot species when at the surface such as beaked whales, real-time detection is difficult given any U.S. Navy or non-Navy science tool presently available.

3) NMFS (2007) USWEX BO Terms and Conditions require the U.S. Navy to estimate the number of ESA-listed marine mammals that may have been exposed to received energy level equal to or greater than 173 dB and 190 dB re 1 $\mu Pa^2 \cdot s$. No estimate can be provided given lack of marine mammal observations from MFAS transmitting ships.

There was a single instance when a Bryde's whale was under direct and continuous observation by observers on board a civilian marine mammal research vessel while MFAS transmission was occurring during USWEX 08-1. At the time of this observation, the research vessel observed a Navy ship in the area. Post-exercise analysis revealed that the ship observed by the research vessel was not transmitting MFAS. However, additional post-exercise analysis indicated that ships not observed by the research vessel were transmitting resulting in a potential exposure of this Bryde's whale to a received level of approximately 141 dB re 1 $\mu Pa^2 \cdot s$. No adverse or abnormal behavioral reactions were noted by the marine mammal observers on board the research vessel.

4) From **Table 2**, a single USWEX would be expected to potentially expose 1,884 ESA-listed marine mammals from all MFAS sources to potential Level B exposures based solely on pre-exercise predicted impact models. However, no potential ESA-listed marine mammals were actually observed during USWEX 08-1 at ranges that may have exposed them to Sound Exposure Level (SEL) greater than 173 dB and 190 dB re 1 $\mu Pa^2 \cdot s$. Humpback whales had the largest pre-exercise predicted exposures, yet November is early for their summer migration to the Hawaii wintering ground. While there was a single humpback whale sighting by the civilian ship visual survey, the location of this sighting was significantly greater than 50 nm from the nearest MFAS use during USWEX 08-1. Given one confirmed humpback shale sighting, the low population density early in the humpback whale season, their typical shallow-water distribution, and the at-sea distances between exercise participants, it is improbable that humpback whales were exposed to MFAS during USWEX 08-1. Blue whales and fin whales in Hawaii are rarer and likewise were potentially not present in the waters north of Oahu during USWEX 08-1 and likely not exposed (**Figure 1**).

5) For all of USWEX 08-1 marine mammal sightings from pre, during, and post-exercise civilian monitoring, there was no obvious indication or report that any animal behaved in a manner not associated with normal movement, or foraging.

Data Limitations and Improvements

There is no information from which to assess how many, if any, animals not observed by Navy lookouts may or may not have been exposed to MFAS received levels greater than 173 dB and 190 dB re 1 $\mu Pa^2 \cdot s$.

Data collection needed to address this question will be reviewed as they become available for potential incorporation into future exercises, although this remains a problematic science issue for even non-Navy marine mammal surveys. Real-time passive sonar systems used by the U.S. Navy, and to some degree by most of the marine mammal science community, lack the ability to automatically classify detected species, although there is substantial academic research into improving this capability. Most current passive data sets rely on extensive post-collection analysis by skilled subject matter experts to conclusively establish species identification. In addition to species classification, range detection using moving passive acoustic systems on U.S. Navy ships is limited in real time to the typical 8-10 knot speeds at which many ASW training events occur. Indeed, if passive range detection of any submerged contacts (submarines or marine mammals) was more advanced and easier, then there would be less tactical reliance on active sonar systems. Also, non-vocalizing marine mammals cannot currently be detected using passive systems.

The U.S. Navy continues conducting robust and realistic exercises, and development of long-term range complex monitoring plans. The goal of these plans is to integrate multiple tools such as surveys in an effort to generate better assessments of marine mammal occurrence and possible MFAS effects, or lack thereof. In accordance with the USWEX BO, data collection needs to address unresolved questions regarding likely area-specific species composition and the potential for alternative detection technologies to be incorporated into future exercises as the U.S. Navy's exercise monitoring program evolves.

Table 2. Total estimated annual exposures based on pre-exercise modeling for MFAS sonar from DoN 2007 (USWEX EA/OES) based on six exercise per year ((*left two columns*), and estimated exposures per exercise (estimated total exposures divided by six) (*right two columns*).

Species	Occurrence Status Within Hawaiian Waters	Annual USWEX potential exposures n =6 exercises (DoN, 2007)		Estimated singe exercise exposures	
		Level B Sub TTS	Level B TTS	Level B Sub TTS	Level B TTS
ESA-listed					
Blue whale	Rare	0	0	0	0
Fin whale	Rare	48	0	8	0
Humpback whale	Seasonal, Nov-Apr	10,273	49	1,712	8
Sei whale	Rare	21	0	4	0
Sperm whale	Regular, Year round	905	3	151	1
Non-ESA listed				0	0
Blainville's beaked whale	Regular, Year round	285	1	48	0
Bottlenose dolphin	Regular, Year round	775	7	129	1
Bryde's whale	Regular, Year round	96	0	16	0
Cuvier's beaked whale	Regular, Year round	1,490	6	248	1
Dwarf sperm whale	Regular, Year round	2,182	12	364	2
False killer whale	Regular, Year round	109	2	18	0
Fraser's dolphin	Regular, Year round	2,045	20	341	3
Killer whale	Infrequent, Year round	71	1	12	0
Longman's beaked whale	Regular, Year round	85	0	14	0
Melon-headed whale	Regular, Year round	408	2	68	0
Minke whale	Seasonal, Nov-Apr	0	0	0	0
Pygmy killer whale	Regular, Year round	106	2	18	0
Pygmy sperm whale	Regular, Year round	839	5	140	1
Pantropical spotted dolphin	Regular, Year round	2743	26	457	4
Risso's dolphin	Regular, Year round	276	2	46	0
Rough-toothed dolphin	Regular, Year round	2,832	41	472	7
Short-finned pilot whale	Regular, Year round	1,849	12	308	2
Spinner dolphin	Regular, Year round	1,957	18	326	3
Striped dolphin	Regular, Year round	1,303	13	217	2
Monk seal	Regular, Year round	0	0	0	0
TOTAL:		30,699	222	**5,116**	**37**

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NMFS, 2007. Biological Opinion (BO) on the U.S. Navy's Proposed Undersea Warfare Training Exercises (USWEX) In The Hawaii Range Complex From January 2007 to January 2009- 26 September 2007. Office of Protected Resources, National Marine Fisheries Service, Silver Springs, MD.

APPENDIX A- NDE MEASURES

NDE

NDE mitigation measures include:

I. General Maritime Protective Measures: Personnel Training:

1. All lookouts onboard platforms involved in ASW training events will review the NMFS approved Marine Species Awareness Training (MSAT) material prior to use of mid-frequency active sonar.
2. All Commanding Officers, Executive Officers, and officers standing watch on the bridge will have reviewed the MSAT material prior to a training event employing the use of MFAS.
3. Navy lookouts will undertake extensive training in order to qualify as a watchstander in accordance with the Lookout Training Handbook (NAVEDTRA 12968-B).
4. Lookout training will include on-the-job instruction under the supervision of a qualified, experienced watchstander. Following successful completion of this supervised training period, Lookouts will complete the Personal Qualification Standard program, certifying that they have demonstrated the necessary skills (such as detection and reporting of partially submerged objects). This does not preclude personnel being trained as lookouts counted as those listed in previous measures so long as supervisors monitor their progress and performance.
5. Lookouts will be trained in the most effective means to ensure quick and effective communication within the command structure in order to facilitate implementation of protective measures if marine species are spotted.

II. General Maritime Protective Measures: Lookout and Watchstander Responsibilities:

6. On the bridge of surface ships, there will always be at least three people on watch whose duties include observing the water surface around the vessel.
7. In addition to the three personnel on watch noted previously, all surface ships participating in ASW exercises will have at all times during the exercise at least two additional personnel on watch as lookouts.
8. Personnel on lookout and officers on watch on the bridge will have at least one set of binoculars available for each person to aid in the detection of marine mammals.
9. On surface vessels equipped with MFAS, pedestal mounted "Big Eye" (20x110) binoculars will be present and in good working order to assist in the detection of marine mammals in the vicinity of the vessel.
10. Personnel on lookout will employ visual search procedures employing a scanning methodology in accordance with the Lookout Training Handbook (NAVEDTRA 12968-B).
11. After sunset and prior to sunrise, lookouts will employ Night Lookouts Techniques in accordance with the Lookout Training Handbook.
12. Personnel on lookout will be responsible for reporting all objects or anomalies sighted in the water (regardless of the distance from the vessel) to the Officer of the Deck, since any object or disturbance (e.g., trash, periscope, surface disturbance, discoloration) in the water may be indicative of a threat to the vessel and its crew or indicative of a marine species that may need to be avoided as warranted.

III. Operating Procedures

13. A Letter of Instruction, Mitigation Measures Message or Environmental Annex to the Operational Order will be issued prior to the exercise to further disseminate the personnel training requirement and general marine mammal protective measures.

14. Commanding Officers will make use of marine species detection cues and information to limit interaction with marine species to the maximum extent possible consistent with safety of the ship.

15. All personnel engaged in passive acoustic sonar operation (including aircraft, surface ships, or submarines) will monitor for marine mammal vocalizations and report the detection of any marine mammal to the appropriate watch station for dissemination and appropriate action.

16. During MFAS operations, personnel will utilize all available sensor and optical systems (such as Night Vision Goggles to aid in the detection of marine mammals.

17. Navy aircraft participating in exercises at sea will conduct and maintain, when operationally feasible and safe, surveillance for marine species of concern as long as it does not violate safety constraints or interfere with the accomplishment of primary operational duties.

18. Aircraft with deployed sonobuoys will use only the passive capability of sonobuoys when marine mammals are detected within 200 yards of the sonobuoy.

19. Marine mammal detections will be immediately reported to assigned Aircraft Control Unit for further dissemination to ships in the vicinity of the marine species as appropriate where it is reasonable to conclude that the course of the ship will likely result in a closing of the distance to the detected marine mammal.

20. Safety Zones - When marine mammals are detected by any means (aircraft, shipboard lookout, or acoustically) within 1,000 yards of the sonar dome (the bow), the ship or submarine will limit active transmission levels to at least 6 dB below normal operating levels.

(i) Ships and submarines will continue to limit maximum transmission levels by this 6 dB factor until the animal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yards beyond the location of the last detection.

(ii) Should a marine mammal be detected within or closing to inside 500 yards of the sonar dome, active sonar transmissions will be limited to at least 10 dB below the equipment's normal operating level. Ships and submarines will continue to limit maximum ping levels by this 10 dB factor until the animal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yards beyond the location of the last detection.

(iii) Should the marine mammal be detected within or closing to inside 200 yards of the sonar dome, active sonar transmissions will cease. Sonar will not resume until the animal has been seen to leave the area, has not been detected for 30 minutes, or the vessel has transited more than 2,000 yards beyond the location of the last detection.

(iv) Special conditions applicable for dolphins and porpoises only: If, after conducting an initial maneuver to avoid close quarters with dolphins or porpoises, the Officer of the Deck concludes that dolphins or porpoises are deliberately closing to ride the vessel's bow wave, no further mitigation actions are necessary while the dolphins or porpoises continue to exhibit bow wave riding behavior.

(v) If the need for power-down should arise as detailed in "Safety Zones" above, Navy shall follow the requirements as though they were operating at 235 dB - the normal operating level (i.e., the first power-down will be to 229 dB, regardless of at what level above 235 sonar was being operated).

21. Prior to start up or restart of active sonar, operators will check that the Safety Zone radius around the sound source is clear of marine mammals.

22. Sonar levels (generally) – The ship or submarine will operate sonar at the lowest practicable level, not to exceed 235 dB, except as required to meet tactical training objectives.

23. Helicopters shall observe/survey the vicinity of an ASW exercise for 10 minutes before the first deployment of active (dipping) sonar in the water.

24. Helicopters shall not dip their sonar within 200 yards of a marine mammal and shall cease pinging if a marine mammal closes within 200 yards after pinging has begun.

25. Submarine sonar operators will review detection indicators of close-aboard marine mammals prior to the commencement of ASW operations involving active mid-frequency sonar.

26. Increased vigilance during major ASW training exercises with tactical active sonar when critical conditions are present.

Based on lessons learned from strandings in Bahamas 2000, Madeiras 2000, Canaries 2002, and Spain 2006, beaked whales are of particular concern since they have been associated with MFAS operations. Navy should avoid planning major ASW training exercises with MFAS in areas where they will encounter conditions which, in their aggregate, may contribute to a marine mammal stranding event.

The conditions to be considered during exercise planning include:

(1) Areas of at least 1000 m depth near a shoreline where there is a rapid change in bathymetry on the order of 1000-6000 meters occurring across a relatively short horizontal distance (e.g., 5 nm).

(2) Cases for which multiple ships or submarines ($\geq$ 3) operating MFAS in the same area over extended periods of time ($\geq$ 6 hours) in close proximity ($\leq$ 10NM apart).

(3) An area surrounded by land masses, separated by less than 35 nm and at least 10 nm in length, or an embayment, wherein operations involving multiple ships/subs ($\geq$ 3) employing MFAS near land may produce sound directed toward the channel or embayment that may cut off the lines of egress for marine mammals.

(4) Although not as dominant a condition as bathymetric features, the historical presence of a significant surface duct (i.e. a mixed layer of constant water temperature extending from the sea surface to 100 or more feet).

If the major exercise must occur in an area where the above conditions exist in their aggregate, these conditions must be fully analyzed in environmental planning documentation. Navy will increase vigilance by undertaking the following additional protective measure:

A dedicated aircraft (Navy asset or contracted aircraft) will undertake reconnaissance of the embayment or channel ahead of the exercise participants to detect marine mammals that may be in the area exposed to active sonar. Where practical, advance survey should occur within about two hours prior to MFA sonar use, and periodic surveillance should continue for the duration of the exercise. Any unusual conditions (e.g., presence of sensitive species, groups of species milling out of habitat, any stranded animals) shall be reported to the Officer in Tactical

Command (OTC), who should give consideration to delaying, suspending or altering the exercise.

All safety zone requirements described in Measure 20 apply.

The post-exercise report must include specific reference to any event conducted in areas where the above conditions exist, with exact location and time/duration of the event, and noting results of surveys conducted.

IV. Coordination and Reporting

27. Navy will coordinate with the local NMFS Stranding Coordinator for any unusual marine mammal behavior and any stranding, beached live/dead or floating marine mammals that may occur at any time during or within 24 hours after completion of mid-frequency active sonar use associated with ASW training activities.

28. Navy will submit a report to the OPR, NMFS, within 120 days of the completion of a Major Exercise. This report must contain a discussion of the nature of the effects, if observed, based on both modeled results of real-time events and sightings of marine mammals.

29. If a stranding occurs during an ASW exercise, NMFS and Navy will coordinate to determine if MFAS should be temporarily discontinued while the facts surrounding the stranding are collected.

APPENDIX B- RESULTS FROM USWEX 08-1 AERIAL MONITORING

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<u>Final Report</u>: Aerial Surveys of Marine Mammals Performed in Support of USWEX Exercises

Nov. 11-17, 2007

Photo by J. Mobley, NOAA Permit No. 810

Submitted to:

Environmental Division

Commander, U.S. Pacific Fleet

Submitted by:

Joseph R. Mobley, Jr., PhD

dba: Marine Mammal Research Consultants

Date: January 28, 2008

Summary

Aerial surveys were performed in support of the US Navy Undersea Warfare Exercise (USWEX) on November 11-12 and 15-17, 2007. The mission was to detect, locate and identify all marine mammal and sea turtle species observed within a specified 6,174 km^2 grid (Figure 1) and during circumnavigation of the islands of Oahu and Molokai. For marine mammal species, additional observation time was spent characterizing behavior at the time of sighting. Target species were observed on two of the five survey days, primarily corresponding to those days with more favorable seastate conditions and the greater visibility of some species (e.g., sea turtles) during circumnavigation (Table 1). Effort comprised 17.15 hrs of survey time, involving a linear distance of approximately 3,150 km. A total of 26 sightings were recorded involving five identified species (Green sea turtles, short-finned pilot whales, Hawaiian spinner dolphins, bottlenose dolphins and Hawaiian monk seals) and four unidentified species (*Stenella* species, unidentified turtle, dolphin and whale) (Tables 2-3). Based on behavioral observation of the marine mammal species, no indications of distressed or unusual behavior were seen. The circumnavigation survey (Nov. 15) yielded no evidence of stranded or near stranded animals.

Background

The US Navy Undersea Warfare Exercise (USWEX) was proposed as an advanced Anti-Submarine Warfare Exercise to be conducted by U.S. Navy Carrier Strike Groups (CSGs) and Expeditionary Strike Groups (ESGs) within the Hawaii Range Complex. Since the exercise involved deployment of mid-frequency active sonar, concerns over possible impacts on protected marine species dictated that a parallel monitoring program be conducted. For the Nov. 07 USWEX, this monitoring involved systematic surveys using both shipboard as well as aerial platforms. This report is specific to the aerial monitoring portion only. Aerial surveys of a pre-determined 56 x 111 km grid as well as coastal areas of the islands of Oahu and Molokai were conducted on five days during the period November 11-12 and 15-17, 2007. The mission was to document incidence, location, and species identity of all marine mammal and sea turtle species within those regions. Additionally, for marine mammal species, additional observation time was spent characterizing behavior at time of sighting.

Method

Three aircraft were utilized. For the transect grid surveys a twin-engine Partenavia Observer (P68) (Nov. 11-12) and Britten Norman Islander (Nov. 16-17) were used. For the circumnavigation portion (Nov. 15), a Robinson 44 helicopter was used. The transect surveys utilized design and methods prescribed by accepted distance sampling theory (Buckland et al., 2001). Survey crew and pilot were not informed as to the status or location of navy exercises to minimize observational bias. Six north-south transect lines 111 km long were placed 9 km apart to cover the 6,174 sq km target area (Figure 1). Random longitudinal startpoints were used so that the exact trackline configuration varied on each survey. Aircraft flew at 100 knots ground speed and altitude of 244 m (800 ft). Survey crew consisted of two experienced observers, one on each side of the plane, and a data recorder. When target species were detected, an angle was taken to the sighting using hand-held Suunto clinometers, typically followed by orbiting to identify species and in the case of marine mammals, to characterize behavior. Environmental data (Beaufort seastate, glare, visibility) were taken at the start of each transect leg or when conditions changed. Positional data via GPS were automatically recorded every 30-sec and manually when sightings occurred.

Table 1. Summary of USWEX aerial surveys

Date	Survey Type	Hrs Effort	No. Sightings	Mean Seastate
Nov. 11	Transect grid	3.85	0	3.7
Nov. 12	Transect grid	4.15	7	2.7
Nov. 15	Circumnavigate Oahu & Molokai	2.53	19	3.7
Nov. 16	Transect grid	2.92	0	5.5
Nov. 17	Transect grid	3.70	0	4.1
	Totals:	17.15	26	3.84

Results and Discussion

The five days of aerial surveys consisted of a total of 17.15 hrs effort, comprising approximately 3,150 km of linear distance. Target species were observed on two of the five days surveyed (Table 2), corresponding to days with more favorable seastate conditions as well as the greater visibility of some species (sea turtles) during circumnavigation of inshore waters (Tables 1 & 2). The total of 26 sightings included three identified species of odontocetes (Hawaiian spinner dolphin, short-finned pilot whale, and bottlenose dolphin), one pinniped species (Hawaiian monk seal) and one sea turtle species (green sea turtle) (Table 3). The only baleen whale sighting was an unidentified species sighting on Nov. 12 that occurred in the eastern portion of the grid (Figure 1). The animal was seen diving but from the body outline it did not appear to be a humpback whale. The three positively identified odontocete species represent ubiquitous species that are among the top five most commonly seen in Hawaiian waters based on the 1993-03 Hawaii survey results (Appendix). The two Hawaiian monk seal sightings included one of a single seal swimming in the waters off Barbers Pt as well as two seals observed resting on a southwestern Molokai beach. These two sightings are noteworthy since sightings of monk seals in the main Hawaiian Islands are relatively rare.

The total of 7 odontocete species observed across the 3,150 km of linear effort corresponded to an average encounter rate of .002 sightings/km. This is considerably less than noted in previous surveys of Hawaiian waters. For the 2005 summer RIMPAC exercises, odontocetes were seen at a rate of .004 sightings/km (Mobley, 2006) and during the 1993-03 Hawaii statewide surveys (period Feb-Apr) they were observed at a rate of .005 sightings/km (Mobley, 2004). The lower encounter rate observed during the USWEX surveys is likely attributable to two factors: a) the average seastate conditions during the present surveys were less favorable than prevailing conditions during the other series mentioned; and b) a greater portion of effort during the

USWEX surveys was spent in deep water greater than 1829 m (1000 fathoms) where odontocetes may be less abundant.

Notes regarding the general behavior of the marine mammal sightings are summarized in Table 2. None of the behavioral descriptions indicated the presence of unusual or distressed behavior (e.g., tight or unusual aggregations, strandings or near strandings).

Overall there were no indications of any deleterious effects of the USWEX exercise on the indigenous marine species observed. It should be noted of course that the absence of such indications does not necessarily imply the absence of any negative effects, merely that no overt indications of such effects were detected.

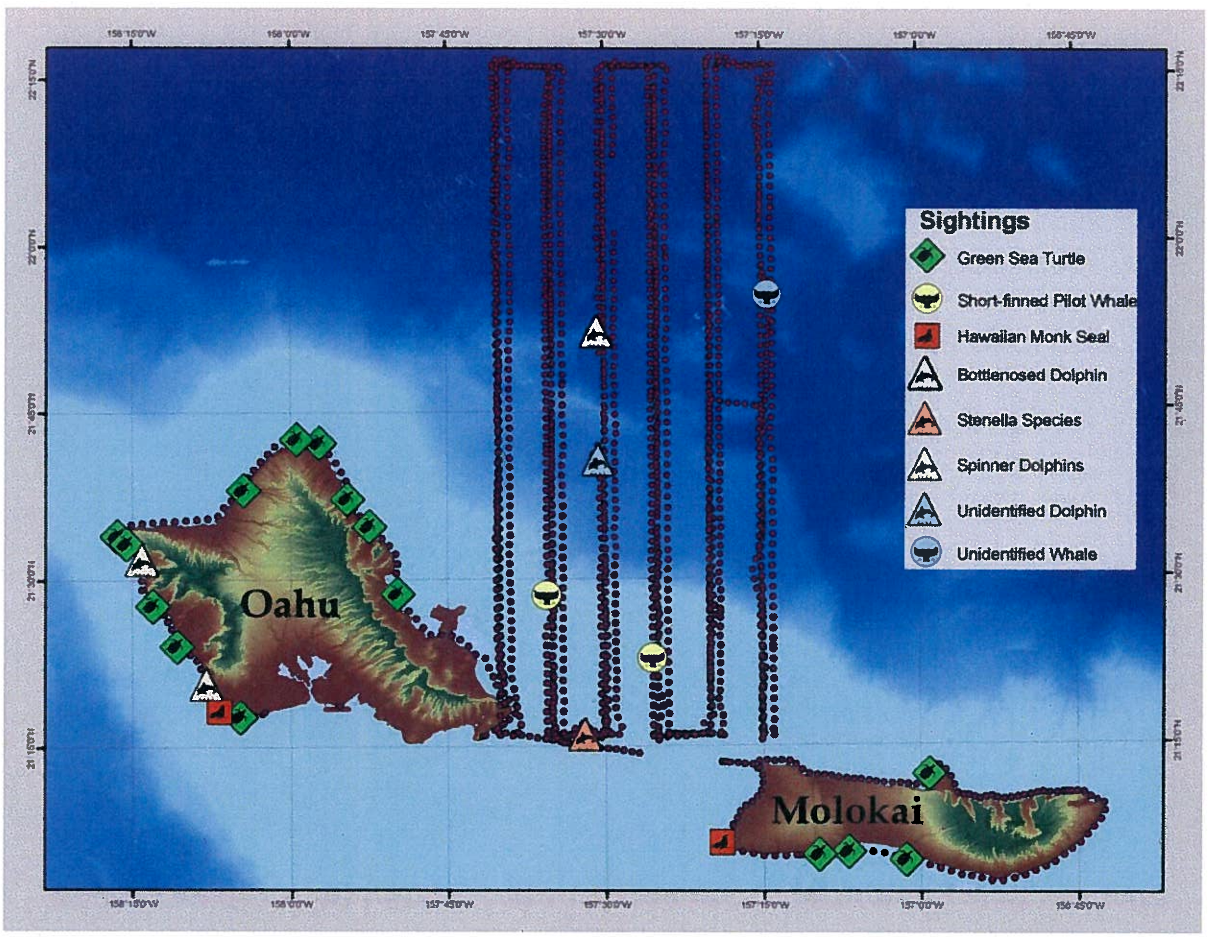

Figure 1. Summary of Effort and Species Sightings. Based on GPS data. For transect grid, random longitude start points were used so the exact trackline varied on each survey date. Note: South shore of Oahu not covered due to Class B airspace restrictions.

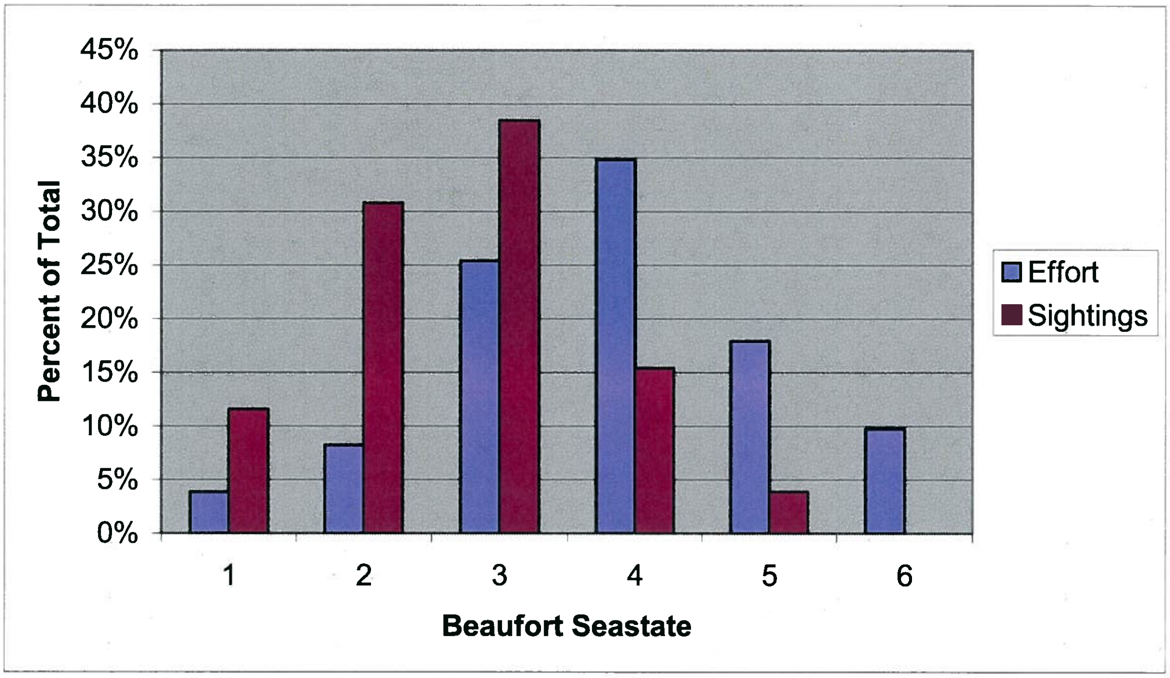

Figure 2. Summary of Beaufort Seastate. As shown, the majority of effort was spent in Beaufort seastate greater than 3 (63%) whereas the majority of sightings occurred in Beaufort seastate 3 or less (81%). Seastate is the primary factor affecting sighting probability of free-ranging marine mammals.

Table 2. Summary of individual sightings

Date	Number	Spp	Time	Seast	Londec	Latdec	Behavioral Description
11/15/2007	14	CM	9:49:31	3	157.8291	21.4781	
11/15/2007	6	CM	9:55:52	3	157.8741	21.5792	
11/15/2007	1	CM	9:57:31	3	157.9093	21.6202	
11/15/2007	1	CM	10:00:43	3	157.9536	21.7047	
11/15/2007	1	CM	10:01:53	3	157.9898	21.7104	
11/15/2007	2	CM	10:05:45	3	158.0747	21.6336	
11/15/2007	3	CM	10:13:02	2	158.2733	21.5659	
11/15/2007	2	CM	10:13:49	2	158.2590	21.5542	
11/15/2007	1	CM	10:24:06	2	158.2176	21.4611	
11/15/2007	1	CM	10:27:04	2	158.1800	21.4006	
11/15/2007	1	CM	10:39:42	3	158.0800	21.2950	
11/15/2007	1	CM	13:05:03	5	156.9861	21.2047	
11/15/2007	1	CM	13:33:24	4	157.0240	21.0772	
11/15/2007	2	CM	13:36:01	4	157.1159	21.0898	
11/15/2007	1	CM	13:37:21	4	157.1626	21.0857	
11/12/2007	1	UT	12:21:44	1	157.4183	21.3762	
11/12/2007	12	GM	10:37:50	1	157.5927	21.4753	scattered; milling
11/12/2007	19	GM	12:19:12	1	157.4252	21.3810	slow travel
11/15/2007	1	MS	10:35:33	3	158.1111	21.3031	slow swimming
11/15/2007	2	MS	13:44:24	4	157.3142	21.1048	sunning on beach
11/15/2007	24	SL	10:15:19	2	158.2321	21.5304	slow swimming
11/15/2007	60	SL	10:30:02	2	158.1310	21.3440	milling; slow swimming
11/12/2007	31	SS	10:55:42	2	157.5298	21.2667	scattered; milling
11/12/2007	5	TT	11:27:12	3	157.5087	21.8691	fast swimming
11/12/2007	1	UD	11:17:38	2	157.5071	21.6769	Dove
11/12/2007	1	UW *	15:56:27	3	157.2400	21.9230	submerged swimming

Species code: CM = green sea turtle; UT = unidentified turtle; GM = short-finned pilot whale; MS = Hawaiian monk seal; SL = spinner dolphin; SS = unidentified *Stenella* species; TT = bottlenose dolphin; UD = unidentified dolphin; UW = unidentified whale

Table 3. Summary of sightings by species

Species	No. Sightings	No. Individuals
Green sea turtle (*Chelonia mydas*)	15	38
Short-finned pilot whale (*Globicephala macrorhynchus*)	2	31
Hawaiian spinner dolphin (*Stenella longirostris*)	2	84
Bottlenose dolphin (*Tursiops truncatus*)	1	5
Stenella species	1	31
Hawaiian monk seal (*Monachus schauinslandi*)	2	3
Unidentified turtle	1	1
Unidentified dolphin	1	1
Unidentified whale	1	1

Acknowledgements

I would like to thank our observers Lori Mazzuca, Julie Oswald, Michael Richlen, and Robert Uyeyama for their excellent work. Mahalo also to our pilot John Weiser for his usual superb piloting. These data were obtained under NOAA permit no. 642-1536-03 issued to the author (JRM).

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http://socrates.uhwo.hawaii.edu/SocialSci/jmobley/2006RIMPAC.pdf

Appendix:
Summary of 1993 - 2003 Hawaiian Islands Aerial Survey Results

Species Name	No. pods	No. indiv.
Humpback whale (*Megaptera novaeangliae*)	2352	3907
Spinner dolphin (*Stenella longirostris*)	52	1825
Spotted dolphin (*Stenella attenuata*)	31	1021
Short-finned pilot whale (*Globicephala macrorhynchus*)	73	769
Melon-headed whale (*Peponocephala electra*)	6	770
Bottlenose dolphin (*Tursiops truncatus*)	54	492
False killer whale (*Pseudorca crassidens*)	18	293
Sperm whale (*Physeter macrocephalus*)	23	106
Rough-toothed dolphin (*Steno bredanensis*)	8	90
Blainville's beaked whale (*Mesoplodon densirostris*)	9	32
Pygmy or dwarf sperm whale (*Kogia* spp.)	4	28
Striped dolphin (*Stenella coeruleoalba*)	1	20
Pygmy killer whale (*Feresa attenuata*)	2	16
Cuvier's beaked whale (*Ziphius cavirostris*)	7	13
Risso's dolphin (*Grampus griseus*)	1	8
Killer whale (*Orcinus orca*)	1	4
Fin whale (*Balaenoptera physalus*)	1	3
Unid. Dolphin	96	452
Unid. Stenella spp.	11	196
Unid. Whale	28	39
Unid. beaked whale	9	23
Unid. Cetacean	14	27
Totals:	2801	10134

APPENDIX C- RESULTS FROM USWEX 08-1 VESSEL MONITORING

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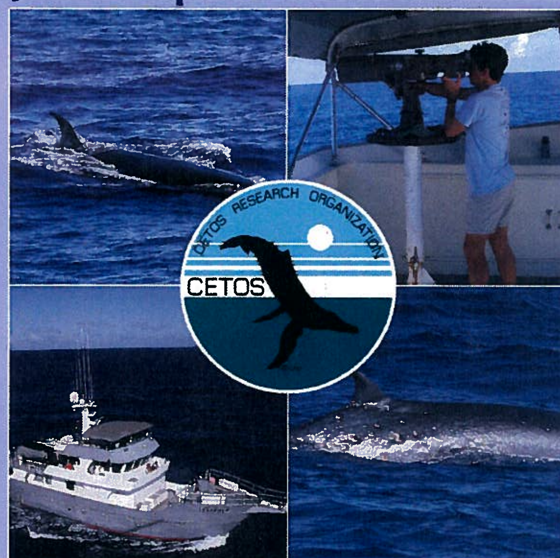
Marine Mammal and Sea Turtle Monitoring Survey in Support of Navy Training Exercises in the Hawai'i Range Complex

November 11-17, 2007 - Field Summary Report

Authors: Mari A. Smultea,
Julia L. Hopkins and Ann M. Zoidis



January 2008 - Final Report
Contract # N62742-07-P-1915

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Marine Mammal and Sea Turtle Monitoring Survey in Support of Navy Training Exercises in the Hawai'i Range Complex.

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Appendix

EXECUTIVE SUMMARY

ES.1 INTRODUCTION

A visually based monitoring survey for cetaceans and sea turtles was conducted by Cetos Research Organization from 11 through 17 November 2007 in Hawaiian waters E and NE of Oahu, in portions of the Hawaii Range Complex, from aboard the 96-ft M/V *Searcher*.

The goals of this project were to monitor, identify, and report surface behavior of marine mammals observed before, during and after the scheduled training exercise, particularly any injured or harmed marine mammals and/or any unusual behavior or changes in behavior, distribution, and numbers of animals. A complimentary goal was to attempt to remain within view of any opportunistically encountered Navy vessels while conducting surveys and focal sessions. Effort was focused in a designated Survey Box ~30 nm wide by ~70 nm long (~55 km by ~130 km).

To meet the project goals, systematic line-transect surveys and focal animal behavior sessions were conducted. Effort focused on priority species including beaked whales, and federally listed species (e.g., sperm, blue, fin, humpback, and sei whales). Experienced marine mammal observers conducted visual observations in the Survey Box using the naked eye, handheld binoculars, and two sets of "Big Eyes" binoculars. The primary objectives were to collect location data and scan samples of behavior of all cetaceans encountered, and to locate in particular, priority cetaceans for the purposes of conducting focal behavior follows. Another objective was to collect bathythermograph (XBT) data during the survey.

ES.2 RESULTS

Surveys were conducted in all four sub-areas within the Survey Box on seven consecutive days, 11-17 November 2007. A total of 65.95 hours (h) or 911 km were visually surveyed. Most (90% or 817 km) of this effort consisted of line transect survey effort, 105 km while Navy vessels were within view. A total of 63 km (7%) of the total 911 km consisted of focal animal observations. Navy vessels were opportunistically encountered on 13 and 14 November and were within view for a total of 8.1 h at distances of over 3 nm (5.6 km). Beaufort sea state ranged from 1 to 6, with most observations conducted in a Bf 5, followed by Bf 3 (27%) then Bf 4 (23%).

A total of eight cetacean groups were sighted during the entire 7-day cruise. No sea turtles were sighted. Five cetacean species were confirmed during the entire survey period: sei whales, Brydes' whale, humpback whales, Risso's dolphins, and spinner dolphins (Table 3, Figure 4). One unidentified small whale was observed and considered to be a probable Cuvier's beaked whale. In addition, a small group of medium-sized delphinids (considered to be probable pygmy killer whales) were sighted. A total of two sightings of sei whales were made on two different days.

Extended focal follows were conducted on four cetacean sightings: a single sei whale, a single Bryde's whale, a group of three subadult sei whales, and a group of three humpback whales. Focal sessions ranged in duration from 50 - 145 minutes, with the longest continuous observation session of 145 minutes occurring with a single sei whale. Longer time was spent with those species with federal listing under the Endangered Species Act (ESA), i.e. the sei whales and humpback whales. Because sei and Bryde's whales can easily be confused, we stayed with these focal animals until a positive identification was made as documented with photographs and detailed survey observations on natural history characteristics by senior observers. Photographs were taken during all focal follows.

ES.3 CONCLUSIONS

Systematic vessel-based survey effort is limited and scant in the Survey Box E and NE of Oahu. Our research effort was successful despite both marginal weather and sea conditions on most days. We were able to collect new and important information on a variety of species in a little-studied area in a relatively short period of time. This included the first verified sighting of a Bryde's whale in the main Hawaiian Islands. In addition, the two sei whale sightings we made represent the first such sightings off Oahu. The presence of three subadult sei whales combined with past rare reports of sei whales off Maui and the Big Island of Hawaii suggest that the main Hawaiian Islands may be an important breeding area for the little-known N Pacific sei whale. The use of Big Eyes binoculars improved the effectiveness of our observations. Successfully remaining within view of Navy vessels, including while following cetaceans, suggests that this monitoring approach is a feasible consideration on an opportunistic basis with respect to monitoring relative to Navy training exercises. Finally, the *Searcher* proved to be a useful and tenable platform from which to conduct visual observations, including under marginal conditions, and has potential for use in multi-day offshore survey efforts.

Information collected during this Cetos survey sponsored by the U.S. Navy contributes to the limited database existing on offshore Hawaiian cetaceans. This information can be used towards efforts to effectively mitigate, monitor, and manage protected marine resources relative to Navy exercises. The survey also provided a platform for evaluating the feasibility of potential monitoring approaches, including in combination with concurrent aerial surveys. Suggestions and recommendations for future monitoring-related efforts have been collected, including comparisons with previous Cetos Research Navy monitoring surveys. Topics identified include holding a workshop to discuss the pros and cons and coordination of past and future monitoring efforts, as well as evaluating protocols that may improve the effectiveness of related vessel-based, aerial, and acoustic survey efforts.

The results of this study illustrate the effectiveness of visual methods, and were successful due to support from the U.S. Navy, the expertise and broad experience of our scientific team, our qualifications gained from conducting previous surveys in conjunction with naval training exercises, and because of the unique capabilities of the research platform (M/V *Searcher*) and crew.

Citation for this report is as follows:

Cetos 2007c. Final Field Summary Report. *Marine Mammal and Sea Turtle Monitoring Survey in Support of Navy Training Exercises in the Hawai'i Range Complex November 11-17, 2007.* Prepared by: Cetos Research Organization, Oakland, CA, under Contract No. N62742-07-P-1915, Naval Facilities Engineering Command Pacific. EV2 Environmental Planning, Pearl Harbor, HI. Authors: Smultea, M.A., J.L. Hopkins, A.M. Zoidis. January 30, 2008.

Photo Credits on Cover: Vessel Photo: Lori Mazzuca; Whale Photos: Cetos Research Observer Team

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SECTION 1 INTRODUCTION

Cetos Research Organization (Cetos) was contracted by the U.S. Navy (Navy) to conduct a monitoring survey for marine mammals and sea turtles concurrent with naval exercises in Hawaiian waters, in the Hawaii Range Complex (HRC), from aboard the vessel (M/V) *Searcher*. Marine mammal monitoring surveys were performed in conjunction with USWEX exercises from November 11 – 17, 2007.

This report focuses on our visual survey results from HRC waters north and east of Oahu from November 11-17, 2007. In addition to presenting results, we evaluate the effectiveness of survey techniques and provide recommendations by Cetos for improving methods of monitoring and for surveying marine species relative to the short- and long-term goals summarized in the BO for the USWEX (NMFS 2007). All data gathered are included in this document as requested by the Navy Scope of Work (SOW).

SECTION 2
METHODS

We conducted modified line transect vessel surveys and opportunistic behavioral sampling for priority cetaceans and sea turtles from aboard the M/V *Searcher* from November 11 – 18, 2007 (including transits). Data collection protocols and forms are provided in Appendix A. The primary study area surveyed was north of Oahu in a rectangular box (referred to herein as the Box) of approximately 30 nm by 70 nm (55 km by 130 km), with the southern border encompassing the northern end of the Kaiwi channel which lays between the eastern tip of Oahu and northwestern Molokai and within the Navy operational area (OPAREA).

The primary goals of this project were to monitor, identify, and report surface behavior of marine mammals and sea turtles observed during the training exercise. Of particular interest were any potentially injured or harmed marine mammals and/or any unusual behavior or changes in behavior, distribution, and numbers of animals observed during the training exercise. Additionally, the research vessel was directed to observe any marine mammal interactions with Navy ships from a safe distance (>3 nm [> 5.5 km]). To meet these goals, six experienced marine mammal observers conducted line transect surveys and focal cetacean behavior sessions in the study area. Our observer team included three senior [>15 years visual marine mammal survey experience and experienced in identification of tropical Pacific species and marine mammal behavior] members. Our primary objectives were to collect location data and scan samples of behavior of all cetaceans and sea turtles encountered, and to locate in particular, "priority" cetaceans for the purposes of conducting focal behavior follows.

Priority species for this project are those identified in the project SOW. These include five ESA-listed species known to occur in Hawaiian waters and beaked whales. According to the SOW, special consideration was to be given to the following species if encountered: "beaked whales and federally listed species including sperm whales, blue whales, humpback whales, fin whales, and sei whales."

Data to be gathered included information on marine mammal species and location, group size and composition, surface behavior and "disposition" (e.g. alive, injured, stranded), and direction of travel. All species were considered for data collection. When possible, photographs and/or video data were to be collected, especially of any unusual circumstances.

To meet survey goals, modified line transect surveys were conducted throughout the study area to locate focal animals for extended behavioral observations, preferably while within view of Navy operations. The methodology and sampling design for this survey were submitted and approved in advance, per the SOW, to the NTR (Cetos 2007b). Once a species of interest was located, "focal animal follows" were opportunistically conducted to monitor behavior, occurrence, and distribution of marine mammals or sea turtles before, during, and after the Navy exercise. Pre- and post-exercise observations were conducted for baseline and comparative purposes with observations during the exercise. The primary goal was to monitor behavior of marine mammals or sea turtles within approximately 3-5 nm (5.5- 9 km) of a Navy vessel (but no closer than 3 nm) as feasible (i.e., when weather and conditions allowed). Focal animal follows involved monitoring animals with "big eyes" binoculars, observing and recording their behavior, and collecting photo-identification and species verification photographs as possible. If any marine mammals were deemed to exhibit unusual behaviors, they were to be monitored by spending extra time with the animal(s) to quantify the behavior with detailed behavioral logs, including descriptions of why and how they were thought to be unusual. The survey was to remain in the designated Survey Area Box unless a sighted animal exhibited anomalous behavior outside the Box or if a focal follow effort led outside the Box. Any marine mammal found to be injured or in distress was to be immediately reported to the COMPACFLT Environmental Representative.

In addition, oceanographic data was recorded using T-7 XBTs, launched twice daily. Information was recorded on sea surface temperature, Beaufort sea state and temperature profiles (Appendix B).

VISUAL OPERATIONS

Visual surveys were conducted to meet the Navy goals outlined in the SOW and were adapted to both the in-situ and predicted weather conditions, as well as to naval activities.

Survey Design

The survey transect design was based on general standard distance sampling methodology and techniques described in Buckland et al. (2001). As indicated above, the survey was designed to systematically locate and monitor marine mammals and sea turtles in conjunction with the Navy's USWEX Training Exercise November 2007 within the designated Survey Area "box" (Box). This was accomplished by conducting line transect surveys until animals of interested were located, then breaking off the survey line to follow and conduct focal animal behavioral sampling of these animals and/or to remain within view of Navy operations. For surveys, the Box was divided into four equal-sized, replicate sub-areas (Cetos 2007b) (Figure 1). Three north-south transect lines were located and surveyed within each sub-area in the Box. Lines were spaced equidistant from each other (approximately 4 nm [7 km]) and the edges of the Box (approximately 3 nm [5.5 km]). Equal coverage of each sub-area following pre-set transect lines was attempted. However, real time and prevalent weather conditions (e.g., large swells, high winds, strong sun glare) sometimes necessitated modifying survey line orientation in conjunction with direction on safest routes from the Captain of the vessel. Survey line position was also modified by up to 30 degrees when needed to improve sighting conditions and effectiveness (see Table 1). In addition, effort deviated occasionally from pre-set lines to a) conduct focal animal follows, to b) remain within view of Navy operations, and to c) transit to and from lines between protected nighttime anchorages. Wind and swell conditions also sometimes made it difficult to maintain a specific line position.

Using the above approach, the study area was monitored. We documented occurrence, distribution, numbers, surface behavior, and/or disposition (injured or dead) of marine mammal and sea turtle species Additional observation effort was focused to the extent practical near and where Navy training exercises were occurring or had occurred, ideally while within view of active Navy vessels (but no closer than 3 nm [5.5 km]) as feasible during the days when training exercises were noted.

Observation Platform

Visual survey effort was conducted from the M/V *Searcher,* a 96-ft. American Bureau of Shipping classed vessel (see http://www.searcherhawaii.com/searcher/index.html for further description). This vessel includes a flying bridge platform located at an eye-level elevation of 7.97m above sea level (ASL). On this deck two pedestal-mounted 25x big eyes binoculars supplied by the Navy were located at each forward (bow) corner. Visual distance to the horizon from approximate observer standing eye height was ~8 nm (15 km). To the maximum extent practicable considering observer safety, three visual observers were posted on the flying bridge during all "on transect effort" visual survey periods.

Two observers scanned the water with the big eyes binoculars during survey efforts. Each observer scanned an approximate 90° arc from dead ahead (0 degrees) to just past the beam on their respective side of the vessel. A third observer scanned the region nearest the vessel and out to the horizon area with the unaided eye or with 7x50 West Marine reticle binoculars. The third observer also functioned as the dedicated data recorder. Observers rotated between watch positions every 20-30 minutes to reduce observer fatigue. A typical observer rotation consisted of 30 min as right big eyes

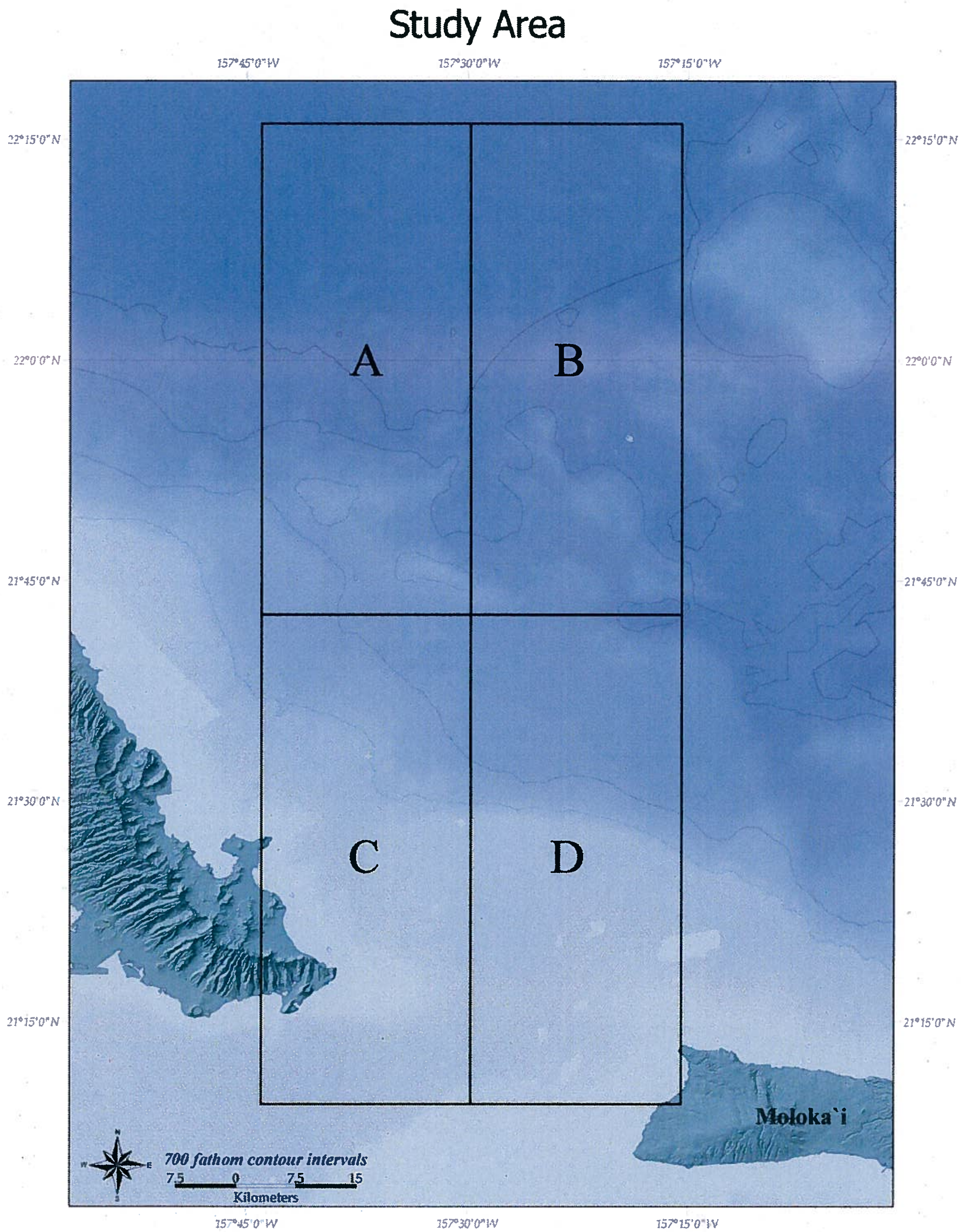

Figure 1. Study Area

observer, followed by 30 min as center observer with naked eye or 7 x 50 binoculars, and 30 min as left big eyes observer, then one hour off.

Data Collection Protocol

When a cetacean sighting was made, the distance and horizontal bearing to the center of the group or individual were estimated using reticle binoculars or the naked eye. In addition, the time, species identification (or lowest taxonomic level that could be confidently discerned), estimated group size, sighting cue, and other associated information were entered by a dedicated recorder into WinCruz, a Windows-based data logging program for recording line-transect data for marine mammals (developed by NOAA Fisheries' Southwest Fisheries Science Center [SWFSC], La Jolla, CA). WinCruz acquires GPS-derived latitude and longitude data to plot sighting and ship-track data. Additional details regarding this program are available online at the following website: http://swfsc.nmfs.noaa.gov/PRD/software/WinCruz.pdf. A WinCruz User's Guide is available in the appendix of our previous Final Field Summary Report (Cetos 2007a).

We used a Garmin GPS Map 76 handheld GPS to collect location data at 1-2 minute intervals throughout the sighting. Weather, swell, Beaufort wind force (sea state), visibility conditions, observers and observer positions, and observation effort status were recorded in WinCruz on every change of observers and at any other time that conditions changed. At the end of each day, a summary of the day's activities and observations were recorded in a field journal kept by the survey leader and a daily sighting log data sheet was filled out.

Visual data collected using WinCruz were reviewed and edited daily while in the field by one assigned visual observer experienced with WinCruz. These data were later exported to a custom-designed (under Cetos contract) summary program specifically created for post processing WinCuz data for the purposes of these surveys. Data then were imported into an Excel database where they were quality-checked twice. GPS data and sighting locations were plotted geographically using GIS software to produce maps. For the purposes of this report, sighting locations were plotted at the location on the ship track where they were initially sighted (Figure 4).

A detailed sighting form was filled out for all sightings by the observer(s) who sighted the animal(s). The sighting form was the same as that used by NOAA Fisheries on their cruises for marine mammals in the Pacific Ocean (NMFS/SWFSC http://www.corporateservices.noaa.gov/~foia/asdhome/frmscat.pdf). The information recorded included a detailed description and sketch(es) of the diagnostic features of the animal(s), a description of the animal's general behavior, speed, and direction of movement, closest observed point of approach to the vessel, whether photographs or video were taken, a standardized questionnaire as to any observed reactions to the vessel, etc., and as delineated in the SOW.

Behavioral Sampling

Behavioral sampling was conducted in two formats. First, we employed focal animal sampling (Altmann 1974) on selected cetacean groups with the intent of focusing on the Navy's prioritized species (beaked whales and sperm, blue, humpback, fin and sei whales). Secondly, for all cetaceans encountered, we used scan-sampling protocol (Altmann 1974) to record behavioral information as described below.

Notably, close approaches to, or behavioral harassment of, certain cetacean species were permitted under the auspices of Cetos' NOAA/NMFS federal and Hawai'i state scientific research permits; however, this permit did not cover sperm, beaked, sei, or fin whales. Any cetacean behavior considered potential harassment as defined under the MMPA or ESA was recorded.

Focal Animal Sampling

Focal animal behavioral sampling was undertaken on selected priority cetacean species using a standard behavioral observation form designed for this survey (Appendix A). Information was collected on species, group size, number of calves, start and end times of observations, unusual and/or surface active (i.e., splash-creating) individual behaviors (e.g., spyhop, breach, head slap, tail slap, etc.), blow and dive times for large whales, distance from the vessel, direction and speed of travel relative to vessel, position of cetaceans relative to vessel, observers/recorders, photos/video taken, and visibility conditions. Ad libitum (Altmann 1974) detailed notes were also taken in the comments column of the form on school configuration, unusual behaviors or circumstances (e.g. birds feeding nearby), and/or any observed reactions to the vessel. A summary was also recorded and described for all focal animal encounters on the SWFSC sighting forms, as explained above.

Scan Sampling

A modified scan sampling protocol (Altmann 1974; Smultea 1994) was used to collect behavioral information on all cetacean groups encountered during the survey, as possible. This information included behavioral state and/or individual behavior, estimated speed of movement, and heading/orientation relative to the vessel. The first datum was recorded in the comment format of WinCruz; the second and third data were also recorded in WinCruz in prompted data entry boxes.

Ancillary Research Activities

Oceanography

One observer with prior related experience was the designated oceanographer and collected subsurface oceanographic data using expendable bathythermograph (XBT) probes provided by the Navy. Two XBT T-7 launches were made per day at 0900 and

1500 hours local ship time and after focal follow sessions. Data were recorded for each drop using WinMK21 SURFACE (Lockhead Martin Sippican, v2.7.1 2006) software.

Photography/Videography

Photo-identification (Photo ID) of animals was conducted opportunistically using a Canon EOS 20D camera with 70-200 mm zoom (f 2.8) lens and a Canon L series 300 mm zoom (f 2.8), with a Canon 1.4X converter and a Canon EOS 30D camera with a 100-400 mm (f 2.8) lens. Data forms were used to track the information (see Appendix A). Photographs were attempted for close encounters with cetaceans in order to both facilitate species identification and to document any deemed unusual behaviors. Photographs also facilitate re-identifying individuals in these waters during past or future Navy exercises or studies.

In addition, video recordings were made for encounters where behavioral sampling occurred using a Sony DCR-PC330 3 mega pixel digital video camera.

SECTION 3
RESULTS

SURVEY EFFORT

Surveys were conducted in all four sub-areas within the Box on seven consecutive days, 11-17 November 2007. A portion of 11 November (5.08 hours [h]) was spent in transit to the survey location. A full chronology of events is given below in Table 1. A total of 65.95 h were spent conducting visual observations. In general, survey effort occurred from sunrise to sunset, averaging approximately 10 h (10.30 h) of effort per day. An exception was 11 November, when a portion of the day was spent in transit and 4.3 h was spent on visual survey. However, poor weather conditions interrupted surveys for short periods on 12 November (0.58 h) and November 14 (0.04 h), totaling 0.62 h off effort. No survey effort occurred on 18 November due mainly to weather. In addition, the vessel was located at the southern tip of the Box at day break, so the vessel was only in the survey area for a limited time that day. Sea state was a Beaufort 6+ and there was a preponderance of wind and rain on the 18th; it was determined to not be conducive to any systematic effort. Nonetheless, one person was kept on watch. Eventually it was determined that effort was ineffective due to high winds and prevailing weather.

Given the size of the survey Box, observers were not always able to locate Navy ships/activities. Surveys conducted on 11-12 November occurred prior to observing Naval exercises in the Box. However, Navy vessels were observed in the Box on 13-14 November. On these days, the Navy was in view (including near and over the horizon) for a total of 8.12 h. The longest day of visual contact with Navy vessels (~6.75 h) was 13 November during which time we conducted survey line effort, a focal follow on a Bryde's whale, and attempted to "shadow" (i.e., follow at a safe distance) a Navy ship (Table 1). At one point we were within 5 nm (9 km) of a Navy ship near where a sei whale sighting had been made the previous day. We took that opportunity to actively follow/ shadow the Navy ship to observe for marine mammals and sea turtles. We followed at a >3 nm (> 5.5 km) distance for 0.25 h. The Navy ship changed its course and we moved away to maintain the >3 nm (> 5.5 km) distance. Shortly thereafter, we opted to return to our survey trackline both as the Navy vessel was headed in a direction

Table 1: Chronology of events during the 11 - 17 November 2007 Marine Mammal and Sea Turtle Survey near the Island of Oahu.

Date	Time	Event
11 Nov	8:20	Depart Ko Olina Marina, Koonelani Harbor to transit along south shore of Oahu to Survey Box ENE of Oahu.
11 Nov	13:25 - 17:43	Conduct observations.
12 Nov	7:08 - 17:44	Conduct observations.
12 Nov	12:25- 12:45	Sighting #1: 1 unid. small whale (possible beaked whale), one blow seen, attempted focal follow, unable to re-sight for positive identification.
12 Nov	13:45- 16:00	Sighting #2: 1 sei whale, focal follow.
13 Nov	7:04 - 17:52	Conduct observations.
13 Nov	10:15- 17:00	Navy vessels in view.
13 Nov	10:30- 11:20	Sighting #3: 1 Bryde's whale, focal follow.
14 Nov	7:15 - 17:40	Conduct Observations
14 Nov	9:24- 9:34	Sighting # 4: 6 Risso's dolphins, attempted focal follow, unable to re-sight.
14 Nov	~14:00 - 15:22	Navy vessels in view: 4 ships, helicopters and plane.
15 Nov	7:37- 17:02	Conduct observations.
15 Nov	13:23 – 13:44	Apparent Navy helicopter circled *Searcher*. Two vessels and possibly a submarine detected by Searcher's radar (potentially related to Navy activities but not confirmed visually).
15 Nov	16:55- 17:03	Sighting #5: 10 spinner dolphins, did not attempt focal follow as darkness imminent.
16 Nov	7:31 - 17:45	Conduct observations, headed directly to previous locations of Navy vessels on 13 Nov.
16 Nov	11:15 - 11:35	Sighting #6: 5 unid. small delphinid (probable blackfish, possible pygmy killer whale), attempted focal follow, unable to re-sight for positive identification.
16 Nov	14:30- 15:34	Sighting # 7: 3 subadult sei whales, focal follow.
17 Nov	6:57 - 16:54	Conduct observations.
17 Nov	10:09- 11:19	Sighting #8: 5 humpback whales, focal follow, obtained photos for ID.
18 Nov		Outside Survey Area Box at day break and Beaufort 6 conditions. In transit back to Ko Olina Marina. No Survey conducted.

away from our vessel and as it was travelling at a fast speed which our vessel could not keep up with; we observed them until they headed over the horizon. On November 14, we headed N on survey effort along the far E edge of the Box. In the afternoon, Navy ships came into view while we remained on our transect headed towards the NE corner of the Box (Table 1). The Navy vessels remained in view as we finished that survey line and headed W to start the adjacent survey line headed S. After ~1.37 h with the Navy vessels in view, the Navy vessels then headed quickly out of sight at a speed at which we could not keep up, so we continued our on-line survey effort headed S. No marine mammal sightings were made while within view of the Navy vessels on this day.

On November 15, a helicopter believed to be associated with the Navy circled our vessel at 5-8 nm (9-15 km); two other unknown vessels appeared on the ship's radar near this time at distances of ~1.7 to 3.5 nm (3-6km), respectively, but were not seen visually at any point (Table 1). These vessels then appeared to increase speed and head away from us over the horizon, again at a speed at which we could not keep up. The *Searcher*'s radar occasionally detected an object which may have been a submarine near the water surface for a short time. The total duration of the latter activities was 0.35 h.

The final two days (16-17 November) of survey were done with no observations of Navy vessels or activities. Survey effort on 16 November was directed toward the location near where Navy vessels were observed on 13 November. On 17 November, we attempted to fill in the gaps in survey line effort at the southern end of the Box. Difficulties with competing swell direction and prevailing winds, in addition to sun glare, made the transect lines more irregular than previous days in order to marginally improve sighting conditions.

Visual effort occurred during most daylight periods (weather permitting) on each of the seven days. Periods when WinCruz operated were categorized as either "on effort" or "off effort" Figure 2. The former portion consisted of two sub-categories: *(1) Survey Effort*, when the visual transect survey protocol was followed with at least three dedicated observers on continuous search effort during a transect within the Box (see Methods) *(2) Survey while Navy in View*, same as Survey Effort but with Navy ships in view on the days during the Navy's exercises. "Off Transect Effort" observations were divided into four categories: *(1) Focal Follows*, when scanning effort was suspended for focal animal behavior follows, *(2) Transit*, when the ship was transiting to the start of a transect line within the Box *(3) Off Weather*, when rain squalls precluded visual surveys, and *(4) Navy Focal Follow*, when the ship attempted to shadow a Navy vessel at a distance of 5 nm (9 km) to observe for any marine mammals or turtles. A total of 491 nm (911 km) were visually surveyed during the seven-day period. Overall, observations occurred during 489 nm (905 km) of this area, representing approximately 99% of the total available daylight watch periods within the Box (Table 2). A summary of visual survey effort (km) by effort type is presented in Table 2.

Sea state conditions ranged from 1 to 6 on the Beaufort (Bf) scale (Table 2). Most (40%) visual observations were conducted in a Bf 5, followed by Bf 3 (27%) then Bf 4 (23%). Sighting of marine mammals and sea turtles is greatly hampered above Bf 5 conditions. Additionally, on several occasions the direction and height of sea swell made observations with the big eyes binoculars impossible. In these cases, hand-held binoculars (7x25 or 7x10) were substituted until observers could return to the big eyes. Beaufort 4 and above conditions were encountered on each day, except 12 November, which was calmer (Figure 3). Conditions of Bf 5 and 6 were encountered on three of the seven days (14 – 16 November).

Table 2. Summary of survey effort (km) and Beaufort sea state (Bf) during the 11 - 17 November 2007 Marine Mammal and Sea Turtle Survey near the Island of Oahu.

Effort Type:	**Total (km)**
Survey Effort	712.3
Survey while Navy in View	104.6
Focal Follow	63.4
Transit	25.5
Off due to Weather	5.8
Total	**911.6**
Beaufort	
1-2	47.0
3	248.0
4	211.5
5	361.3
6	42.2
>6	0.0
Total	**910.0***

* Beaufort readings were recorded within a few minutes after going "on effort" leading to the discrepancy between total km of effort and total km of Beaufort.

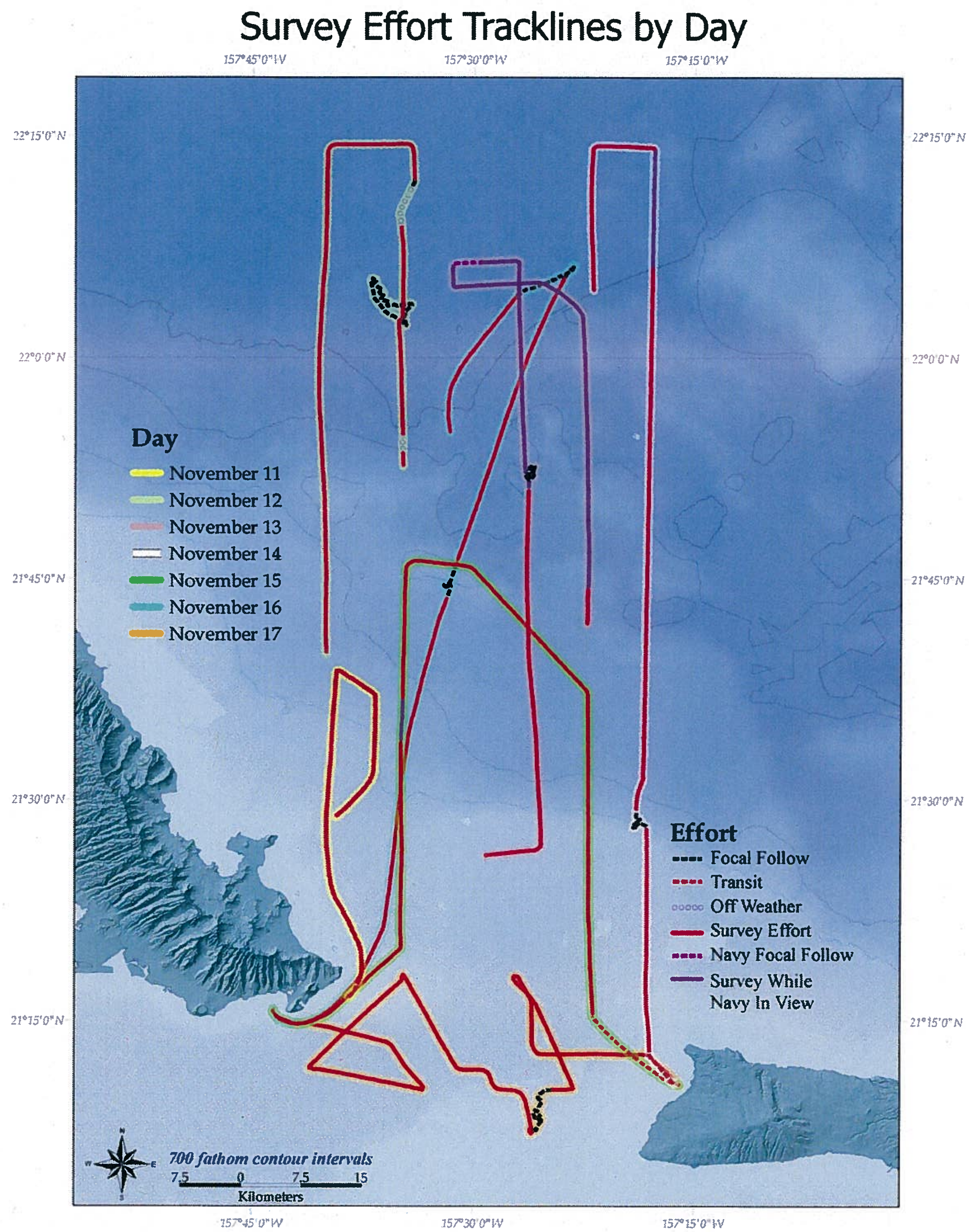

Figure 2. Map Summary of Survey Effort including "On Effort" Transect Survey Tracklines Aboard the M/V Searcher During the 11 - 17 November 2007 Marine Mammal and Sea Turtle Survey Near the Island of Oahu.

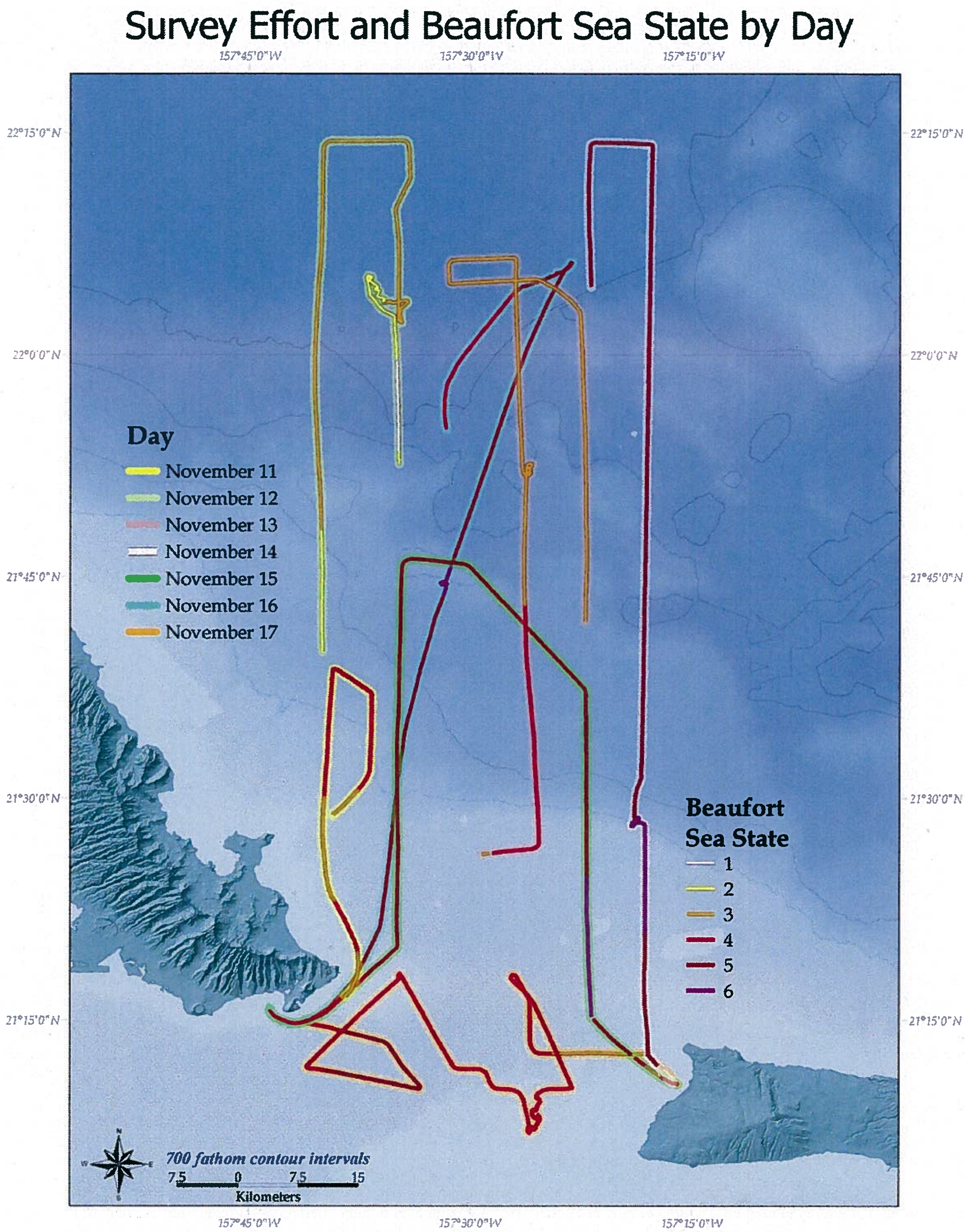

Figure 3. Map Summary of Beaufort Sea States aboard the M/V Searcher During the 11 - 17 November 2007 Marine Mammal and Sea Turtle Survey Near the Island of Oahu.

VISUAL RESULTS

A total of eight cetacean groups were sighted during the entire 7-day cruise (Table 3, Figure 4). No sea turtles were sighted. Five cetacean species were confirmed during the entire survey period: sei whales, Bryde's' whale, humpback whales, Risso's dolphins, and spinner dolphins (Table 3, Figure 4). In addition, one unidentified small whale was observed (probable Cuvier's beaked whale) as was a small group of medium-sized delphinids (probable pygmy killer whales).

In the best judgment of the team of experienced, seasoned observers, no "harassment" under the MMPA or ESA occurred during this survey. Close encounters with cetaceans typically resulted from the animals approaching the survey vessel and no "flee" or avoidance type behavior was observed.

Unidentified Small Whale

Sighted 12 November. Single blow sighted at initial distance of 2 nm (4 km) (Table 3) in the NE quarter of subarea A (22°09.66 N, 155°37.21 W) (Figures 1 and 4). Appeared to be a single animal. After 20 minutes we were not able to resight to confirm species, number of animals, or group composition. Water depth and blow characteristics with back lighting led the observer to an initial unconfirmed identification of Cuvier's beaked whale (*Ziphius cavirostris*). No photo or video were taken.

Sei whale (*Balaenoptera borealis*)

Sighted 12 November. Initial sighting was made of 12-15 ft blow at 1.8 nm(3.2 km), at 200 degrees to right of bow heading to the south near the center portion of Box subarea A (22°02.53 N, 157°34.95 W). We moved closer to the single adult whale to conduct a focal follow (see Behavioral Results). The whale seemed unconcerned with the ship and repeatedly closely (~20 to 30 m) approached the *Searcher* as it was maneuvered in order for observers to take photos and video. The whale repeatedly surfaced to breathe, two times in succession, every 8-12 min while maintaining slow surface travel of 3-4 kts. A total of 145 min were spent with this whale during which time it made occasional no-blow rises, logged just under the surface, and traveled at a slow speed parallel to the ship. Positive identification was made through photos and visual cues.

Table 3. Cetacean species sighted during visual survey 2007 during the Marine Mammal and Sea Turtle Survey near the Island of Oahu. There were no sea turtle sightings. See Figure 4 for a map of all sighting locations. The groups followed for extended periods to conduct focal behavioral sessions are indicated in boldface type. See Table 4 for further details on these focal groups.

Date	Species	Initial Sighting Distance (km)	Beaufort Sea State	Group Size/ Composition	Photos/Video Taken	Summary of Observed Behavior
12 Nov	Unid. small whale (possible *Ziphius cavirostris*)	4.0	3	1/unk	No	Unable to resight. Probable beaked whale.
12 Nov	**Sei whale (*Balaenoptera borealis*)**	3.2	2-3	1/A	Yes/Yes	26 resights of 1 sei whale in 2.25 h. It repeatedly approached boat; blows every 6-12 min.
13 Nov	**Bryde's whale (*Balaenoptera edeni*)**	<1.6	3	1/A	Yes/Yes	11 resights of 1 Bryde's whale. Whale approached boat to within ~65 m.
14 Nov	Risso's dolphin (*Grampus griseus*)	0.05	6	5/A	No/No	Sighting made near bow in proximity to previous location of yellow-fin tuna school.
15 Nov	Spinner dolphins (*Stenella longirostris*)	0.32	4	10/A	No/No	Three subgroups totaling ~10 dolphins swam close and parallel to shore as we headed into mouth of bay at dusk; approached and crossed our bow.
16 Nov	Unid. medium delphinid (possible *Feresa attenuata*)	0.8	6	5/unk	No/No	Unable to re-sight. Probable pygmy killer whales.
16 Nov	**Sei whale (*Balaenoptera borealis*)**	2.9	4	3/SA	Yes/Yes	Appeared to be ~1-2 year old whales.
17 Nov	**Humpback whale (*Megaptera novaeangliae*)**	1.6	3	3/1SA, 2A	Yes/Yes	May have been up to 5 different animals, seen 1-2 at a time. Other blows seen near horizon on Penguin Bank.

unid. = unidentified
unk. = unknown composition
A = adult
SA = subadult

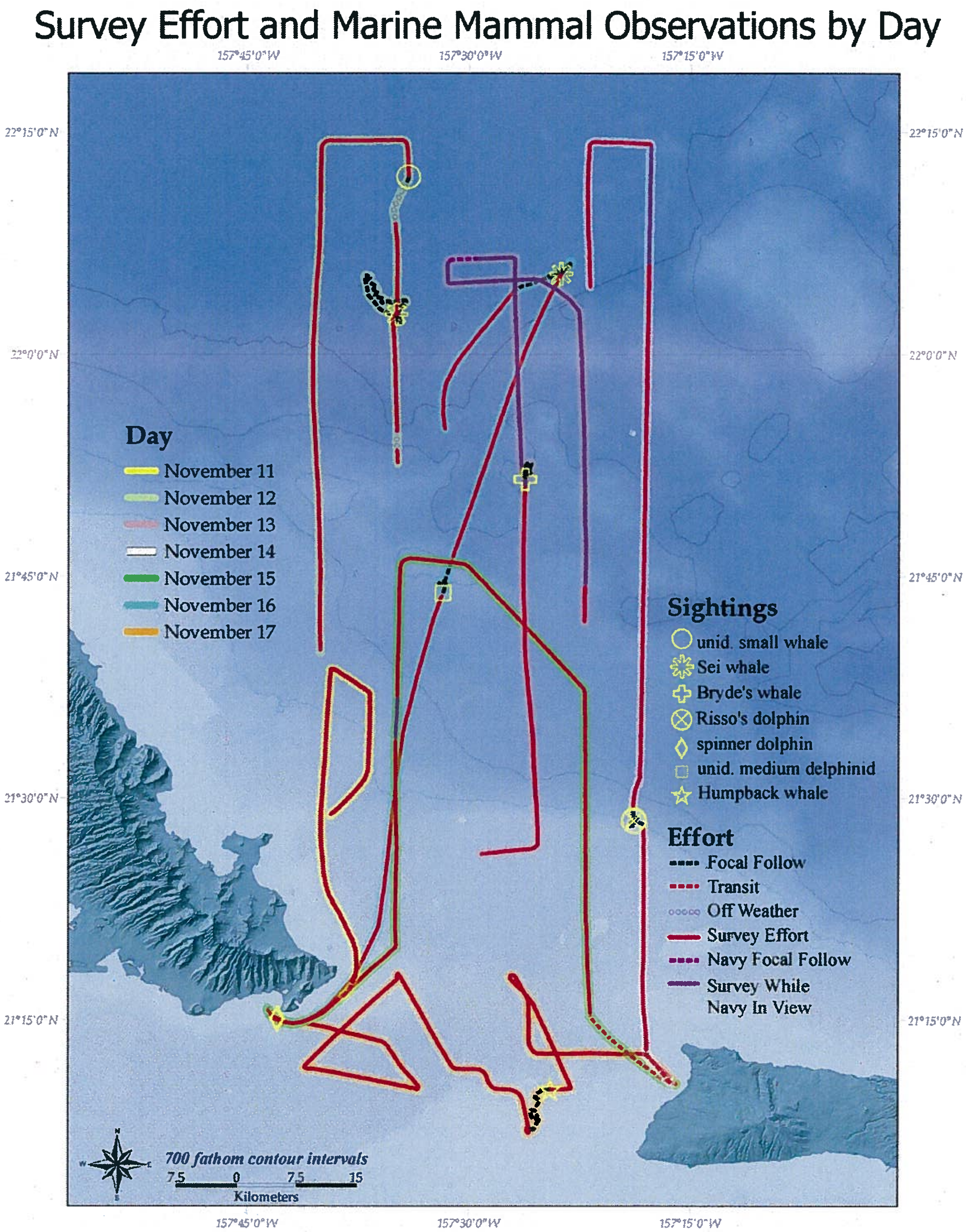

Figure 4 Map Summary of Visual Detections of Marine Mammals during Visual Observations from Aboard the M/V Searcher During the 11 - 17 November 2007 Marine Mammal and Sea Turtle Survey Near the Island of Oahu.

Bryde's Whale (*Balaenoptera edeni*)

Sighted November 13. A whale blow was seen at the initial distance of <0.86 nm (1.6 km), in the SW quarter of Box subarea B (21°51.90 N, 157°26.20 W), and was re-sighted 13 min later at a distance of 0.06 nm (0.11 km). During a 50-min focal follow the whale was observed swimming at slow speeds (3-5 kts), blowing and remaining submerged from 4-14 min. The whale exhaled underwater at least three times. The whale did not seem to actively avoid the ship and approached the ship maintaining its behavior state of slow travel on numerous occasions. We noted 12 cookie cutter shark marks/bites on this single adult. During this encounter, a Navy vessel was in sight over the horizon to our NW (320 degrees magnetic) at approximately 15 nm (28 km) at which time the whale was traveling to the NNE. Positive identification was made with photographs.

Risso's Dolphins (*Grampus griseus*)

Sighted 14 November. These dolphins were sighted just off the bow of the ship (.003 nm [6 m]) in the NE quarter of Box subarea D (21°28.60 N, 157°18.60 W). Initial sighting was 2 animals crossing the bow heading ESE at a moderate speed. The second sighting at 0.22 nm (400 m) indicated 6 adults traveling at a moderate speed continuing to head SE. The sighting was made in Bf 5-6, while the ship was traveling at 8 kts. We were not able to resight for photo/video or focal follow. This sighting was made in the vicinity of previously sighted yellow-fin tuna school and feeding birds.

Spinner Dolphins (*Stenella longirostris*)

Sighted 15 November. Three subgroups totaling ~10 dolphins (minimum of 5, 3 and 2 adults in each subgroup) seen near dusk in the SW quarter of Box subarea C (21°15.34 N, 157°42.74 W). The first subgroup was seen within .05 nm (100 m) of the ship at 60 degrees off the starboard bow. They were re-sighted as two subgroups traveling slowly parallel to the vessel with a heading of 0 degrees relative to the bow. As they approached to within 0.14 nm (250 m) they increased their speed and changed their heading to 350 degrees (relative). A third group was seen at 330 degrees off the port bow moving away from the ship. In the 8 minutes spent sighting and resighting no photos or video were acquired.

Unidentified Medium Delphinid

Sighted 16 November. A group of 5 delphinids was seen traveling slowly (1-3 kts) in rough Bf 6 conditions within ~0.14 nm (250 m) ahead of the ship, traveling to the east. Three dorsal fins were initially seen as they slowly rolled at the surface; another animal was sighted as its head broke the water surface. Identified characteristics were similar to pygmy killer whales (*Feresa attenuata*). No unusual behavior was seen; the animals were not resighted despite 20 minutes of searching in the SE quarter of Box subarea A where they were initially seen (21°49.00 N, 157°22.29 W). No photo or video was obtained.

Sei whales (*Balaenoptera borealis*)

Sighted 16 November. This was our second sighting of sei whale, and at a similar latitude (22 ° 05.70 N) as the sighting on 12 November (22 ° 02.53 N) (~20 km apart; Fig. 4). This time the sighting was in the NW quarter of Box subarea B (22 ° 05.70 N, 157 ° 22.59 W). Initial sighting was a blow at 1.5 nm (2.9 km) to the north. Group consisted of three subadult sei whales estimated to be about the same size at ~8 to 11 m long. Throughout the total 64 min of observations, the three subadult sei whales traveled slowly (1-3 kts) and appeared to be "riding" or "surfing" the swells. They usually traveled just below the surface taking visible breaths every 8-10 minutes, sometimes logging at the surface. On numerous occasions, they crossed the bow, approaching the *Searcher* to within 15 m. Their general travel direction was south. Two of the whales generally remained within approximately 1-3 body lengths of one another. All three whales seemed unconcerned with the movements of the ship and did not exhibit any fleeing or evasive movement or behavior. Numerous photos (n = 337) were taken, many showing confirmational identifying characteristics for sei whales.

Humpback Whale (*Megaptera novaeangliae*)

Sighted 17 November. A blow identified this group of 2 adults and 1 subadult initially traveling fast headed south toward Penguin Bank in the southern end of Box subarea D (21 ° 09.60 N, 157 ° 25.36 W). Part-way through the observations near the time a breach was observed, one of the adults left the group. The next time humpbacks surfaced, we were not sure if they were the same individuals. However, close examination of photo-identification photographs may reveal the fluke identification and/or the actual number of individuals we followed. We observed typical respiratory and non-respiratory behaviors (breaching, peduncle and flipper splashing, tail swishing) and obtained underside fluke and dorsal photos for individual identification. The subadult breached three times and was recorded on video. Two to three other humpback pods were seen near the horizon. During the course of the focal follow, we moved SW out of the Box to continue behavioral observations.

BEHAVIORAL SAMPLING

Focal follows were conducted on four cetacean sightings: a single sei whale, a single Bryde's whale, a group of three subadult sei whales, and a group of three humpback whales. Details of these focal pod follows are described in Table 4. Focal follows were conducted in three of the four subareas in subareas A, B, and D (Figure 2) Focal behavioral sessions ranged in duration from 50 - 145 minutes, with the longest continuous observation session of 145 minutes occurring with the first sei whale. Longer time was spent with those species with federal listing under the ESA, i.e. the sei whales and humpback whales.

Sei whales and Bryde's whales can easily be confused. We spent additional time on the focal follow of the Bryde's in order to make a positive identification of the animal. Photographs were taken during all focal follows. Video was obtained during the sei

Table 4. Behavioral sampling results of focal animal follows 11 - 17 November 2007 Marine Mammal and Sea Turtle Survey near the Island of Oahu.

Date	Species	Total Time With Animal/s	Depth (m)	Group Size/ Composition	Behavior State	Individual Non-Blow Behavior	Comments
12 Nov	Sei whale (*Balaenoptera borealis*)	145 min	2500	1/ adult	Slow travel	No blow rise.	Maintained slow travel throughout observations, often logging just below water surface; repeatedly approached/paralleled *Searcher*.
13 Nov	Bryde's whale (*Balaenoptera edeni*)	50 min	4500	1/ adult	Slow travel	No blow rise, underwater blow.	Maintained slow travel speed throughout observations; approached Searcher several times. Navy vessel in view over the horizon during encounter.
16 Nov	Sei whale (*Balaenoptera borealis*)	64 min	5000	3/subadults	Logging, slow travel	No blow rise, "surfing swells", "bow riding"	Repeatedly followed vessel, crossed bow and "surfed" bow wave and swells. Whale movement appeared to be propelled by swells.
17 Nov	Humpback whale (*Megaptera novaeangliae)*	70 min	40	3/2 adult, 1 subadult, may have been as many as 5 animals.	Fast and medium travel, surface-active travel	Breach, peduncle slap, pectoral fin slap, tail swish, fluke up, peduncle arch, no blow rise	Frequently changed travel directions in apparent response to other nearby humpbacks; appeared to be a disaffiliation then an affiliation of humpbacks associated with surface-active behaviors.

whale focal follow on 12 November and the humpback whales focal follow on 17 November.

Ad libitum continuous sampling was conducted on all focal follows of baleen whales. This resulted in continuous or nearly continuous records of all blows, surfacings, and conspicuous individual behaviors (e.g., breaches, pectoral fin slaps, tail swishes, etc.). In addition, closest inter-individual spacing (estimated in relative body lengths), distance and bearing from the observation vessel, behavioral state, speed of travel, and orientation of whales relative to the vessel were recorded at least once during each surfacing sequence. The latter typically was recorded at the beginning and sometimes the end of the surfacing. The presence, number, distance and activity of all vessels and aircraft within view at the time of focal observations were also regularly noted. Five to 11 observers, including the Cetos team of professional marine mammal observers and additionally up to five crewmembers, were involved in extended focal sessions of baleen whales typically from the flying bridge. Additional observers aided in the resightings of whales between surfacing bouts. Two to three professional marine mammal observers focused on logging behaviors, one or two of which observed the animals and the other whom recorded information on data sheets and Wincruz (the latter for successive lat/long positions). Another professional marine mammal observer took video, while one to two other professional marine mammal observers took digital photographs. The photographer also called out behavioral-related data in the case of multiple whales in a group.

This protocol approach as described allowed us to obtain continuous or nearly continuous, detailed data on the small groups of baleen whales encountered and followed for extended periods. In all cases, focal observation sessions ended at the discretion of the lead scientist in order to meet other goals of the study. Furthermore, none of the whales followed during focal sessions exhibited any notable evasive or disturbance behavior related to the observation vessel or as defined under the MMPA. Other than the repetitive "bow riding" and "surfing" behavior exhibited by the three subadult sei whales, no "unusual" behavior was noted. The former behavior was deemed unusual because very little is known about sei whale behavior as reported in available literature, particularly of subadults/juveniles (e.g., Reeves et al. 2002; Jefferson et al. 2008). It was the opinion among the assembled professional observers (with an average field experience of 24 years) that such continuous, repetitive, "leisurely" "surfing" behavior among sei whales has not been commonly observed either by any of them nor has it been reported to occur in the literature. This behavior was considered attributable to the relatively large swells that day (0.9 to 1.5 m [3 to 7 ft] swells) and the movement of the observation vessel through the water and swells. Again, the whales did not exhibit any distress or otherwise recognizable evasive or adversely disturbed behavior. In contrast, they appeared to be attracted to the vessel and the bow waves/swells/currents it generated at its bow as it traveled at approximately 1-3 kt.

ANCILLARY RESEARCH ACTIVITIES

Oceanography

A total of 13 bathythermograph (XBT) launches were successfully conducted during the Marine Mammal and Sea Turtle Monitoring Survey 11-17 November 2007 as launched from the stern of the *Searcher*. Related results, figures, and discussion are provided in Appendix B.

Photography/Videography

Photographs were taken during all focal follows (see Behavioral Sampling). Certain photos assisted with positive identification in 3 of 4 focal follows. Sei and Bryde's whales can easily be confused and are frequently misidentified. The photos were definitive in these cases. Photos taken of the humpback whale focal group may be of use in identifying individuals using existing photo ID databases. Both cameras produced photos on all focal follows. The photographic data obtained is presented in Table 5.

Table 5. Photo/video results from 11 - 17 November 2007 Marine Mammal and Sea Turtle Survey near the Island of Oahu.

Date	Species Sighting	Total Photos	# Frames utilized for Species ID	Min of Video
12 Nov	Sei whale (*Balaenoptera borealis*)	124	14	4:04
13 Nov	Bryde's whale (*Balaenoptera edeni*)	67	9	-
16 Nov	Sei whale (*Balaenoptera borealis*)	337	7	-
17 Nov	Humpback whale (*Megaptera novaeangliae)*	143	-	2:29

Video was taken during two of the four focal encounters. Technical difficulties with the equipment during the focal follow on 16 November, were resolved and video recording was resumed for the focal follow on 17 November. Video on 12 November produced limited useful footage. Video on 17 November recorded a near full breach by the sub-adult humpback whale, two dives, and footage of dorsal hump, back and caudal peduncle of the humpback whales.

SECTION 4
DISCUSSION

The occurrence of cetacean species is not well documented in the HRC off the windward-facing NE shore of Oahu, particularly in waters >25 nm (46 km) from shore. This is due to predominant strong NE tradewind and wave conditions that typically preclude effective visual observations as well as minimal survey effort in waters >25 nm (46 km) from shore. Prior to our survey, the most recent and comprehensive systematic survey that included waters of the HRC was a NOAA Fisheries-sponsored line-transect vessel-based survey of the U.S. Exclusive Economic Zone (EEZ) and an area outside the EEZ around the Hawaiian Islands chain including the Northwest Hawaiian Islands from August to November 2002 (Barlow 2003, 2006; Barlow et al. 2004). The latter survey was focused on odontocetes (toothed whales), primarily delphinids (dolphin species), in pelagic waters near some of the islands; very little effort occurred in the HRC (Barlow 2003, 2006; Barlow et al. 2004). While some aerial survey transects have occurred in the HRC, relatively few cetacean sightings have been made in the usually rough sea conditions encountered there (e.g., Mobley et al. 1999a, 1999b, 2000, 2001, 2004). It is not known, however, whether this is because the density is truly low, or whether it is a factor of poor observation conditions. Thus, there is a considerable data gap in the distribution and occurrence of cetaceans in the HRC off the NE coast of Oahu.

Despite relatively poor weather and sea conditions during much of the survey, our research effort was successful on several fronts, as follows:

- We documented the first occurrence of the Bryde's whale near the main Hawaiian Islands. Previous verified sightings from the Hawaiian Islands region have occurred only in the leeward Northwestern chain of the Hawaiian Islands at least ~1160 km WNW of Kauai (Barlow 2003, 2006; Barlow et al. 2004).

- We documented two rare sightings of sei whales composed of 4 individuals NE of Oahu. Sei whales were only recently (in 2002) documented and confirmed to occur in waters surrounding the Hawaiian Islands (Shallenberger, 1981; Mobley et al. 2000; Mobley 2002; Barlow 2003, 2006; Barlow et al. 2004; Rankin and Barlow 2007). Within the main Hawaiian Islands, previous sei whale sightings occurred ENE of Molokai and off the E side of the Big Island of Hawaii, with no sei whale sightings near Oahu (Barlow et al. 2004; Rankin and Barlow 2007). Another important factor from our survey related to sei whales is that one of our sei whale sightings consisted of three juveniles estimated to be 1-2 years old. Winter breeding/calving grounds of North Pacific sei whales have not been located, although they are known from whaling data to breed and calve during fall (Reeves et al. 2002; Jefferson et al. 2008). The latter sighting of young sei whales combined with other sei whale sightings during fall suggests that some sei whales use the offshore waters of the Hawaiian Islands during the fall breeding season.

- We demonstrated that opportunistically "shadowing" / "following" Navy exercise vessels at a safe distance (>3 nm [> 5.5 km]) for an extended period (up to ~8 hours) is possible, at least under the circumstances we encountered. It was also possible, under the circumstances we encountered, to conduct a focal follow of a whale sighting while within view of Navy exercise vessels.

- We demonstrated that using two sets of Big Eyes in addition to a naked-eye observer from the *Searcher* improves the effectiveness of sighting cetaceans during conditions of Beaufort sea state <6 and limited swell conditions. Two of the eight total cetacean sightings were initially made with the Big Eyes (vs. six were made with the naked eye initially). However, when heading into swells over approximately 5-6 ft in height from the Searcher, the ability and efficiency of using the Big Eyes is compromised due to instability of the observation platform. This effects can be somewhat mitigated by shifting the vessel's heading. Big eyes also facilitated confirmation of species identifications by allowing for more detailed sightings.

- Data collected during this study contribute to baseline data important in developing and implementing effective marine mammal monitoring for the Undersea Warfare Exercises proposed to continue to be conducted through January 2009 in the HRC.

- This Cetos survey was also important in identifying both limitations of and recommendations for future monitoring-related efforts as discussed in the following section.

It is not possible in this report to assess potential effects of the Navy exercises on marine mammals as we were not provided with detailed information on the nature and timing of their activities. Therefore, we can not make correlations between behaviors and Navy actions.

SECTION 5
RECOMMENDATIONS

A list of recommendations for future monitoring efforts relative to the survey design and its implementation has been compiled by Cetos Research Organization for use in future monitoring efforts. These recommendations are based on results of and events relating to this survey, as well as on our previous experience with and knowledge of relevant mitigations and of monitoring surveys, including past USWEX monitoring surveys (e.g., Cetos 2005, 2007a). Below is a short summary of these recommendations.

A. Monitoring Workshop

Cetos highly recommends that a workshop be held on behalf of the Navy to identify and synthesize the effectiveness and feasibility of various monitoring approaches that could be implemented in association with USWEX Navy exercises and other such Navy activities. A brief synopsis of some of our recommendations is provided below. Greater detail could be provided and developed in a workshop as suggested above, which would be designed to address this type of survey project. A workshop on this topic would allow for the following:

- This workshop could pull together experts and professionals knowledgeable about Hawaiian cetaceans, those with considerable marine mammal monitoring experience with the species of concern, and others with relevant expertise (e.g., survey design, behavioral reactions to anthropogenic sounds, etc.) that could contribute to the goals of the workshop.

- In particular, this format could be used to develop an approach to determining the minimum sample sizes needed to address monitoring concerns, and aid in selecting approaches that are feasible given the limitations of the issue(s) of concern (e.g., species density/attainable sample size vs. ability to determine effects, etc..

B. Feasibility of Monitoring Near Navy Activities/Vessels

Based on our results, on an opportunistic basis, it is possible to remain within view and a safe distance (>3 nm [> 5.5 km]) from the USWEX Navy exercises encountered during this survey. This approach should be implemented as a potentially viable monitoring measure as part of vessel-based monitoring for marine mammals and sea turtles during future activities. Related future recommendations include:

- If the survey vessel encounters Navy vessel activities, the survey vessel should stay within view but >3 nm (> 5.5 km) from the vessels for as long as feasible. This would facilitate identification of any marine mammals and sea turtles of concern that may exhibit reactions to the Navy activities.

- If the Navy vessels move out of sight faster than the survey vessel can follow, the survey vessel should remain in the vicinity where the Navy activities occurred to identify any potential changes in animal behavior or reaction, and/or to obtain "post Navy activity" behavioral observations

- Cetos recommends using a small aircraft to monitor behavioral observations in addition to vessel-based monitoring. If the aircraft is kept at a sufficient radial distance from the animals of concern (i.e., out of hearing range given Snell's cone—see Richardson et al. 1995), then potential confounding effects of the aircraft on whale behavior can be discounted. Aerial surveys have been shown to be effective for assessing disposition of marine mammals as well as to determine abundance, and even photographic identification of individuals (Barlow and Gisiner 2006) Aerial surveys in conjunction with vessel-based surveys offers an optimal platform for monitoring. Note: for vessel-based behavioral observations, it can be problematic to separate out behavioral effects from the vessel. However, the vessel, combined with aerial surveys, remains a logical platform to identify the disposition of marine mammals (e.g., unusual behaviors, injured animals, etc.). Combined aerial and visual surveys took place during this training exercise i.e. aerial surveys were done in addition to the shipboard survey, although under separate contract.

C. Vessel-Based Survey Protocol

Based on our findings from this and other surveys, vessel based surveys are effective for monitoring during Navy training exercises. Data collection and relevant information gathering would be enhanced by incorporating our suggestions and recommendations below. These include:

- A minimum of six marine mammal visual observers as used during this survey are warranted to provide effective data gathering in various weather conditions. After experimenting with more and fewer observers, having a team that is comprised of six individuals is our recommendation. This ensures adequate coverage, and effective observations as well as data collection.

- A navigating program should be purchased and used from the observer station in conjunction with the data collecting PC. A program of this type was used by the Captain and crew of the Searcher during the survey; however, it could not be used in real time by the observers because the monitor was located in the enclosed bridge. . This necessitated that an observer would have to take several minutes to leave the observation station on the flying bridge, go below, and obtain information of interest. In order to do this, the observer in question was required to actually observe the monitor located in the bridge (i.e., the information could not be effectively communicated via radio from the bridge to the flying bridge). A real time charting program improves effectiveness of observations by:

  - Providing a real-time image of proposed, past, and recent ship tracks relative to survey design/track lines, sighting locations, locations of Navy activities, etc.;

  - Provides ability to quickly calculate distances and estimated time to arrive at destinations; this aids in survey planning that can be readily adapted to changing conditions (e.g., sighting Navy vessels, species of concern sightings, winds, currents, swells, glare, etc.); and

  - Data layers that can be displayed graphically in real time include bathymetry, bottom topography, currents, winds, other vessels, shoreline, tracks, sightings etc. Information can also be edited (e.g., shown or deleted, etc.) and printed out to provide maps for in situ adaptive survey planning purposes, data analyses, reports, etc.

- Wincruz is considered awkward and inadequate for the purposes of monitoring surveys. This has been the assessment of our monitoring team since our first survey (Cetos 2005) and we remain confidant that it is not the best program for these surveys as it was designed to be executed for different survey goals. We recommend obtaining ***Noldus,*** a program designed specifically for monitoring animal behavior, and having the engineers assist in creating the program designed for these surveys. The ***Noldus*** program can be specifically tailored to meet the needs and interests of any user, in this case, the Navy's monitoring program. (http://www.noldus.com/site/nav10000). Our conclusion is based on the following:

  - In particular, it is currently impossible to collect individual data on all whales in groups of >2 animals using Wincruz and hand-taken notes/data sheets. Noldus provides a small PDA, optionally with a touch screen, that speeds up the data recorder's ability to take detailed behavioral observations, including for more animals. Noldus also reduces the need for multiple entries on different sources by combining all needed data into one program/computer.

- Noldus can be designed with specific statistic tests in mind so that various hypotheses can be addressed, with the statistical power warranted.

Noldus must be obtained with enough lead time so that the tailoring of the program could be done prior to survey start. This program would provide ongoing support to Navy exercises on a continual basis, and greatly increase the relevance and usefulness of collected data. The data gathered would be more in alignment with the goals of the monitoring study.

D. Survey Preparation

We recommend six weeks absolute minimum lead time to allow for appropriate survey preparation which in turn will allow for better collection of data. This lead time is a minimum to allow us to amass the appropriate (professional and trained in marine mammal observing) staff, who are often scheduled months in advance. It will also allow us to prepare/procure the appropriate equipment, and allow for less expensive travel (air tickets) i.e. with advance ticket purchases. Advance time will allow us to reserve charter vessels and in many cases will create the opportunity to obtain a less expensive rate which will save funds. In terms of mobilization, a minimum of two days prep time is recommended in order to set up equipment on the boat. Particularly in terms of big eyes, 2 days is a minimum and in many cases, more time will be needed especially without local onsite help which is only occasionally available. Lead time will allow us to continue to develop database programs which enhance analysis. In the case of this survey, for example, we had enough time to develop a needed program based on our experience from our last survey. We contracted a programmer to design a program to post-process the WinCruz data so that data was summarize correctly.

E. Future Vessel-Based Surveys

The Searcher and its crew are considered sufficiently safe, seaworthy, amenable, and adequate to conduct vessel-based monitoring surveys in other areas of concern to the Navy in Hawaii that are further offshore, e.g., the Navigator Seamounts.

F. Coordination with Aerial Surveys

When vessel-based and aerial surveys are to occur concurrently in the same area, they should be coordinated prior to and during the surveys for the following reasons:

- If an animal of concern is found by either team, but particularly initially by the vessel team, exhibiting unusual behavior or disposition, the aerial team is capable of following the animals over a wider range and performing a longer term case study of the animals' disposition;

- The aerial survey team can also take photographs from a different perspective that can aid in species ID and behavioral descriptions; and

- Vice versa, i.e. if the aerial team identifies a species of concern as such to the vessel, and subsequently needs to leave the area, they can inform the vessel team of the animals' exact whereabouts (possibly even staying on station until the vessel arrives) allowing the vessel continue following the animal and collecting data for the sighting.

G. Aerial Survey Recommendations to Identify Potential Strandings

Cetos recommends that aerial surveys circumnavigate nearby islands (in the vicinity of the training) to search for stranded, injured, or unusually behaving species of concern. This additional tracking should be scheduled as follows:

- First, this survey would occur once before the Navy activities begin. This would allow for the ID'ing any strandings that may exist before activities begin, to eliminate potential cause and effect links to Navy activities for such strandings;

- Subsequently this survey would occur at minimum once during Navy activities. The aerial survey should be scheduled considering the distance of the Navy activities to the nearby land, and also with the predominant current and wind speed and direction relative to the location of Navy activities addressed. By assessing these factors, the survey can be conducted with the provision for enough time to create the opportunity to sight any potentially stranded animals i.e. animals that may have had a reaction to training would have had sufficient time to potentially be stranded. For example, if the activities occur 30 nm (56 km) from shore, and the predominant current speed is 3 kt toward an island, then it could take 30 nm (56 km)divided by 3 nm (5.6 km)/h = 10 hr for a dead or injured animal to land on the beach.

- Finally, this survey should occur at minimum once after Navy activities have ended, with timing coordinated to consider factors identified above (e.g., distance to study area, currents, wind, etc.)

H. Acoustic Monitoring Via Array

We continue to believe that using acoustic research equipment would aid in monitoring for the Navy exercises. A towed acoustic array that is capable of localizing vocalizing cetaceans is recommended to be used along with associated software and hardware for the following reasons (also see Cetos 2005 and 2007a):

- It can be used to increase the detection rates of cetaceans that vocalize but are not seen, and when visual observation is not possible;

- Marine mammals can be recorded vocalizing or not vocalizing before, during, and after Navy exercises; and

- Acoustic monitoring team can assess marine mammal activity at night; we recommend monitoring should include at least two dedicated acoustics specialists who can alternate shifts over nighttime monitoring

SECTION 6
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APPENDIX A

FORMS AND PROTOCOL

Appendix A: Forms and Protocols

1. Beaufort Sea State Criteria
2. Ethogram of Marine Mammals
3. Photo and Video Camera Log
4. Behavioral Monitoring Data Entry Form
5. Daily Sighting Summary Form
6. WinCruz Code Definition Sheet - Survey Nov. 2007
7. XBT data collection form
8. MMPA take form

1. Beaufort Sea State Criteria

(Beaufort Scale or *Beaufort Wind Force Scale)*

Beaufort number 0 - Calm

Wind speeds: less than 1 knot (<1 mph; <1 kph; <0.3 mps)

At sea: Sea like a mirror, calm

Sea disturbance number: 0

Probable wave height: flat (0 ft; 0 m)

On land: Smoke rises vertically

Beaufort number 1 - Light Air

Wind speeds: 1-3 knots (1-3 mph; 1-5 kph; 0.3-1.5 mps)

At sea: Ripples with the appearance of scales are formed but without foam crests

Sea disturbance number: 0

Probable wave height: 5-10 cm (2-4 in) (0 ft; 0 m)

On land: Direction of wind shown by smoke drift, but not by vanes

---

Beaufort number 2 - Light Breeze

Wind speeds: 4-6 knots (4-7 mph; 6-11 kph; 1.6-3.3 mps)

At sea: Small wavelets, still short but more pronounced; crests have a glassy appearance and do not break

Sea disturbance number: 1

Probable wave height: 10-15 cm (4-6 in); (0-1 ft; 0-0.3 m)

On land: Wind felt on face; leaves rustle; ordinary vane moved by wind

---

Beaufort number 3 - Gentle Breeze

Wind speeds: 7-10 knots (8-12 mph; 12-19 kph; 3.4-5.4 mps)

At sea: Large wavelets; crests begin to break; foam of glassy appearance; perhaps scattered white horses

Sea disturbance number: 2

Probable wave height: 60 cm (2 ft); (1-2 ft; 0.3-0.6 m)

On land: Leaves and small twigs in constant motion; wind extends light flag

---

Beaufort number 4 - Moderate Breeze

Wind speeds: 11-16 knots (13-18 mph; 20-28 kph; 5.5-7.9 mps)

At sea: small waves, becoming longer; fairly frequent white horses

Sea disturbance number: 3

Probable wave height: 1 m (3.5 ft); (2-4 ft; 0.6-1.2 m)

On land: Raises dust and loose paper; small branches are moved

---

Beaufort number 5 - Fresh Breeze

Wind speeds: 17-21 knots (19-24 mph; 29-38 kph; 8.0-10.7 mps)

At sea: Moderate waves taking a more pronounced long form; many white hourses are formed; chance of some spray

Sea disturbance number: 4

Probable wave height: 2 m (6-7 ft); (4-8 ft; 1.2-2.4 m)

On land: Small trees in leaf begin to sway; crested wavelets form on inland waters

---

Beaufort number 6 - Strong Breeze

Wind speeds: 22-27 knots (25-31 mph; 39-49 kph; 10.8-13.8 mps)

At sea: Large waves begin to form; the white foan crests are more extensive everywhere; probably some spray

Sea disturbance number: 5

Probable wave height: 3 m (9-10 ft); (8-13 ft; 2.4-4 m)

On land: Large branches in motion; whistling heard in telegraph wires; umbrellas used with dificulty

---

Beaufort number 7 - Near Gale / Moderate Gale

Wind speeds: 28-33 knots (32-38 mph; 50-61 kph; 13.9-17.1 mps)

At sea: Sea heaps up and white foam from the breaking waves begins to be blown in streaks along the direction of the wind

Sea disturbance number: 6

Probable wave height: 4 m (13-14 ft); (13-20 ft; 4-6 m)

On land: Whole trees in motion; inconvenience felt when walking against wind

---

Beaufort number 8 - Gale / Fresh Gale

Wind speeds: 34-40 knots (39-46 mph; 62-74 kph; 17.2-20.7 mps)

At sea: Moderately high waves of greater length; edges crests begin to break into spindrift; the foam is blown in well-marked streaks along the direction of the wind

Sea disturbance number: 6

Probable wave height: 5.5 m (18 ft); (13-20 ft; 4-6 m)

On land: Breaks twigs off trees; generally impedes progress

Beaufort number 9 - Strong Gale

Wind speeds: 41-47 knots (47-54 mph; 75-88 kph; 20.8-24.4 mps)

At sea: High waves; dense streaks of foam along the direction of wind; crests of waves begin to topple, tumble and roll over; spray may affect visibility

Sea disturbance number: 6

Probable wave height: 7 m (23 ft); (13-20 ft; 4-6 m)

On land: Slight structural damage occurs (chimney post and slates removed)

Beaufort number 10 - Storm / Whole Gale

Wind speeds: 48-55 knots (55-63 mph; 89-102 kph; 24.5-28.4 mps)

At sea: Very high waves with long overhanging crests; resulting foam in great patches is blown in dense white streaks along the direction of the wind; on the whole, the surface of the sea takes a white appearance; tumbling of the sea becomes heavy and shock-like; visibility affected

Sea disturbance number: 7

Probable wave height: 9 m (29 ft); (20-30 ft; 6-9 m)

On land: Seldom experienced inland; trees uprooted; considerable structural damage occurs

Beaufort number 11 - Violent Storm / Storm

Wind speeds: 56-63 knots (64-75 mph; 103-117 kph; 28.5-32.6 mps)

At sea: Exceptionally high waves (small and medium size ships might be for a time lost from view behind waves); sea is completely covered with long white patches of foam lying along the direction of wind; everywhere the edges are blown into froth; visibility affected

Sea disturbance number: 8

Probable wave height: 11 m (37 ft); (30-45 ft; 9-14 m)

On land: Very rarely experienced; accompanied by widespread damage

Beaufort number 12 (-17) - Hurricane

Wind speeds: 64 knots and greater (> 75 mph; >117 kph; >32.7 mps)

At sea: The air is filled with foam and spray; sea completely white with driving spray; visibility very seriously affected

Sea disturbance number: 9

Probable wave height: 11 m and more (> 37 ft); (>45 ft; >14 m)

On land: Very rarely experienced; accompanied by widespread damage

2. Ethogram of Marine Mammals
Navy Marine Mammal Monitoring Survey 003
Cetos 2007

BEHAVIORAL STATES
(FOR SURVEY SCANS AND FOCAL ANIMAL FOLLOWS)
**(i.e., activities with duration that are mutually exclusive of one another,
Not individual or instantaneous behaviors)**
During focal animal follows, note the behavioral state every min or at least when it changes.

TRAVEL (Fast or Slow):	point to point directed movement in one direction by the majority of a group.
MILL:	continuous changes in headings, asynchronized orientations of majority of individuals (i.e., majority of group orientation is not synchronized in one direction)
SURFACE-ACTIVE:	individual behaviors that cause conspicuous splashes (e.g., breaches, tail slaps, flipper slaps, peduncle slaps, chin rises or slaps, porpoising, etc)
SURFACE-ACTIVE/ MILL:	Mill with at least one individual in the group displaying behaviors that cause conspicuous splashes (see above)
COMPETITIVE:	Includes surface active behaviors but is more specifically about a group size>3 with males competing for female attention (humpbacks only)
REST:	remaining in one location with no forward movement; only surfacing to breath and return to depth
FEEDING:	for cetaceans other than humpbacks; visible foraging behaviors

Also Note if animals appear to be feeding, social/touching, bird presence, "play", etc. in comments

DISPOSITION
I = Injured
D = Dead
O = Ordinary

INDIVIDUAL BEHAVIORS
FOR FOCAL ANIMAL BEHAVIORAL SAMPLING/ FOLLOWS
(To be used primarily with whales or small groups of animals as possible)

BL	BLOW
FU	FLUKE UP
BR	BREACH
FS	FLUKE SLAP
PS	PECTORAL FIN SLAP
NR	NO BLOW RISE (BODY VISIBLE WITH OUT VISIBLE BLOW)
HS	HEAD SLAP
LO	LOGGING AT SURFACE
HR	HEADRISE

ALSO NOTE THE FOLLOWING INFORMATION ON FOCAL GROUPS ~1 min if possible (i.e., scan sampling):

- Largest distance between individuals in a group (in body lengths)
- Closest distance between individuals in a group (in body lengths)
- Bearing of animal/center of group in degrees L or R relative to bow of vessel where bow is 0 degrees
- Heading/orientation of animal or majority of group relative to bow of vessel in degrees L or R where bow is 0 degrees
- Any unusual behavior

3. Marine Mammal Survey Photo and Video Camera Log

Date______________Month/day/year Camera or Video______________ Page_______of_____
List which still camera if more than 1 used

CREW:

Photographer/Videographer: ___________________________ Data Taker:________ _____________

TIME START	TIME END	FILM ROLL OR VIDEO NUMBER	FRAME OR COUNTER NUMBER	DESCRIPTION

4. Behavioral Monitoring Data Entry Form:

(only headers included).

Date:

Observer:

Lat/Long @ Start:

Lat/Long @ End:

WS/WE:

Visibility:

Species:

Focal Group #:

Wincruz ID #:

Group Size:

 # Calves

Water Depth:

Behavioral States: **T**=travel, **M**=mill, **SAT**=surface active travel, **SAM**=surface active mill, **R**=rest

Indiv. Behav. Codes: **BL**= blow, **BR**= breach, **FU**= fluke up,
FS= fluke slap, **HR**= head rise, **HS**= head slap,**NR**= no blow rise,
LO= logging, **PS**= pec fin slap,

Boat Activity (Motor, Sail, Drift)	Time			Behavior		MM Bearing relat to vessel (0=dead ahead)		Distance		Speed (S, M, F)	Comments
	Hr	Min	Sec	Behav State (1x/ min)	Indiv. Beh Code	Where At	Where To	# Ret or Eye	# m		

5. Daily Sighting Summary Form

(only headers included).

Daily Sighting Summary Form Recorder:

Sight-ing #	Date	Time (start time/ end time)	Start Lat - 3 decimal places	Start Long - 3 decimal places	End Lat - 3 decimal places	End Long - 3 decimal places	Species	# Animals (Group Size	Group comp	Depth	Behav State	Orientation	Speed	Anim Head-ing	Anim Bear-ing	Beaufort	Comments

6. WinCruz Code definitions Sheet – Survey Nov. 2007

WINCRUZ CODES

P	Observers	F6
301	Gary Friedrichsen	
302	Tom Jefferson	
303	Mari Smultea	
304	Chris Cutler	
305	Julie Hopkins	
306	Kalyn Quintin	

V	Viewing Conditions	F7
Beaufort	1 thru 6	
Swell height	feet	
Swell Direction	degrees	
Wind Speed	mph	

N	Navigation	F8
Course	degrees	
Speed	knots/hr	

W	Weather	F9
Rain/fog	1=none, 2=fog, 3=rain, 4=both,	

S & A	Sightings	F2
Sighting #	assigned	
Observer	number	
First Cue	1=bird,2=splash,3=mm,4=ship,5=?,6=blow,7-helo	
Method	1=eye,2=7x,4=25x,5=not25x,6=other,7=helo	
Bearing	left is negative	
Initial ID	spp #	
Reticle	to animal	
Distance	nmi to sighting	
Course	direction of animal	
Speed	of animal	
ID Label	letter for map	
A		
Sp Code1-3	most likely to 3rd choice, spp #	
Photos	y or n	
Birds	y or n	
School size	per species estim.	

F-198

5=haze

Wind

Direction degrees

Visibility miles

Species numbers

2	Stenella Attenuata (offshore) Pantropical	70
3	Stenella longirostrus, Spinner	71
5	Delphinus spp.	72
13	Stenella coeruleoalba, Striped	73
15	Steno bredanensis, Rough-toothed	74
18	Tursiops truncatus, Bottlenose	75
21	Grampus griseus, Risso's	76
22	Lagenorhynchus obliquidens, Pac white-side	77
26	Lagenodelphis hosei, Fraser's	78
31	Peponcephala electra, Melon-headed whale	79
32	Feresa attenuata, Pygmy killer whale	80
33	Pseudorca crassidens, False killer whale	96
36	Globicephala macrorhynchus, Short-finned pilot	97
46	Physeter macrocephalus, Sperm whale	98
47	Kogia breviceps, Pygmy sperm whale	177
48	Kogia sima, Dwarf sperm whale	277
49	ziphiid whale	377
51	Mesoplodon spp.	477
53	Mesoplodon hectori, Hecto's beaked whale	
57	Mesoplodon ginkgodens, Ginkgo-toothed	
59	Mesoplodon desirostris, Blainville's beaked	
61	Ziphius cavirostris, Cuvier's beaked whale	
65	Indopaecetus pacificus, Longman's beaked	

7. XBT data collection form

(only headers included).

XBT Launch for Oceanographic data

Date	Time	Type of XBT	Routine or Focal Follow	Comments

8. MMPA take form

(only headers included; broken up into 2 sections to fit on page).

TABLE ONE: TABULATED PERMIT INFORMATION

Date (dd/mm/07)	Location (descriptive)	GPS start (3 decimal places; at encounter start)	GPS end (3 decimal places; at encounter end)	Pod #/Sighting #	Type of Species	Time Encounter Start	Time Encounter End	# animals in pod (high/med/low)	Pod Composition (HUWH = MC, MCE, etc)	Pod Behavior (note start, mid, and end behaviors)	
		Take mid encounter GPS readings if it goes on for longer than 30 minutes		*Pod # = sequential i.e. 1, 2, 3; Sighting # = wincruz #*						*rest, mill, sing, Slow Travel (ST), Fast T (FT), Surface Active, Competitive, etc.*	

Number of Animals Approached	Number of Approach Episodes Conducted	Number of Takes (total)	Number of Times Each Animal was Harassed	Observed Reactions of Animals to Research	Mitigation Measures Utilized to Minimize Reactions	Total # harrassments <u>by species</u>:	Total Time With Animals	Summary of Observed Behavior

APPENDIX B
XBT OCEANOGRAPHIC SUMMARY

A total of 13 bathythermograph (XBT) launches were successfully conducted during the Marine Mammal and Sea Turtle Monitoring Survey 11-17 November 2007 from the *Searcher*. Figure B-1 shows XBT launch locations overlaid with satellite-derived sea surface temperature (SST) and ocean color (chlorophyll *a*) measurements. This presentation provides a basis by which to compare and interpret the associated *in situ* expendable temperature data that were collected,

Oceanographic conditions during the survey were characterized by a moderate latitudinal, or north-south gradient in sea surface temperature (Figure B-1, left panel). SST values at the northern end of the survey area (north of 21.8°N; XBT drops 2, 3, 11, 5, 7) were approximately 0.4 – 1.0 °C cooler than surface temperatures measured near the southern end (south of 21.6 °N; XBT drops 1, 4, 6, 8, 9, 10, 12, 13). Surface-ocean color, a satellite-based measurement of chlorophyll *a* and a proxy for productivity, shows an increase in chlorophyll concentrations with increasing proximity to land (Figure B-1, right panel), with particularly high concentrations observed on the windward (eastern) sides of Oahu and Molokai. The southern end of the survey was conducted within the vicinity of these two islands, where chlorophyll *a* values were greater (~0.05 – 0.1 $\mu g\ l^{-1}$) when compared to the northern portion of the survey.

Temperature data obtained from XBT drops are plotted in Figures B-2 and B-3 with XBT locations shown in Figure B-1. Data statistics are provided in Table B-1. In general, temperature profiles extended down to ~750 m for 11 of the 13 drops; drops XBT-1 and XBT-2 ceased collecting data at ~200 m for unknown causes. When comparing all XBT drops, temperature data show a moderate separation, or spreading, between profiles, likely indicating an asymmetry in physical oceanographic forcing within the survey region (Figure B-2). Examining the upper 100 m highlights this spreading of profiles and brings attention to the substantial differences in mixed layer depth and mixed layer temperature (Figure B-3). XBT drops 2, 3, 11, 5, and 7 are all located at the northern portion of the survey area and exhibit strong vertical mixing with surface-mixed layers extending down to 92 m (range: 60 – 92 m) and mixed layer temperatures of approximately 25.5 °C (range: 25.43 – 25.53). In comparison, XBT drops performed at the southern end are highly stratified and are characterized by shallow (range: 5-62 m) and warm (25.75 – 26.6 °C) surface-mixed layers. This observed north-south difference in upper ocean stratification may also account for the patterns observed in satellite-derived chlorophyll *a* concentrations. A stratified water column, or a column of water with monotonically decreasing water temperature with depth, allows for increased nutrient retainment in the euphotic zone, eventually leading to enhanced phytoplankton growth and surface productivity. Well-mixed waters, such as those observed to the north of the survey area, have a low retainment of nutrients and therefore are typically less productive.

When comparing *in situ* sea surface temperatures with satellite SST, slightly warmer temperatures are observed in the XBT data. This bias in temperature measurements can be attributed to diurnal heating and cooling of the ocean surface. XBT drops were performed during the day, when SSTs are generally warmer, while satellite measurements are an average of day and nighttime temperatures, leading to slightly cooler measurements.

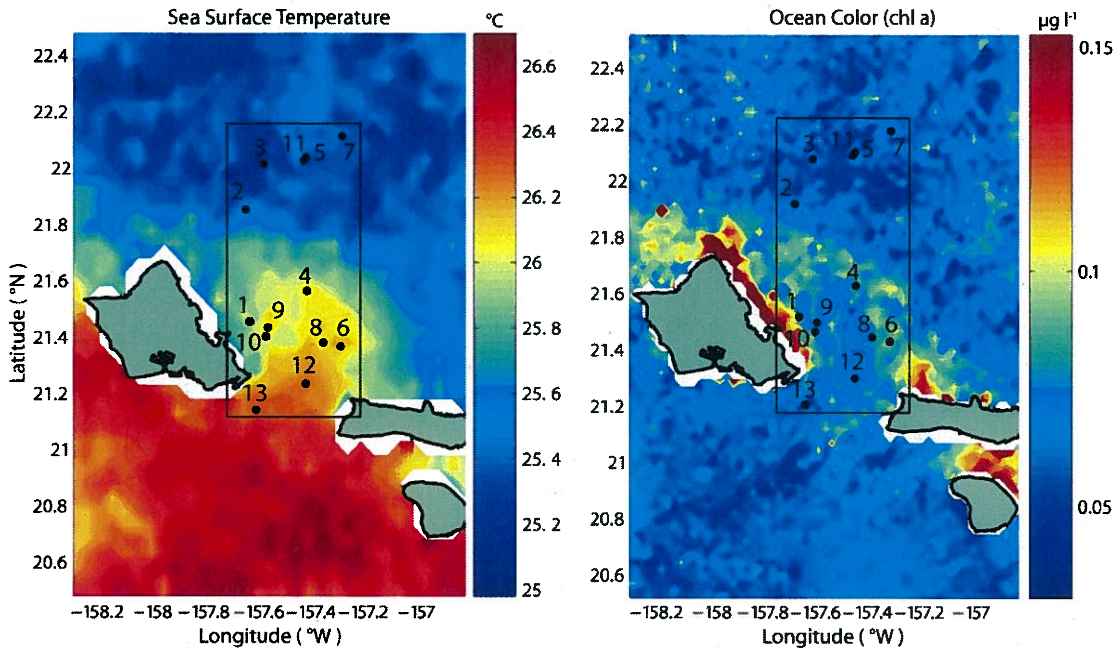


Figure B-1: Expendable Bathythermograph (XBT) drops (black dots) performed during the Marine Mammal and Sea Turtle Monitoring Survey 11-17 November 2007, overlaid with GOES 5.5 km sea surface temperature (SST) (left) and MODIS Aqua 2.5 km ocean color (chlorophyll *a*). SST and ocean color are 14 day means centered on November 15th, 2007. Data was obtained from NOAA's Coastwatch (http://coastwatch.pfel.noaa.gov). The black square indicates the area surveyed.

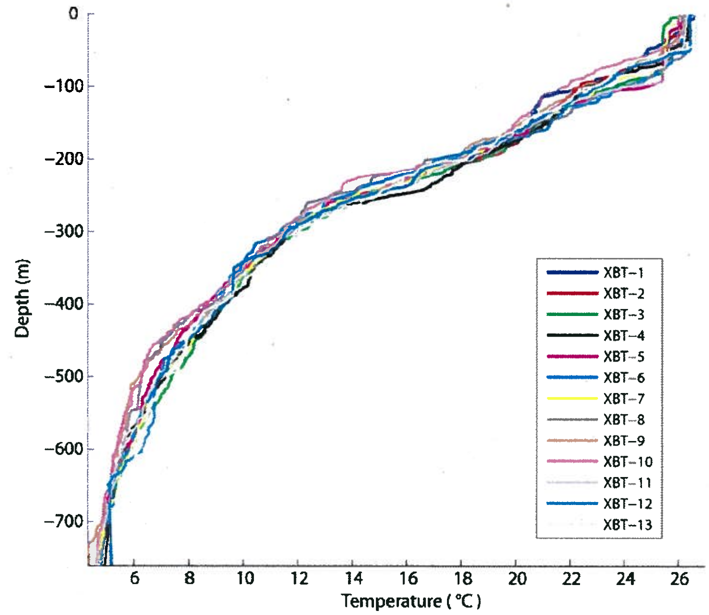


Figure B-2: Expendable Bathythermograph (XBT) profiles obtained from 11-17 November 2007 during the Marine Mammal and Sea Turtle Monitoring survey. XBT locations are shown in Figure B-1.

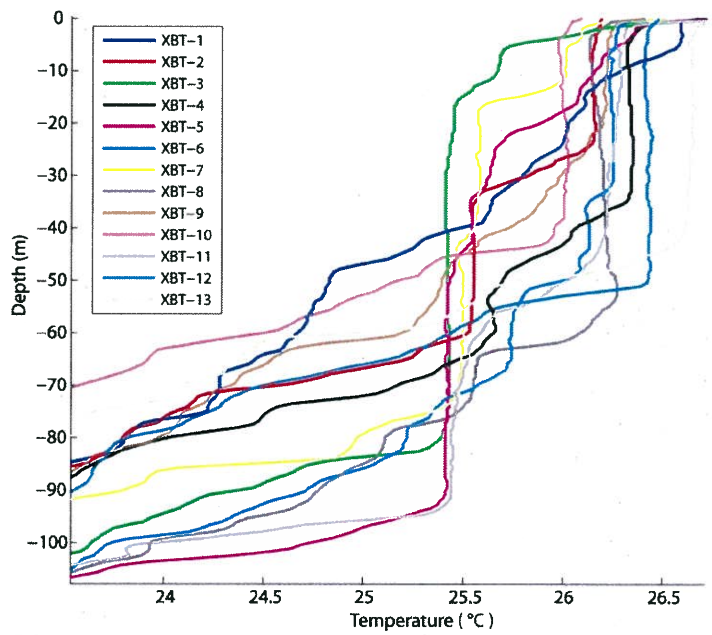


Figure B-3: Expendable Bathythermograph (XBT) profiles for first 100 m depth showing mixed layer depth and temperature profiles. Marine Mammal and Sea Turtle Monitoring survey, 11-17 November 2007. XBT locations are shown in Figure B-1.

Table B-1: Data statistics from each of the XBT drops performed during the Marine Mammal and Sea Turtle Monitoring survey 11-17 November 2007. Mixed layer depth and max depth are given in meters while mixed layer temp, surface temp, and bottom temp are measured in °C.

	Mixed Layer Depth	Mixed Layer Temp	Surface Temp	Bottom Temp	Max Depth
XBT 1	5	26.58	26.59	18.2	200
XBT 2	60	25.53	26.17	18.54	200
XBT 3	80	25.4	26.17	4.75	750
XBT 4	35	26.32	26.38	4.95	750
XBT 5	92	25.41	26.36	4.7	750
XBT 6	65	25.75	26.27	4.86	750
XBT 7	72	25.4	26.09	4.74	750
XBT 8	55	26.2	26.19	4.82	750
XBT 9	25	26.12	26.25	4.36	750
XBT 10	40	26	26.02	4.68	750
XBT 11	92	25.43	26.31	4.66	750
XBT 12	50	26.4	26.43	5.18	750
XBT 13	40	26.6	26.67	5.87	750

Appendix G
Overview of Airborne and Underwater Acoustics

APPENDIX G OVERVIEW OF AIRBORNE AND UNDERWATER ACOUSTICS

G.1 INTRODUCTION

This appendix provides additional information on the characteristics of in-air noise and underwater sound. Sound transmission characteristics are different for sounds in air versus sounds in water. Similarly, sound reception sensitivities vary for in-air sound and in-water sound. Therefore, this appendix is divided into two major subsections: Airborne Noise Characteristics and Underwater Noise Characteristics. A third subsection describes sound transmission through the air-water interface. Underwater ambient sound is partially a result of sound sources that occur outside of the Hawaii Range Complex (HRC). However, for the purposes of this Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS), the region of influence for underwater noise is limited to airborne and underwater sound sources that occur primarily within the HRC boundaries. Full citations for the literature cited in this appendix are provided in Chapter 9.0 of the EIS/OEIS.

G.2 AIRBORNE NOISE CHARACTERISTICS

Primary sources of Navy airborne noise in the HRC include aircraft and their weapons, naval gunfire, aerial targets, and airborne ordnance (e.g., missiles). Throughout this section, the F-4 aircraft is used to represent typical jet aircraft that operate in the HRC. For the purpose of noise characterization, aerial targets and airborne ordnance are essentially small-scale aircraft.

Two distinct types of noise may result from aircraft activities. When an aircraft flies slower than the speed of sound or subsonically, noise is produced by the aircraft's engine and by effects of aircraft movement through air. When an aircraft flies faster than the speed of sound, a sharply defined shock front is created, producing a distinct phenomenon called "overpressure." Noise produced by this physical phenomenon is termed "impulse noise." Thunder claps, noise from explosions, and sonic booms are examples of impulse noise. Airborne noise that originates in higher altitudes is seldom heard on the ground. This is due to the upward bending of sound that takes place in temperature inversions, where the surface temperature is warmer than the temperature at the higher altitude of the sound source. The characteristics of subsonic and supersonic noise are discussed below.

G.2.1 SUBSONIC NOISE

The physical characteristics of noise (or sound) include its intensity, frequency, and duration. Sound is created by acoustic energy, which produces pressure waves that travel through a medium, such as air or water, and are sensed by the eardrum. This may be likened to ripples in water that would be produced when a stone is dropped into it. As acoustic energy increases, the intensity or height of these pressure waves increases, and the ear senses louder noise. The ear is capable of responding to an enormous range of sound levels, from that of a soft whisper to the roar of a rocket engine.

Units of Measurement

The range of sound levels that humans are capable of hearing is very large. If the faintest sound level we can recognize (threshold of hearing) is assigned a value of one, then the highest level humans are capable of hearing (threshold of pain), measured on the same scale, would have a value of 10 million. In order to make this large range of values more meaningful, a logarithmic mathematical scale is used: the decibel [dB] scale. On this scale, the lowest level audible to humans is 0 dB and the threshold of pain is approximately 140 dB. The reference level for the decibel scale used to describe airborne sound is thus the threshold of hearing (for young adults). In physical terms, this corresponds to a sound pressure of 20 micropascals (μPa). Atmospheric pressure is about 100,000 pascals (Pa).

Noise Measurement (weighting)

The normal human ear can detect sounds that range in frequency from about 20 cycles per second or hertz (Hz) to 15,000 Hz. However, all sounds throughout this range are not heard equally well. Figure G-1 shows the in-air hearing threshold curves (audiograms) for humans and a marine mammal species that can hear well in air as well as underwater. The human ear can be seen to be most sensitive at 1 to 4 kilohertz (kHz), whereas the sensitive band for the elephant seal extends upward to at least 10 kHz. However, at most frequencies the hearing threshold for these animals listening in air is 20 to 50 dB higher (less sensitive) than that for the human.

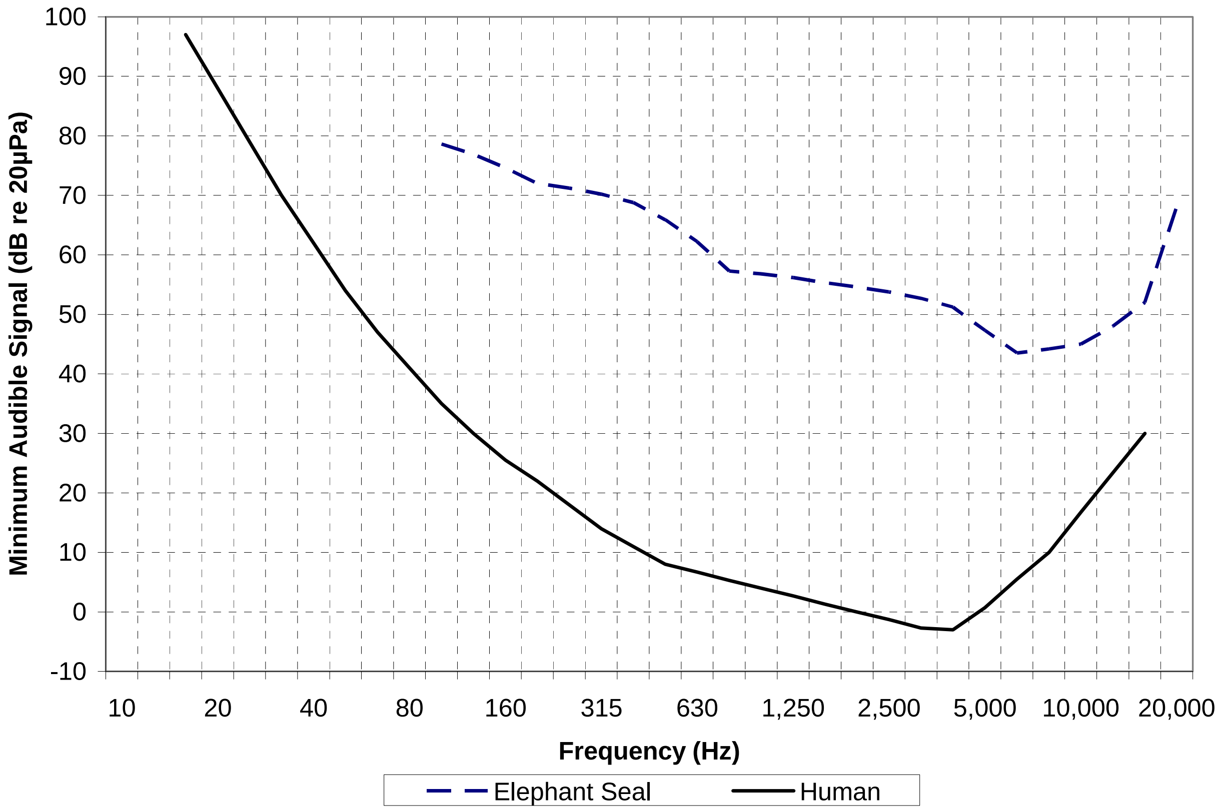


Figure G-1. Human and Marine Mammal In-Air Hearing Thresholds

Sound level meters have been developed to measure sound fields and to show the sound level as a number proportional to the overall sound pressure as measured on the logarithmic scale described previously. This is called the sound pressure level (SPL). It is often useful to have this meter provide a number that is directly related to the human sensation of loudness. Therefore, some sound meters are calibrated to emphasize frequencies in the 1 to 4 kHz range and to de-emphasize higher and especially lower frequencies to which humans are less sensitive. Sound level measurements obtained with these instruments are termed "A-weighted" (expressed in dBA). The A-weighting function is shown in Figure G-2. It is closely related to the human hearing characteristic shown previously in Figure G-1. Because other animals are sensitive to a different range of frequencies, other weighting protocols may be more appropriate when their specific hearing characteristics are known. Alternative measurement procedures such as C-weighting or flat-weighting (unweighted), which do not de-emphasize lower frequencies, may be more appropriate for various animal species such as baleen whales.

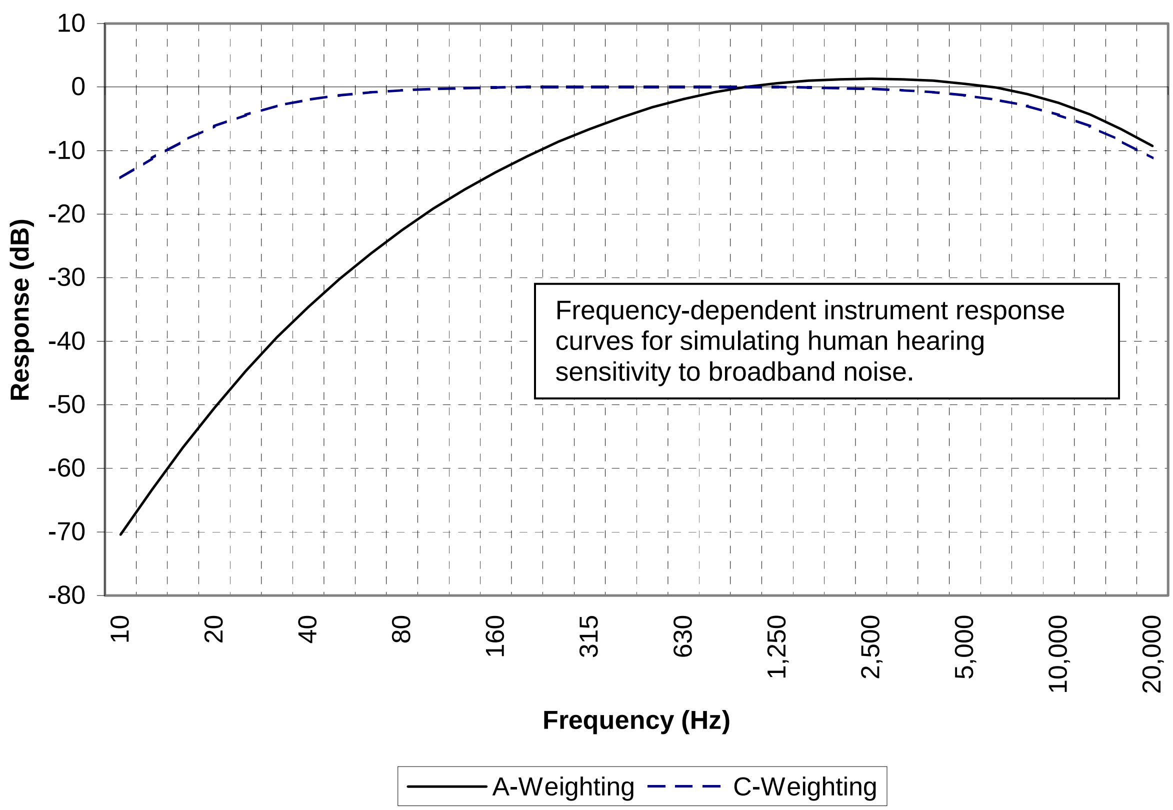


Figure G-2. Noise Weighting Characteristics

Although sound is often measured with instruments that record instantaneous sound levels in dB, the duration of a noise event and the number of times noise events occur are also important considerations in assessing noise impacts. With these measurements, sound levels for individual noise events and average sound levels, in decibels, over extended periods of hours, days, months, or years can be calculated (e.g., the daily day-night average sound level [L_{dn}] in dB).

Sound Exposure Level (Single Noise Event)

The sound exposure level (SEL) measurement provides a means of describing a single, time varying, noise event. It is useful for quantifying events such as an aircraft overflight, which includes the approach when noise levels are increasing, the instant when the aircraft is directly overhead with maximum noise level, and the period of time while the aircraft moves away with decreasing noise levels. SEL is a measure of the physical energy of a noise event, taking into account both intensity (loudness) and duration. SEL is based on the sounds received during the period while the level is above a specified threshold that is at least 10 dB below the maximum value measured during a noise event. SEL is usually determined on an A-weighted basis, and is defined as the constant sound level that provides the same amount of acoustic exposure in one second as the actual time-varying level for the exposure duration. It can also be expressed as the 1-second averaged equivalent sound level (L_{eq} 1 sec).

Table G-1 provides a brief comparison of A-weighted, C-weighted, and flat SEL (F-SEL) values for military aircraft operating at various altitudes and power settings. By definition, SEL values are normalized to a reference time of one second and should not be confused with either the average or maximum noise levels associated with a specific event. There is no general relationship between the SEL value and the maximum decibel level measured during a noise event. By definition, SEL values exceed the maximum decibel level where noise events have durations greater than 1 second. For subsonic aircraft overflights, maximum noise levels are typically 5 to 7 dB below SEL values.

Table G-1. SEL Comparison for Select Department of Defense Aircraft (in dB)

	P-3			F-4C			F/A-18		
Power Setting	2000 ESHP			100% RPM			88% RPM		
Speed (knots)	180			300			400		
Sound Exposure Level (SEL) at Ground Level									
Altitude	**A-SEL**	**C-SEL**	**F-SEL**	**A-SEL**	**C-SEL**	**F-SEL**	**A-SEL**	**C-SEL**	**F-SEL**
2,500 feet	83.5	88.4	88.4	106.7	110.6	110.4	91.3	95.3	95.2
2,000 feet	85.6	90.0	90.0	109.0	112.7	112.6	93.7	97.4	97.3
1,600 feet	87.7	91.6	91.6	111.3	114.8	114.6	96.0	99.4	99.4
1,000 feet	91.7	94.7	94.7	115.7	118.7	118.7	100.2	103.2	103.2
500 feet	97.2	99.2	99.3	122.3	124.1	124.3	105.9	108.5	108.5
315 feet	100.6	102.2	102.2	126.7	127.5	127.7	109.3	111.7	111.8
200 feet	103.9	105.1	105.2	130.9	130.6	130.9	112.5	114.8	114.9

ESHP = effective shaft horsepower
RPM = revolutions per minute

Day-Night Average Sound Level

The day-night average sound level (L_{dn} or DNL) is the energy-averaged sound level measured over a 24-hour period, with a 10 dB penalty assigned to noise events occurring between 10:00 p.m. and 7:00 a.m. L_{dn} values are obtained by summation and averaging of SEL values for a given 24-hour period. L_{dn} is the preferred noise metric of the U.S. Department of Housing and Urban Development, Federal Aviation Administration, U.S. Environmental Protection Agency, and Department of Defense insofar as potential effects of airborne sound on humans are concerned.

People are constantly exposed to noise. Most people are exposed to average sound levels of 50 to 55 L_{dn} or higher for extended periods on a daily basis. Normal conversational speaking produces received sound levels of approximately 60 dBA. Studies specifically conducted to determine noise impacts on various human activities show that about 90 percent of the population is not significantly bothered by outdoor average sound levels below 65 L_{dn} (Federal Aviation Administration, 1985).

L_{dn} considers noise levels of individual events that occur during a given period, the number of events, and the times (day or night) at which events occur. Since noise is measured on a logarithmic scale, louder noise events dominate the average. To illustrate this, consider a case in which only one aircraft flyover occurs in daytime during a 24-hour period, and creates a sound level of 100 dB for 30 seconds. During the remaining 23 hours, 59 minutes, and 30 seconds of the day, the ambient sound level is 50 dB. The calculated sound level for this 24-hour period is 65.5 L_{dn}. To continue the example, assume that 10 such overflights occur during daytime hours during the next 24-hour period, with the same 50 dB ambient sound level during the remaining 23 hours and 55 minutes. The calculated sound level for this 24-hour period is 75.4 L_{dn}. Clearly, the averaging of noise over a given period does not suppress the louder single events.

In calculating L_{dn}, noise associated with aircraft activities is considered, and a 10 dB penalty is added to activities that occur between 10:00 p.m. and 7:00 a.m.; this time period is considered nighttime for the purposes of noise modeling. The 10 dB penalty is intended to compensate for generally lower background noise levels and increased human annoyance associated with noise events occurring between the hours of 10:00 p.m. and 7:00 a.m.

While L_{dn} does provide a single measure of overall noise, it does not provide specific information on the number of noise events or specific individual sound levels that occur. For example, as explained above, an L_{dn} of 65 dB could result from very few, but very loud events, or a large number of quieter events. Although it does not represent the sound level heard at any one particular time, it does represent total sound exposure. Scientific studies and social surveys have found L_{dn} to be the best measure to assess levels of human annoyance associated with all types of environmental noise. Therefore, its use is endorsed by the scientific community and governmental agencies (U.S. Environmental Protection Agency, 1974; Federal Interagency Committee on Urban Noise, 1980; Federal Interagency Committee on Noise, 1992).

Onset-Rate Adjusted Day-Night Average Sound Level

Aircraft operating at low altitude and in special use airspace generate noise levels different from other community noise environments. Overflights can be sporadic, which differs from most community environments where noise tends to be continuous or patterned.

Military overflight events also differ from typical community noise events because of the low altitude and high airspeed characteristics of military aircraft. These characteristics can result in a rate of increase in sound level (onset rate) of up to 30 dB per second. To account for the random and often sporadic nature of military flight activities, computer programs calculate noise levels created by these activities based on a monthly, rather than a daily, period. The L_{dn} metric is adjusted to account for the surprise, or startle effect, of the onset rate of aircraft noise on humans. Onset rates above 30 dB per second require an 11 dB penalty because they may cause a startle associated with the rapid noise increase. Onset rates from 15 to 30 dB per second require an adjustment of 0 to 11 dB. Onset rates below 15 dB per second require no adjustment because no startle is likely. The adjusted L_{dn} is designated as onset-rate adjusted monthly day-night average sound level (L_{dnmr}).

G.2.2 SUPERSONIC NOISE

A sonic boom is the noise a person, animal, or structure on the earth's surface receives when an aircraft or other type of air vehicle flies overhead faster than the speed of sound (or supersonic). The speed of sound is referred to as Mach 1. This term, instead of a specific velocity, is used because the speed at which sound travels varies for different temperatures and pressures. For example, the speed of sound in air at standard atmospheric conditions at sea level is about 772 statute miles per hour, or 1,132 feet (ft) per second. However, at an altitude of 25,000 ft, with its associated lower temperature and pressure, the speed of sound is reduced to 1,042 ft per second (approximately 710 miles per hour). Thus, regardless of the absolute speed of the aircraft, when it reaches the speed of sound in the environment in which it is flying, its speed is Mach 1.

Air reacts like a fluid to supersonic objects. When an aircraft exceeds Mach 1, air molecules are pushed aside with great force, forming a shock front much like a boat creates a bow wave. All aircraft generate two shock fronts. One is immediately in front of the aircraft; the other is immediately behind it. These shock fronts "push" a sharply defined surge in air pressure in front of them. When the shock fronts reach the ground, the result is a sonic boom. Actually, a sonic boom involves two very closely spaced impulses, one associated with each shock front. Most people on the ground cannot distinguish between the two and they are usually heard as a single sonic boom. However, the paired sonic booms created by vehicles the size and mass of the space shuttles are very distinguishable, and two distinct booms are easily heard.

Sonic booms differ from most other sounds because: (1) they are impulsive; (2) there is no warning of their impending occurrence; and (3) the peak levels of a sonic boom are higher than those for most other types of outdoor noise. Although air vehicles exceeding Mach 1 always create a sonic boom, not all sonic booms are heard on the ground. As altitude increases, air temperature normally decreases and these layers of temperature change cause the shock front to be turned upward as it travels toward the ground. Depending on the altitude of the aircraft and the Mach number, the shock fronts of many sonic booms are bent upward sufficiently that they never reach the ground. This same phenomenon also acts to limit the width (area covered) of those sonic booms that actually do reach the ground.

Sonic booms are sensed by the human ear as an impulsive (sudden or sharp) sound because they are caused by a sudden change in air pressure. The change in air pressure associated with a sonic boom is generally a few pounds per square foot, which is about the same pressure change experienced riding an elevator down two or three floors. It is the rate of change—the sudden onset of the pressure change—that makes the sonic boom audible. The air pressure in excess of normal atmospheric pressure is referred to as "overpressure." It is quantified on the ground by measuring the peak overpressure in pounds per square foot and the duration of the boom in milliseconds. The overpressure sensed is a function of the distance of the aircraft from the observer; the shape, weight, speed, and altitude of the aircraft; local atmospheric conditions; and location of the flight path relative to the surface. The maximum overpressures normally occur directly under the flight track of the aircraft and decrease as the slant range, or distance, from the aircraft to the receptor increases. Supersonic flights for a given aircraft type at high altitudes typically create sonic booms that have low overpressures but cover wide areas if the sonic boom reaches the ground.

The noise associated with sonic booms is measured on a C-weighted scale (as shown previously in Figure G-2). C-weighting provides less attenuation at low frequencies than A-weighting. This is appropriate based on the human auditory response to the low-frequency sound pressures associated with high-energy impulses (such as those generated by sonic booms).

G.2.3 AIRBORNE NOISE EFFECTS ON WILDLIFE

The previous discussion primarily concerned the metrics that have been developed to predict human response to various noise spectral and temporal characteristics. Response prediction metrics for non-human species such as marine mammals are generally not available. Because of the limited amount of response data available for marine mammals, it is not possible to develop total sound exposure metrics similar to those applied to human population centers. Instead, the potential impacts of noise sources in the HRC need to be assessed by examining individual source-receiver encounter scenarios typical of range activities. Assessment of potential effects must consider both airborne noise on marine mammals out of the water (e.g., pinniped), and airborne noise (transmitted into the water) potentially effecting marine mammals when they are underwater (e.g., cetacea).

There have been several studies of hauled-out pinniped response to airborne noise and sonic booms from aircraft and missile flyovers, although few sound exposure data have been reported. For marine mammals underwater, one study—the Malme et al. (1984) investigation of gray whales—is the only study to provide data on reactions to aircraft sound underwater that was isolated from other potential stimuli such as visual behavioral reactions elicited from low altitude aircraft. As demonstrated by that study, the underwater received levels necessary to elicit reactions (115 dB to 127 dB SPL) would require an airborne source level at the surface of approximately 175 dB to 187 dB. This is much higher than should be expected as a result of most aircraft overflight in the HRC for reasons described later in Section G.3 involving sound transmission through the air-water interface. To assess the potential impact of airborne noise sources in the HRC on non-human species, a weighting function related to the hearing characteristics of a specific species is required, analogous to the A-weighting used for human response prediction (see Southall et al., 2007).This facilitates the application of sound level criteria based on potential avoidance behavior, potential temporary threshold shift, or some other appropriate response (refer to Section 4.1 of the EIS/OEIS, Marine Mammals).

If the hearing thresholds of a species have been measured at various frequencies, as in Figure G-1, the resulting audiogram can be used as a weighting function. An example of this is shown in Figure G-3 where the 1/3-octave spectra of two different types of aircraft are shown. (Sound levels are shown in 1/3-octave bands because in humans and some mammals, the effective filter bandwidth of the hearing process is not constant but has a proportional bandwidth of approximately 1/3-octave.) The F-4 jet noise spectrum is seen to be dominated by frequencies above 500 Hz, whereas the P-3 has dominant propeller noise bands at 63 and 125 Hz. When these radiated noise spectra are weighted by subtracting the elephant seal hearing response (see Figure G-1), the effective perceived level spectra are obtained. The difference in perceived loudness of these two aircraft, as heard by the seal, can be estimated by looking at the overall perceived levels (shown on the right edge of the graph). There is a difference of about 30 dB in the overall perceived levels even though there is only a difference of about 10 dB in the overall flat-weighted levels. Human listeners perceive a 10-dB difference in sound level as being approximately a factor of two. If the seal has a similar perception, the two aircraft would differ in perceived loudness by about eight times, but the measured difference for a flat sound level meter would be only 10 dB.

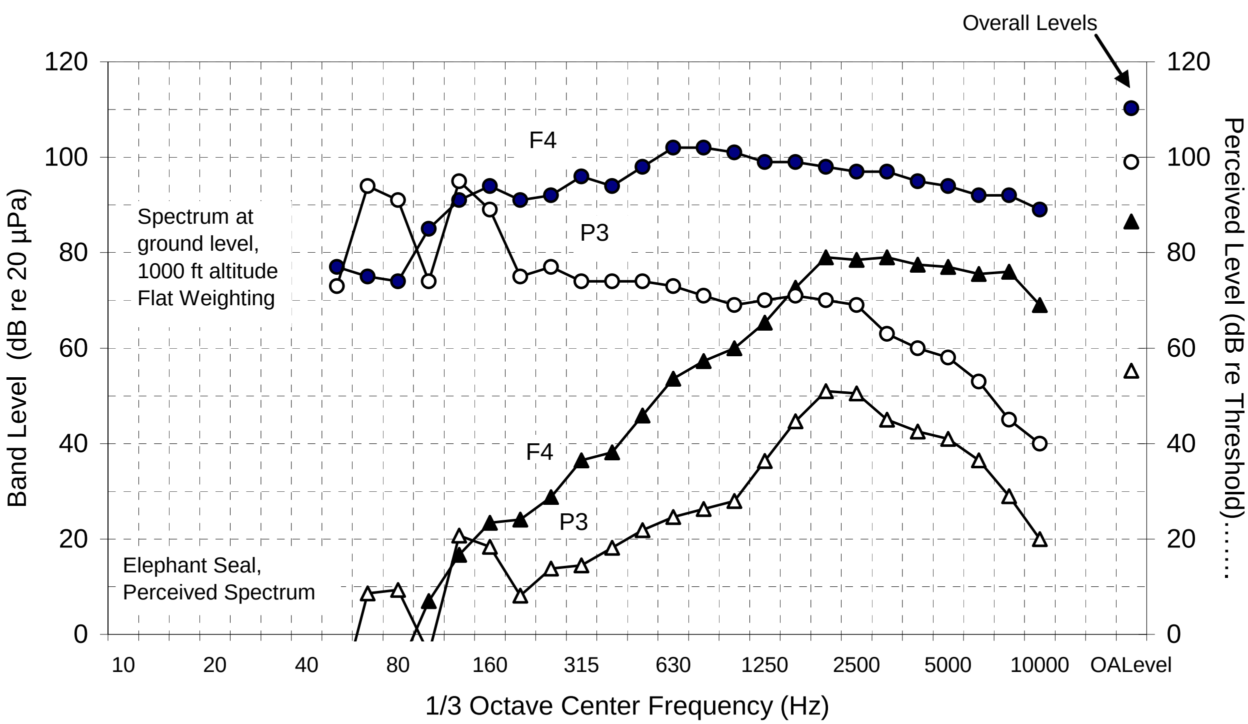


Figure G-3. Aircraft Noise Spectra vs. Hearing Response

While the actual audiogram can be used as a weighting function as demonstrated above, this is not a practical solution in the present application because of the large number of species and sources involved. Moreover, the audiograms of many animal species listening in air are not known. Several species of concern, such as pinnipeds and birds, have reduced sensitivity at low frequencies as compared with at moderate frequencies (the same pattern as in humans). Therefore, the A-weighting response appropriate for humans was examined as a potential basis for estimating the levels perceived by species exposed to a variety of noise sources on the HRC.

For birds, a comparison of real and perceived levels from F-4 and P-3 aircraft was made by using the reported hearing thresholds of selected bird species. The results of the analysis show that the measured difference in overall received noise levels for the two aircraft produced by the A-weighting function is comparable to the estimated differences in perceived levels for birds (Table G-2). The measured difference using unweighted overall sound levels is much smaller and thus would provide a poor estimate of the potential noise impact of these sources on birds. This comparison indicated that A-weighting (which attenuates low frequencies) is effective in simulating the hearing function of birds, since the difference in the A-weighted aircraft spectra is similar to the difference in the perceived levels. A-weighted metrics are therefore considered appropriate for use in determining potential noise impacts on birds.

Table G-2. Analysis of A-Weighted Sound Level vs. Flat Overall Level as a Measure of Loudness for Birds

	Overall Measured Sound Level (1,000 feet altitude, re 20 μPa)		Perceived Sound Level [3] (Received level—hearing threshold)	
Aircraft	**dB (flat) [1]**	**dBA [2]**	**Anseriforms [4]**	**Passeriforms [5]**
F-4 (100%)	110.0	109.0	94.0	87.0
P-3 (100%)	99.0	84.0	65.0	59.0
F-4 - P-3 difference	11.0	25.0	29.0	28.0

Notes:

[1] dB (flat) - overall sound level with no weighting.

[2] dBA - overall A-weighted level.

[3] Perceived Sound Level - overall sound level of the aircraft above the hearing threshold. It is an estimate of the loudness perceived by a given species.

The difference between the unweighted levels of the two aircraft is 11 dB, whereas the A-weighted level difference is 25 dB. The F-4 has a significant amount of sound energy at high frequencies compared with the P-3. If A-weighting (which attenuates low frequencies) is effective in simulating the hearing function of birds, the difference in the A-weighted aircraft spectra should be similar to the difference in perceived levels, as these data indicate.

[4] Anseriforms are waterfowl (e.g., ducks, geese, swans).

[5] Passeriforms are perching birds or passerines (i.e., songbirds).

The hearing response of the elephant seal in its most sensitive range is about 20 dB less sensitive than that of human hearing (see Figure G-1). To compensate for this, an additional 20 dB attenuation was added to the A-weighting response and the resulting characteristic was applied to the F-4 and P-3 spectra. The results are shown in Figure G-4. Here the adjusted A-weighted responses are compared to the estimated perceived responses. The overall adjusted A-weighting responses for the two aircraft can be seen to differ by about 26 dB, compared to the perceived difference of about 30 dB. The overall adjusted A-weighted level exceeds the overall perceived level by about 4 dB for the F-4 and about 9 dB for the P-3. This difference occurs because, at low frequencies, the A-weighting factors are relatively higher than the seal audiogram. This difference is most important for sources with dominant low-frequency components.

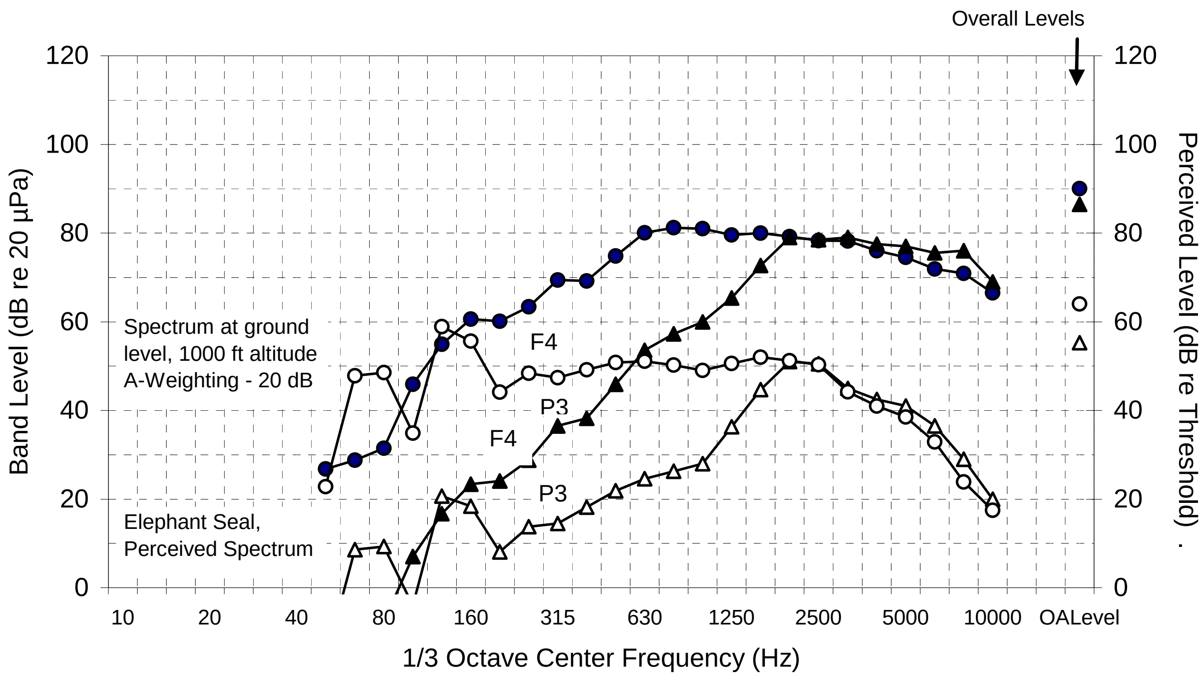


Figure G-4. Adjusted A-Weighting of Aircraft Noise vs. Hearing Response

G.2.4 AMBIENT NOISE

Ambient noise is the background noise at a given location. Airborne ambient noise can vary considerably depending on location and other factors, such as wind speed, temperature stratification, terrain features, vegetation, and the presence of distant natural or man-made noise sources.

In predicting human response to loud airborne noise sources, it is reasonable to assume that ambient background noise would have little or no effect on the calculated noise levels since the ambient levels would add insignificant fractions to calculated values. Therefore, ambient background noise is not considered in the noise calculations.

Ambient noise may have a more significant effect on prediction of marine mammal response to loud airborne noise sources. Marine mammals are exposed to a wide range of ambient sounds ranging from the loud noise of nearby wave impacts on the quiet of remote areas during calm wind conditions. The ambient noise background on beaches is strongly influenced by surf noise. During high surf conditions pinnipeds may not hear an approaching aircraft until it is nearly overhead. The resulting rapid noise level increase may cause a panic response that normally would not occur for calm conditions when the approaching aircraft can be initially heard at longer ranges. Some examples of airborne noise levels in human and marine mammal habitat are given in Table G-3.

It should be noted that the characteristics of subsonic noise, which is measured on an A-weighted scale, and supersonic noise, which is measured on a C-weighted scale, are different. Therefore, each is calculated separately, and it would be incorrect to add the two values together. Nevertheless, both subsonic and supersonic noises occur in the HRC. Together, they form the cumulative acoustic environment in the region. Therefore, each is addressed where applicable in this EIS/OEIS.

Table G-3. Representative Airborne Noise Levels

Source of Noise	dBA re 20 μPa
F/A-18 at 1,000 feet (Cruise Power)	98
Helicopter at 200 feet (UH-1N)	91
Car at 25 feet (60 mph) [1]	70–80
Light Traffic at 100 feet [1]	50–60
Quiet Residential (daytime) [1]	40–50
Quiet Residential (night) [1]	30–40
Wilderness Area [1]	20–30
Offshore (low sea state) [2]	40–50
Surf [2]	60–70

[1] Kinsler et al., 1982.
[2] U.S. Coast Guard, 1960.

G.3 SOUND TRANSMISSION THROUGH THE AIR-WATER INTERFACE

Many of the sound sources considered in this EIS/OEIS are airborne vehicles, but a significant portion of the concern about noise impacts involves marine animals at or below the surface of the water. Thus, transmission of airborne sound into the ocean is a consideration. This subsection describes some basic characteristics of air-to-water transmission of sound for both subsonic and supersonic sources. Sound is transmitted from an airborne source to a receiver underwater by four principal means: (1) a direct path, refracted upon passing through the air-water interface; (2) direct-refracted paths reflected from the bottom in shallow water; (3) lateral (evanescent) transmission through the interface from the airborne sound field directly above; and (4) scattering from interface roughness due to wave motion.

Several papers are available in the literature concerning transmission of sound from air into water. Urick (1972) presents a discussion of the effect and reports data showing the difference in the underwater signature of an aircraft overflight for deep and shallow conditions. He includes analytic solutions for both the direct and lateral transmission paths and presents a comparison of the contributions of these paths for near-surface receivers. Young (1973) presents an analysis which, while directed at deep-water applications, derived an equivalent dipole underwater source for an aircraft overflight that can be used for direct path underwater received level estimates. A detailed description of air-water sound transmission is given in *Marine Mammals and Noise* (Richardson et al., 1995a). The following is a short summary of the principal features.

Figure G-5 shows the general characteristics of sound transmission through the air-water interface. Sound from an elevated source in air is refracted upon transmission into water because of the difference in sound speeds in the two media (a ratio of about 0.23). Because of this difference, the direct sound path is totally reflected for grazing angles less than 77°, i.e., if the sound reaches the surface at an angle more than 13° from vertical. For smaller grazing angles, sound reaches an underwater observation point only by scattering from wave crests on the surface, by non-acoustic (lateral) pressure transmission from the surface, and from bottom reflections in shallow water. As a result, most of the acoustic energy transmitted into the water from a source in air arrives through a cone with a 26° apex angle extending vertically downward from the airborne source. For a moving source, the intersection of this cone with the surface traces a "footprint" directly beneath the path of the source, with the width of the footprint being a function of the altitude of the source. To a first approximation, it is only the sound transmitted within this footprint that can reach an underwater location by a direct-refracted path. Because of the large difference in the acoustic properties of water and air, the pressure field is actually doubled at the surface of the water, resulting in a 6 dB increase in pressure level at the surface. Within the direct-refracted cone, the in-air sound transmission paths are affected both by geometric spreading and by the effects of refraction.

In shallow water within the direct transmission cone, the directly transmitted sound energy is generally greater than the energy contribution from bottom reflected paths. At horizontal distances greater than the water depth, the energy transmitted by reflected paths becomes dominant, especially in shallow water. The ratio of direct to reverberant energy depends on the bottom properties. For hard bottom conditions the reverberant field persists for longer ranges than the direct field. However, with increasing horizontal distance from the airborne source, underwater sound diminishes more rapidly than does the airborne sound.

Near the surface, the laterally transmitted pressure from the airborne sound is transmitted hydrostatically underwater. Beyond the direct transmission cone this component can produce higher levels than the underwater-refracted wave. However, the lateral component is very dependent on frequency and thus on acoustic wavelength. The level received underwater is 20 dB lower than the airborne sound level at a depth equal to 0.4 wavelength.

For this application, it is necessary to have an analytical model to predict the total acoustic exposure level experienced by marine mammals near the surface and at depth near the path of an aircraft overflight. Malme and Smith (1988) described a model to calculate the acoustic energy at an underwater receiver in shallow water, including the acoustic contributions of both the direct sound field (Urick, 1972) and a depth-averaged reverberant sound field (Smith, 1974).

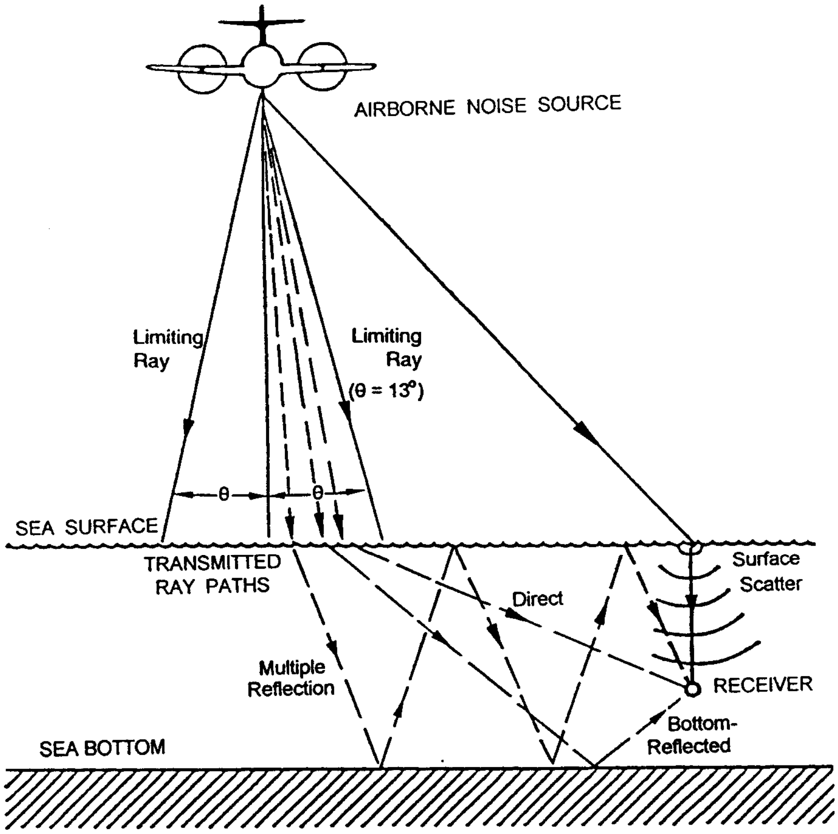


Figure G-5. Characteristics of Sound Transmission through Air-Water Interface

In the present application, the Urick (1972) analysis for the lateral wave field was also included to predict this contribution. The paths of most concern for this application are the direct-refracted path and the lateral path. These paths will likely determine the highest sound level received by mammals located nearly directly below a passing airborne source and mammals located near the surface, but at some distance away from the source track. In shallow areas near shore, bottom-reflected acoustic energy will also contribute to the total noise field, but it is likely that the direct-refracted and lateral paths will make the dominant contributions.[1]

Figure G-6 shows an example of the model prediction for a representative source-receiver geometry. The transmission loss (TL) for the direct-refracted wave, the lateral wave, and their resultant energy-addition total is shown. Directly under the aircraft, the direct-refracted wave is seen to have the lowest TL. For the shallowest receiver at a 3-ft depth, the lateral wave is seen to become dominant at about a horizontal range of 40 ft. Beyond this point the underwater level is controlled by the sound level in the air directly above the receiver and follows the same decay slope with distance. For the deeper receiver at 10 ft, the lateral wave does not become dominant until the horizontal range is about 130 ft. When sound reaches the receiver via the direct-refracted path, it decays at about 12 dB/distance doubled (dd), consistent with a surface dipole source. In

[1]The bottom-reflected reverberant sound field section of this model for offshore applications requires detailed knowledge of bottom slope and bottom composition. In view of the requirements of this application, this level of detail is not appropriate and the reflected path subroutine was not used.

contrast, when the sound reaches the receiver via the lateral path, it decays at about 6 dB/dd, consistent with the airborne monopole source. Underneath the aircraft, the drop in sound level with depth change from 3 to 10 ft is only about 2 dB, but beyond about 200 ft, a 12 dB drop occurs for the same change in depth.

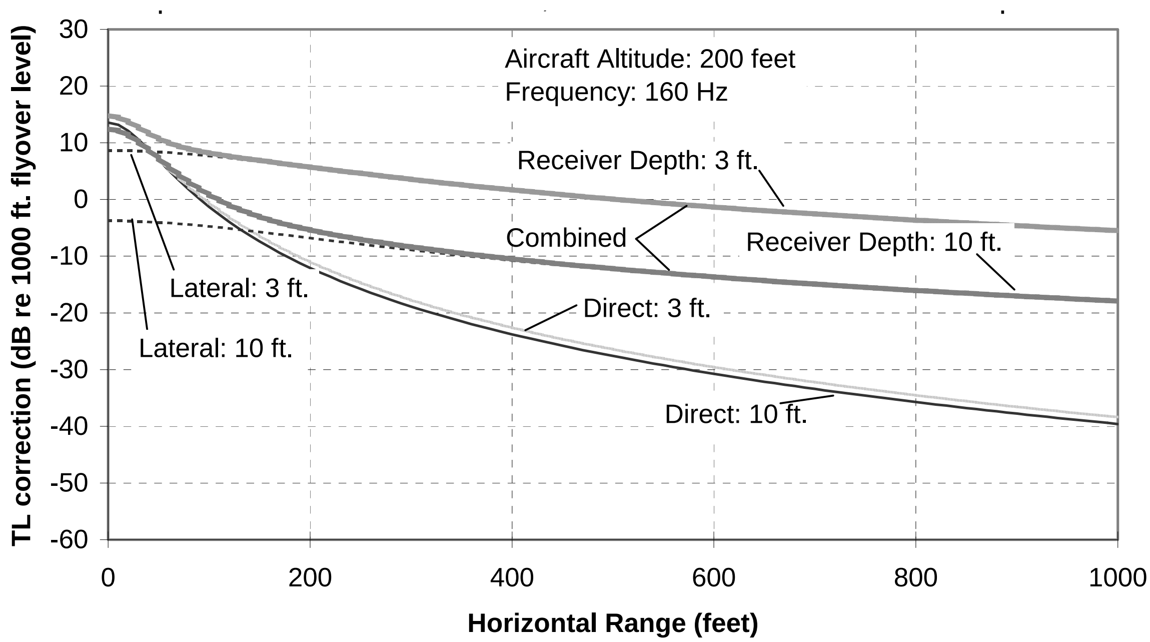


Figure G-6. Transmission Loss of Noise through Air-Water Interface, Comparison of Direct-Refracted, Lateral and Combined TL Components

Figures G-7A-C illustrate the interaction between the various parameters for different sets of variables. For clarity, only the total transmission loss curves are shown in these figures. Figure G-7A shows the influence of frequency (wavelength) change on transmission loss. Here the loss at a depth of 3 ft can be seen to increase significantly with frequency in the region where the lateral wave is dominant. Thus marine mammals near the surface will benefit from high-frequency attenuation when they are not directly below the source track. Figure G-7B shows the change in TL with receiver depth for low-frequency sound. Near the source track, a 6 dB drop in level occurs for a change in depth from 1 to 30 ft, but beyond a horizontal range of 200 ft, there is a 20 to 30 dB drop in level for the same change in receiver depth. Note, however, that for an increase in depth from 30 to 300 ft, the received level increases because of the effective source directionality. Figure G-7C shows the effect of increasing the aircraft altitude. In this case the region near the source track is affected the most with about a 38 dB drop in level for an altitude change of 50 ft to 5,000 ft. At a horizontal range of 200 ft, this drop is about 20 dB, with a decrease to 15 dB at 500 ft.

For a passing airborne source, received level at and below the surface diminishes with increasing source altitude, but the duration of exposure increases. The maximum received levels at and below the surface are inversely proportional to source altitude, but total noise energy exposure is inversely proportional to the product of source altitude and speed because of the link between altitude and duration of exposure.

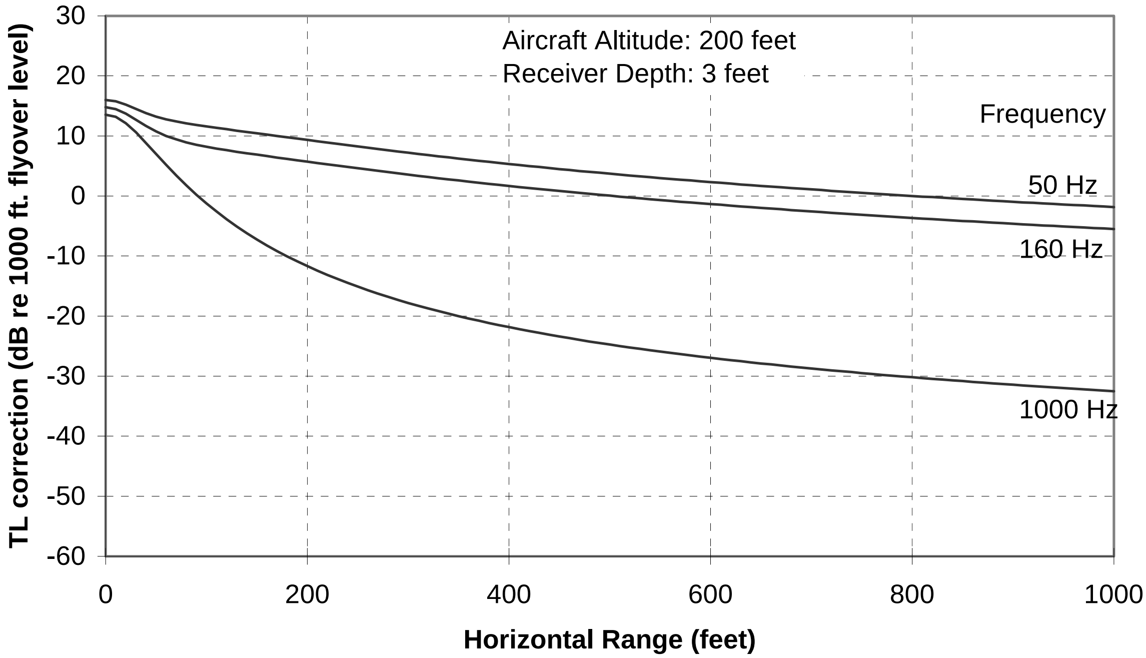


Figure G-7A. Air-Water Transmission Loss vs. Frequency

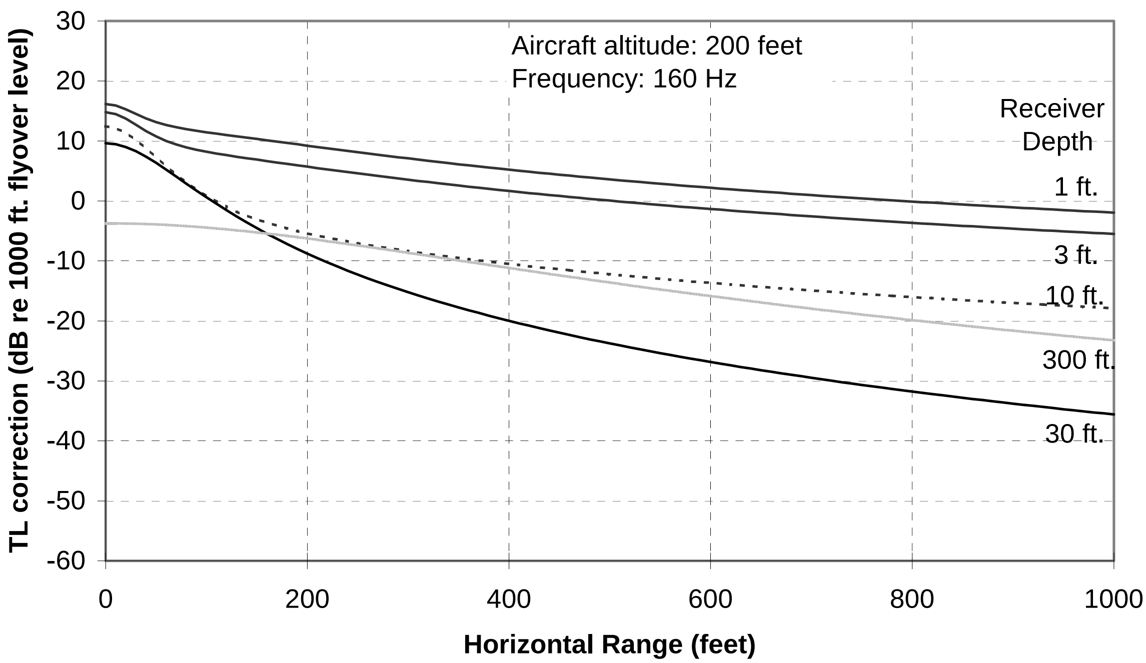


Figure G-7B. Air-Water Transmission Loss vs. Receiver Depth

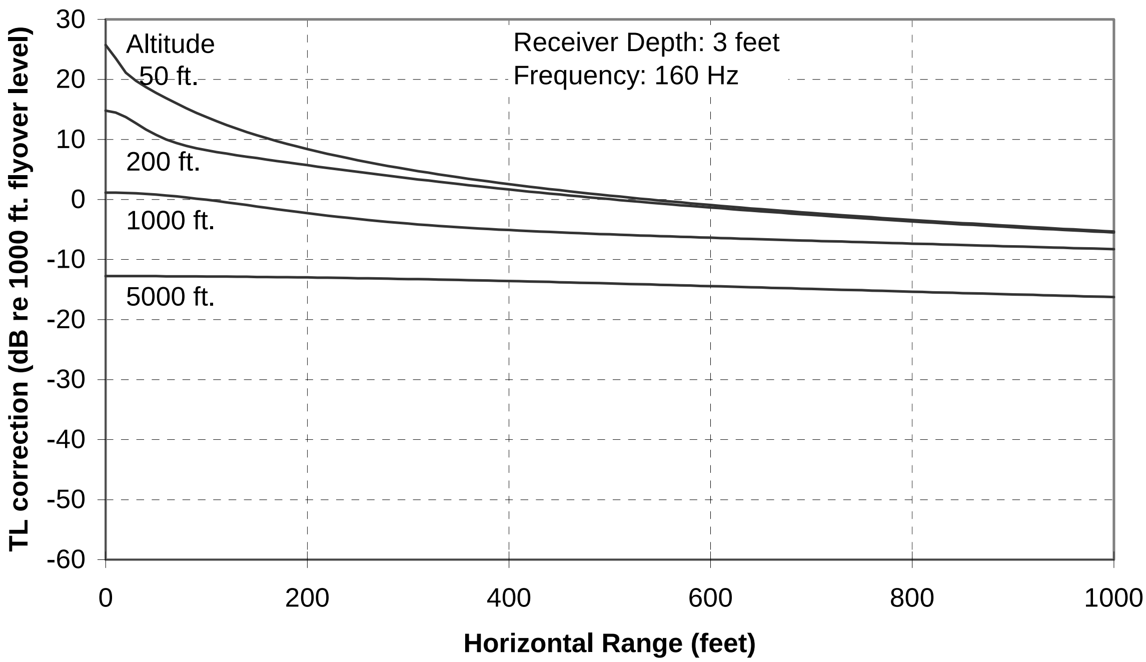


Figure G-7C. Air-Water Transmission Loss vs. Aircraft Altitude

In summary, airborne sound does not, in general, transmit well into the water because of the difference in sound speeds between air and water. If the sound reaches the surface at an angle more than 13° from vertical, the sound is generally reflected rather than transmitted into the water. While scattering from waves also facilitates sound entering the water, in the ocean this is also somewhat offset by bubbles at the surface introduced by breaking waves. A 13° cone from the source's altitude to the ocean's surface traces a "footprint" along the source's flight, but as size of the footprint increases with altitude, the sound level reaching the ocean surface decreases as a result of transmission loss through the air.

G.3.1 SUPERSONIC SOURCES

While sonic booms are not always heard at the surface, if present, a sonic boom footprint produced by a supersonic aircraft in level flight at constant speed traces a hyperbola on the sea surface. The apex of the hyperbola moves at the same speed and direction as the aircraft with the outlying arms of the hyperbola traveling at increasing oblique angles and slower speeds until the boom shock wave dissipates into a sonically propagating pressure wave at large distances from the flight path. The highest boom overpressures at the water surface are produced directly below the aircraft track. In this region the pressure-time pattern is described as an "N-wave" because of its typical shape. Aircraft size, shape, speed, and altitude determine the peak shock pressure and time duration of the N-wave. The incidence angle of the N-wave on the water surface is determined by the aircraft speed (i.e., for Mach 2 the incidence angle is 45). Thus for aircraft in level flight at speeds less than about Mach 4.3, the N-wave is totally reflected from the surface. Dives and other maneuvers at supersonic speeds of less than Mach 4.3 can generate N-waves at incidence angles that are refracted into the water, but the water source regions affected by these transient events are limited. Since the aircraft, missiles, and targets used in range activities generally operate at less than Mach 4.3, sonic boom penetration into the water from these sources occurs primarily by lateral (evanescent) propagation. Analyses by Sawyers (1968) and Cook (1969) have shown that the attenuation rate (penetration) of the boom pressure wave is related to the size, altitude and speed of the source vehicle. The attenuation of the N-wave is not related to the length of the signature in the simple way that the lateral wave penetration from subsonic sources is related to the dominant wavelength of their signature. Specific examples will be given for the supersonic vehicles used in range tests as appropriate in this EIS/OEIS.

G.4 UNDERWATER SOUND CHARACTERISTICS

Many of the general characteristics of sound and its measurement were discussed in the introduction to airborne noise characteristics. This section expands on this introduction to summarize the properties of sound underwater that are relevant to understanding the effects of range activities on the underwater marine environment in the HRC area. Since the effect of underwater sound on human habitat is not an issue (except perhaps for divers), the primary environmental concern that is addressed is the potential impact on marine mammals.

G.4.1 UNITS OF MEASUREMENT

The reference level for airborne sound is 20 μPa, consistent with the minimum level detectable by humans. For underwater sound, a reference level of 1 μPa is used because this provides a more convenient reference and because a reference based on the threshold of human hearing in air is irrelevant. For this reason, as well as the different propagation properties of air and water, it is not meaningful to compare the levels of sound received in air (measured in dB re 20 μPa) and in water (in dB re 1 μPa) without adding the 26 dB correction factor to the airborne sound levels.

G.4.2 SOURCE CHARACTERISTICS

The most significant range-related sources of underwater sound operating on the HRC are the ships used in Anti-Submarine Warfare Exercises. Because of their slow speed compared to most of the airborne sources considered in the last section, they can be considered to be continuous sound sources. The primary underwater transient sound sources are naval gunfire, aircraft delivered bombs and gunfire, missile launches, and water surface impacts from missiles and falling debris. All sources are subsonic or stationary in water. While supersonic underwater shock waves are produced at short ranges by underwater explosions, no sources operate at supersonic speeds in water.

G.4.3 UNDERWATER SOUND TRANSMISSION

Airborne sources transmit most of their acoustic energy to the surface by direct paths which attenuate sound energy by spherical divergence (spreading) and molecular absorption. For sound propagating along oblique paths relative to the ground plane, there may also be attenuation (or amplification) by refraction (bending) from sound speed gradients caused by wind and temperature changes with altitude. There may also be multipath transmission caused by convergence of several refracted and reflected sound rays, but this is generally not important for air-to-ground transmission. However, for underwater sound, refracted and multipath transmission is often more important than direct path transmission, particularly for high-power sound sources capable of transmitting sound energy to large distances.

A surface layer sound channel often enhances sound transmission from a surface ship to a shallow receiver in tropical and mid-latitude deep-water areas. This channel is produced when a mixed isothermal surface layer is developed by wave action. An upward refracting sound gradient, produced by the pressure difference within the layer, traps a significant amount of the sound energy within the layer (Sound travels faster with increasing depth.) This results in cylindrical rather than spherical spreading. This effect is particularly observable at high frequencies where the sound wavelengths are short compared to the layer depth. When the mixed layer is thin or not well defined, the underlying thermocline may extend toward the surface, resulting in downward refraction at all frequencies and a significant increase in transmission loss at shorter ranges where bottom reflected sound energy is normally less than the directly transmitted sound component.

In shallow water areas sound is trapped by reflection between the surface and bottom interfaces. This often results in higher transmission loss than in deep water because of the loss that occurs with each reflection, especially from soft or rough bottom material. However, in areas with a highly reflective bottom, the transmission loss may be less than in deep water areas since cylindrical spreading may occur.

The many interacting variables involved in prediction of underwater transmission loss have led to the development of analytical and computer models. One or more of these models will be used in analyzing the potential impact of the underwater sound sources in the range areas.

G.4.4 UNDERWATER AMBIENT SOUND

For Hawaii, Au et al., (2000) have demonstrated that ambient sound pressure levels during the peak of humpback whale “season” (specifically between mid-February and mid-March) are approximately 120 dB re µ1 Pa with spectral peaks at 315 Hz and 630 Hz. For the ocean in general, above 500 Hz, deep ocean ambient sound is produced primarily by wind and sea state conditions. Below 500 Hz, the ambient sound levels are strongly related to ship traffic, both near and far. In shallow water near continents and islands, surf is also a significant factor. Wenz (1962) and Urick (1983) are among many contributors to the literature on underwater ambient sound. Figure G-8, based on these two sources, was adapted by Malme et al. (1989) to show ambient sound spectra in 1/3-octave bands for a range of sea state and ship traffic conditions.

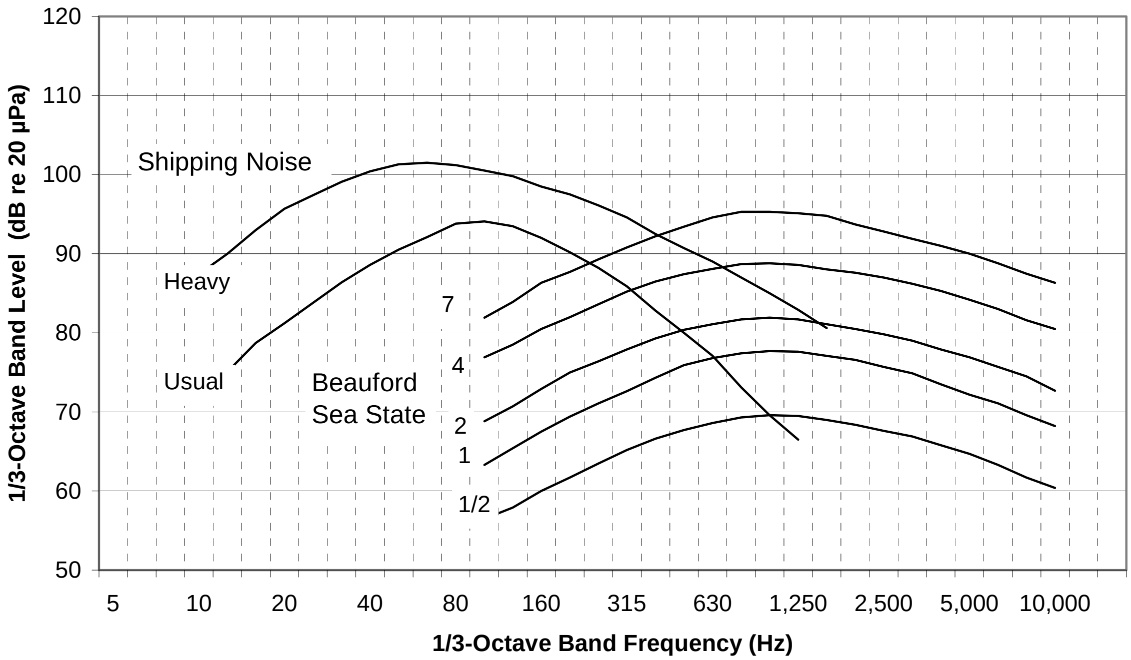


Figure G-8. Underwater Ambient Sound

Wind

On a 1/3-octave basis, wind-related ambient sound in shallow water tends to peak at about 1 kHz (see Figure G-8). Levels in 1/3-octave bands generally decrease at a rate of 3 to 4 dB per octave at progressively higher frequencies and at about 6 dB per octave at progressively lower frequencies. Sound levels increase at a rate of 5 to 6 dB per doubling of wind speed. At a frequency of about 1 kHz, maximum 1/3-octave band levels are frequently observed at 95 dB referenced to 1 μPa for sustained winds of 34 to 40 knots and at about 82 dB for winds in the 7 to 10 knot range. Wave action and spray are the primary causes of wind-related ambient sound; consequently, the wind-related noise component is strongly dependent on wind duration and fetch as well as water depth, bottom topography, and proximity to topographic features such as islands and shore. A sea state scale, which is related to sea surface conditions as a function of wind conditions, is commonly used in categorizing wind-related ambient sound. The curves for wind-related ambient sound shown in Figure G-8 are reasonable averages, although relatively large departures from these curves can be experienced depending on site location and other factors such as bottom topography and proximity to island or land features.

Surf

Very few data have been published relating specifically to local sound levels due to surf in offshore areas along mainland and island coasts. Wilson et al. (1985) present underwater sound levels for wind-driven surf along the exposed Monterey Bay coast, as measured at a variety of distances from the surf zone. Wind conditions varied from 25 to 35 knots. They vary from 110 to 120 dB in the 100 to 1,000 Hz band at a distance of 650 ft from the surf zone, down to levels of 96 to 103 dB in the same band 4.6 nm from the surf zone. Assuming that these levels are also representative near shorelines in the HRC area, surf sound in the 100 to 500 Hz band will be 15 to 30 dB above that due to wind-related noise in the open ocean under similar wind speed conditions.

Distant Shipping

The presence of a relatively constant low-frequency component in ambient sound within the 10 to 200 Hz band has been observed for many years and has been related to distant ship traffic as summarized by Wenz (1962) and Urick (1983). Low-frequency energy radiated primarily by cavitating propellers and by engine excitation of the ship hull is propagated efficiently in the deep ocean to distances of 100 nm or more. Higher frequencies do not propagate well to these distances due to acoustic absorption. Also, high-frequency sounds radiated by relatively nearby vessels will frequently be masked by local wind-related sound. Thus, distant shipping contributes little or no sound at high frequency. Distant ship-generated low-frequency sound incurs more attenuation when it propagates across continental shelf regions and into shallow offshore areas than occurs in the deep ocean.

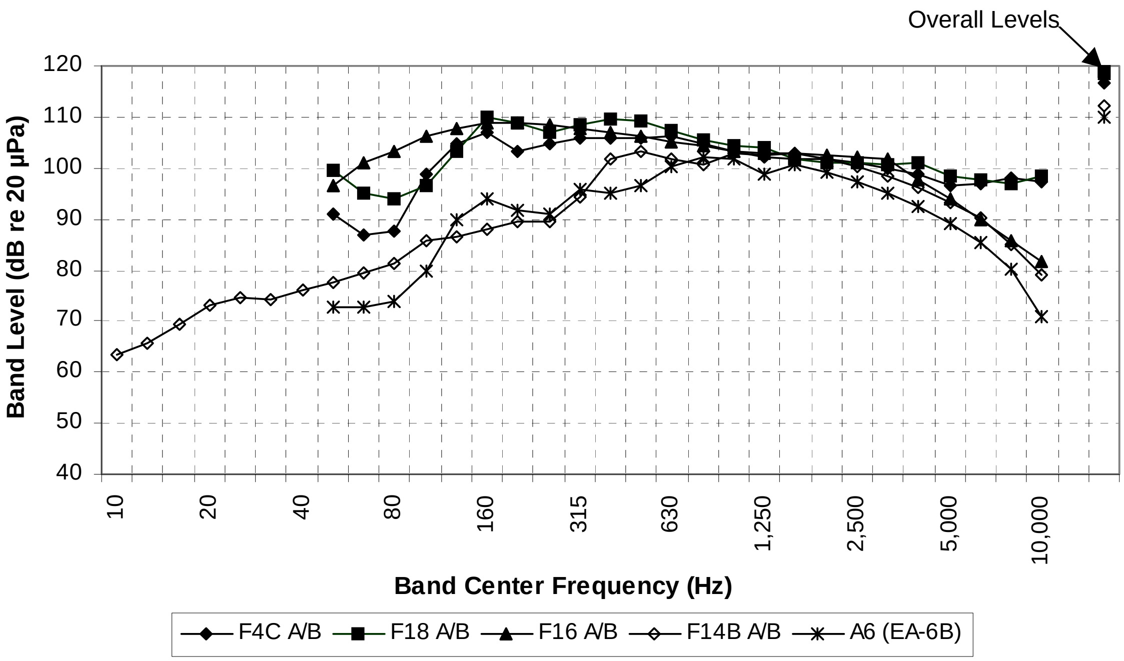
Figure G-8 also provides two curves that approximate the upper bounds of distant ship traffic sound. The upper curve represents the sound level at sites exposed to heavily used shipping lanes. The lower curve represents moderate or distant shipping sound as measured in shallow water. As shown, highest observed ambient sound levels for these two categories are 102 dB and 94 dB, respectively, in the 60 to 100 Hz frequency range. In shallow water the received sound level from distant ship traffic can be as much as 10 dB below the lower curve given in Figure G-8, depending on site location on the continental shelf. In fact, some offshore areas can be effectively shielded from this low-frequency component of shipping sound due to sound propagation loss effects.

Note that the shipping sound level curves shown in Figure G-8 show typical received levels attributable to *distant* shipping. Considerably higher levels can be received when a ship is present within a few miles.

G.4.5 MARINE MAMMAL SOUND METRICS

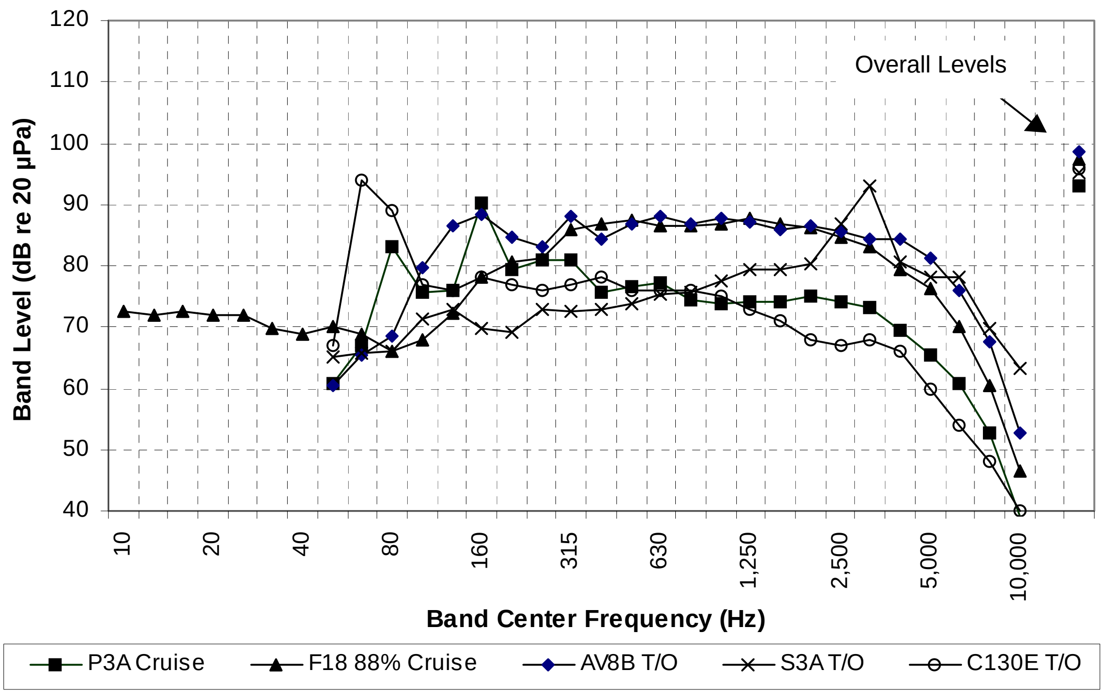
Sound received at and below the sea surface is relevant to marine mammals and some other marine animals at sea. The spectral composition and overall level of each airborne noise source must both be considered in assessing potential impacts on marine mammals present at sea in the HRC. As described earlier, the most significant sources are low-flying aircraft and their related weapons, naval gunfire, targets, missiles, and debris impacts. Brief sound transients or impulses from surface missile launches, low level explosions, and gunfire may also be important during training.

Aircraft spectrum information was obtained from the U.S. Air Force Armstrong Laboratory for various aircraft types (Air Force Aerospace Medical Research Laboratory, 1990). Data for some additional types of aircraft occasionally used on the HRC were also included. The information obtained is summarized in the 1/3-octave band spectra shown in Figure G-9A (for fighter and attack aircraft), Figure G-9B (selected HRC aircraft), and Figure G-9C (helicopters). Most of these spectra represent received levels near the surface during overflights at 1,000 ft above sea level under standard atmospheric conditions (59° F, 70 percent relative humidity). The data shown in this standard format can be adjusted for different aircraft altitudes and other atmospheric attenuation conditions—an important consideration at high frequencies.



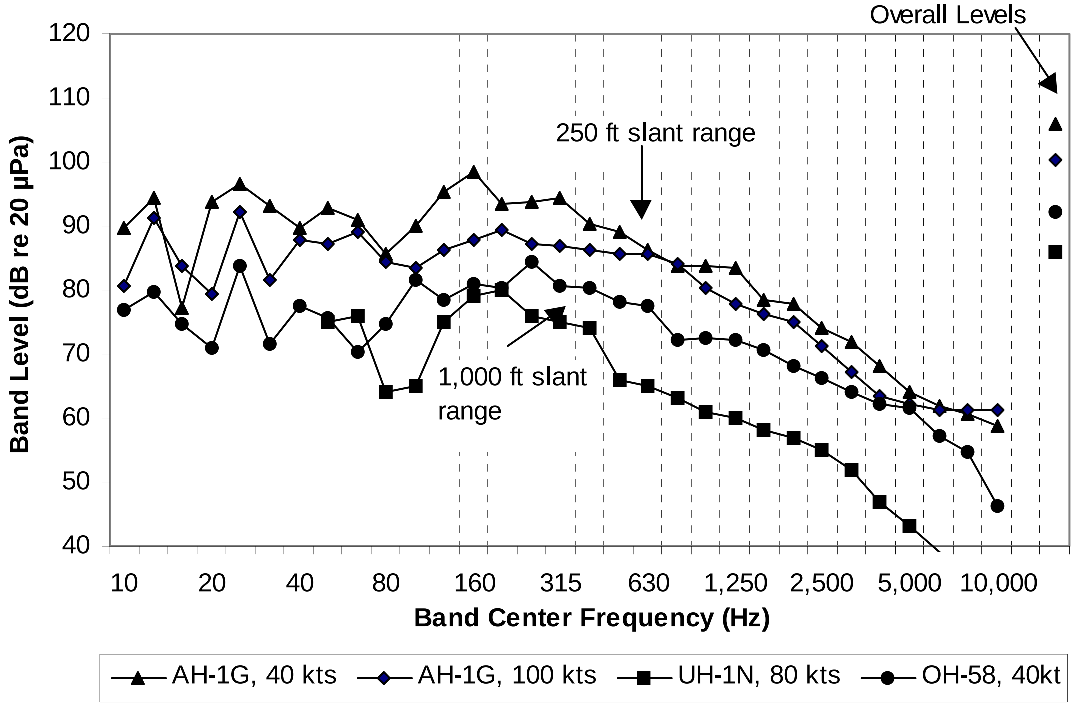
Source: Air Force Aerospace Medical Research Laboratory, 1990.

Figure G-9A. Noise Spectra: Fighter and Attack Aircraft



T/O = takeoff
Source: Air Force Aerospace Medical Research Laboratory, 1990.

Figure G-9B. Noise Spectra: Selected HRC Aircraft



Source: Air Force Aerospace Medical Research Laboratory, 1990.

Figure G-9C. Noise Spectra: Helicopters

The aircraft spectra can be compared to the shapes and quantitative features of marine mammal audiograms, when known, to determine the weighting functions and overall level adjustments needed to estimate the perceived overall levels produced during close encounters. These levels can then be compared to known or assumed impact thresholds to determine whether a detailed analysis is needed. If a detailed analysis is indicated, then contour plots can be calculated to estimate the total number of animals potentially affected by an encounter scenario.

G.4.6 SONIC BOOM PROPAGATION INTO THE WATER

Aircraft Overflights

Supersonic activities in the HRC result in sonic boom penetration of the water in the operating area. Boom signatures were estimated using the Air Force's PCBOOM3 model to determine the potential for sound impacts near or at the surface. The F-4 fighter was used in this analysis since it is representative of aircraft using the range. Table G-4 shows the underwater boom parameters at locations near the water surface together with the estimated attenuation rate of peak pressure with depth using a method developed by Sawyers (1968).

Table G-4. Underwater Sonic Boom Parameters for F-4 Overflight

Sonic Boom Parameters			Depth Peak Pressure Loss (feet)					
Speed	**Alt. (feet)**	**T (msec)**	**Lp (1µPa)**	**CSEL**	**ASEL**	**6 dB**	**10 dB**	**20 dB**
M1.2	10,000	103	168.0	143.9	129.6	11.5	24.6	68.9
M1.2	5,000	88	179.9	148.8	134.3	9.8	21.3	59.7
M1.2	1,000	64	182.9	159.1	145.6	6.9	15.1	42.6
M2.2	1,000	44	186.7	163.1	149.7	9.7	21.0	58.4

Source: Ogden Environmental, 1997.

Missile and Target Overflights

Low-level supersonic target and missile flights also produce significant sounds underwater from sonic booms. Specific data are not available for the Vandal target under normal flight conditions at low altitudes of 100 ft down to 20 ft. The required sonic boom estimates were made using a method developed by Carlson (1978) and adapted for model-based analysis by Lee and Downing (1996). This analysis assumes that the essential boom signature is a simple “N-wave” as is typically measured for supersonic aircraft passing at high altitudes (hundreds of feet). At lower altitude overflights, which are of interest here, the pressure contributions from the shape variations on the aircraft body and wings become observable, and at very low altitudes the signature is no longer a simple N-wave.

The acoustic impact analysis requires estimates of both the peak pressure level produced by a Vandal boom and the total sound energy exposure. The peak pressure level produced at close range (near field) can be influenced by contributions from minor peaks in the waveform. A relevant study by McLean and Shrout (1966) made a comparison of near-field boom waveforms calculated with appropriate near-field theory with waveforms predicted by far-field theory for representative aircraft. The results showed that the peaks predicted by the near-field theory were generally about 10 percent lower than those predicted at the same range by far-field theory. Thus in this application, the use of the Carlson method would be expected to yield conservative results.

The energy density spectrum and total sound energy exposure were estimated using Fourier analysis of the predicted N-wave to obtain the unweighted (flat) energy density spectrum and the F-SEL. This spectrum was then A-weighted to estimate the A-SEL. The A-SEL is about 9 dB below the F-SEL. On the issue of near-field effects, the change in frequency distribution of the pressure signature with distance must be considered. The near-field signature has more of its energy in smaller shock waves associated with the details of the airframe (e.g., fins, fuselage changes in area, etc.). The peaks associated with the far-field N signature have not yet fully developed so more of the acoustic energy appears at higher frequencies. A coalescing process is caused by non-linear propagation of high-pressure sound in the atmosphere (sound travels faster at higher pressures) that occurs with distance as the sound wave propagates outward from the flight path. Initially smooth high-pressure fluctuations compress into shock waves. Thus, because of the increased high-frequency content, the resulting total energy of a near-field signature measured at 20 ft would likely be reduced less by the A-weighting process than would the total energy of an N-wave approximation. However, this difference is not be expected to be more than 2 to 3 dB because of the large shifts in spectrum energy that would be required during propagation.

An analytic model was developed to predict the boom signature produced by Vandal flights that used the Vandal dimensions and assumed a level flight at Mach 2.1 at various altitudes. For an altitude of 20 ft, the predicted overpressure underwater at the surface is 300 pounds per square foot or 203 dB re 1 µPa with a boom duration of 4.8 milliseconds. The peak level is estimated to be 10 dB lower at a depth of 1.5 ft and 20 dB lower at a depth of 5 ft, based on an analysis developed by Sawyers (1968).

Appendix H
Cultural Resources

APPENDIX H
CULTURAL RESOURCES

Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999

MEMORANDUM OF AGREEMENT
AMONG
THE UNITED STATES DEPARTMENT OF THE NAVY,
PACIFIC MISSILE RANGE FACILITY;
THE HAWAII STATE HISTORIC PRESERVATION OFFICER;
AND
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
REGARDING
ACTIVITIES PROPOSED WITHIN
THE PACIFIC MISSILE RANGE FACILITY ENHANCED CAPABILITY
ENVIRONMENTAL IMPACT STATEMENT,
BARKING SANDS, KAUAI, HAWAII

January 1999

WHEREAS, the United States (U.S.) Department of the Navy, under Section 106 of the National Historic Preservation Act, is responsible for taking into account the effects of its undertakings on properties included on, or eligible for listing on, the National Register of Historic Places (National Register), herein after referred to as historic properties, and, prior to approval of an undertaking, to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on the undertaking; and

WHEREAS, the Navy proposes to enhance the capabilities of the Pacific Missile Range Facility (PMRF) to support Navy theater ballistic missile defense (TBMD) and other Department of Defense missile testing and training activities, which enhancements would involve areas on the islands of Kauai and Niihau; and

WHEREAS, the Navy has determined that the enhancements of PMRF's capabilities may have an effect upon historic properties and has consulted with the ACHP and the Hawaii State Historic Preservation Officer (SHPO) pursuant to Section 800.13 of the regulations (36 CFR Part 800) implementing Section 106 of the National Historic Preservation Act (16 USC 470f); and

WHEREAS, interested agencies and members of the public, including the Hawaii SHPO, potentially affected Native Hawaiian organizations, and affected land owners, have been provided the opportunity to comment on the possible effects that this undertaking may have on historic properties at the locations defined in Stipulations I, II, III, and IV and shown on Attachments A through D, through public hearings, consultation meetings, or other means; and

WHEREAS, the Navy conducts on-going activities on Niihau and Kaula Island, with respect to which questions have been raised as to whether they constitute undertakings requiring consultation with the Hawaii SHPO; and

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Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

WHEREAS, the areas of potential effect for the Navy's proposed and on-going activities, as noted above, are as follows: on the island of Kauai, as depicted on Attachment B, the PMRF Main Base, the Restrictive Easement area, the area of Makaha Ridge under the jurisdiction of PMRF, the Kokee area under PMRF jurisdiction, and the Kamokola magazine area in the vicinity of the existing storage magazines and the proposed missile storage buildings; the entire island of Kaula; and on the island of Niihau, the areas primarily in the Northern and Southern portions of the island in the vicinity of proposed support sites and on-going ground exercises; and

WHEREAS, portions of the PMRF Restrictive Easement Area (ground hazard area) associated with the undertaking are known to contain historic properties , but that the activities conducted for this undertaking are ongoing and have been previously reviewed by the Hawaii SHPO and determined to have no effect (Attachment E); and

WHEREAS, PMRF and the Niihau Ranch have an established protocol for the use of Niihau Island facilities and helicopter services (Attachment G), which takes into account potential effects on historic properties from Navy activities; and

WHEREAS, the Niihau landowner and residents have an interest in preserving confidentiality concerning the existence and location of archeological resources on Niihau, which interest is similar to that recognized in Section 470hh of the Archeologica Resources Protection Act with respect to such resources on public lands, and the parties recognize that trafficking in, removal, damage to, or defacement of such properties is prohibited and punishable by State and Federal law; and

WHEREAS, the acronyms, abbreviations, and definitions given in Attachment I are applicable throughout this Memorandum of Agreement and its attachments;

NOW THEREFORE, the Navy, the Hawaii SHPO, and the ACHP agree that the proposed undertaking shall be implemented in accordance with the following stipulations in order to take into account the effect of the undertaking on historic properties. The Navy will ensure that the measures in Stipulations I through V are carried out.

STIPULATIONS

I. Pacific Missile Range Facility, Main Base

Potential effects on historic properties within, or in the vicinity of, PMRF Main Base locations (Attachment C) from facility construction (including ground clearing and subsurface excavation), instrument siting, operational activities (including amphibious, RIMPAC, and National Guard activities), a launch pad mishap, an accidental launch vehicle ground strike, construction or launch vibration, ignition of vegetation from missile exhaust or debris and subsequent fire suppression activities, and/or increased personnel or off-road traffic within, or in the vicinity of, proposed locations, shall be mitigated in the following manner:

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Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

A. Avoidance of known historic properties, as practical.
B. When avoidance is not possible, monitoring of all ground disturbing activities within sensitive areas, in a manner consistent with the proposed Draft Archaeological Monitoring Plan provided in Attachment J of this Memorandum of Agreement.
C. Survey by a professional archaeologist, qualified by standards established by the Department of the Interior, National Park Service and described in 36 CFR, Part 61, Appendix A, of potential construction areas and relocation of those areas, as practicable, prior to any construction or exercises to ensure the avoidance of sensitive areas, particularly in the Major's Bay and Nohili Dune and Nohili ditch areas.
D. Spraying of water on vegetation surrounding launch sites prior to launches to prevent ignition.
E. Use of open sprays rather than directed streams of water to suppress unexpected fires and avoid dune erosion or damage to sensitive sites.
F. Survey by a professional archaeologist (as described in Stipulation I.C) subsequent to unexpected fires, launch pad mishaps, or accidental launch vehicle ground strikes; historic buildings and/or structures inspections subsequent to unexpected fires, launch pad mishaps, accidental launch vehicle ground strikes, or excessive construction or launch vibration.
G. In all cases where funerary objects and/or human remains are inadvertently discovered or disturbed, all activity in the immediate area will cease and the following individuals or organizations notified:
    1. PMRF Environmental Engineer or Historic Preservation Point of Contact
    2. U.S. Navy Archaeologist
    3. Hawaii SHPO
    4. Na Ohana Papa O Mana
    5. Hui Malama I Na Kupuna O Hawaii Nei
    6. Office of Hawaiian Affairs.
    7. Kauai/Niihau Islands Burial Council

   Subsequent actions taken will be in accordance with Sections 3(d) and 7 of the Native American Graves Protection and Repatriation Act (NAGPRA), its implementing regulations at 43 CFR Part 10, and 36 CFR, Part 800.11, and will follow the procedures of the Draft Burial Plan provided in Attachment K.
H. Briefings to construction and operational personnel regarding the sensitivity of cultural resources sites and the civil penalties associated with their intentional disturbance by personnel or off-road vehicular traffic.

II. Pacific Missile Range Facility, Makaha Ridge, Kokee, and Kaula Island

The Navy has conducted records searches and field investigations to determine if historic properties are present within the areas of potential effect of the Navy's undertakings at Makaha Ridge, Kokee, and Kaula Island and determined that these areas do not contain historic properties, with the exception of potential cold war properties, at Makaha Ridge and Kokee. (Cultural Resources Management Overview Survey, Pacific Missile Range Facility, Hawaiian Area, Kauai, Hawaii, August 1996; Environmental Impact Assessment

Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

Kaula Island Target Hawaii, U.S. Navy, February 1980). None of the cold war properties should be affected by the Navy activities. If it were later determined that Navy activities would affect any of these properties, data recovery would be conducted to preserve information concerning the properties.

III. Pacific Missile Range Facility, Kamokala Magazines

The Navy has conducted only a reconnaissance level survey of the area proposed for construction of two new missile storage buildings near Kamokala Magazines, and it has not been determined whether there are historic properties within the area of potential effect. Prior to any construction or ground disturbing activities, the Navy shall conduct archaeological surveys of the area of potential effect associated with the proposed missile storage buildings to determine the existence of historic properties. The surveys shall be conducted by a professional archaeologist (as described in Stipulation I.C). If historic properties are found, the potential effects on such properties from facility construction or remediation activities (including ground clearing and subsurface excavation) and operational activities, shall be determined and mitigations established in consultation with the Hawaii SHPO and other signatories to this Memorandum of Agreement, as appropriate. Potential mitigations may include:

A. Those mitigations described in Stipulations I.A, I.B, I.G, and I.H of this Memorandum of Agreement;

B. Inspections of historic structures subsequent to unexpected fires or excessive construction vibration.

IV. Island of Niihau

A. The Navy has conducted archaeological surveys of areas A, B, Q, E, F, G, and J on the Island of Niihau, which are shown on Attachment A of this Memorandum of Agreement; and has determined that they do not contain any prehistoric or historic archeological sites. The Navy has conducted partial archaeological surveys of areas H, I, K, and M on Niihau, as shown on Attachment A, and has determined that the likelihood of historic properties being in these areas is low. The Hawaii SHPO believes that the archaeological report needs revision to acceptably cover Section 106 concerns. Additionally, the Hawaii SHPO believes that the process used by the Navy to identify historic properties on Niihau was not adequate to determine the presence of traditional cultural resources and further believes that an ethnographic survey covering the area of potential effect on Niihau will be necessary to make this determination.

B. Prior to conducting any new activities on the island of Niihau, the Navy shall ensure that an ethnographic survey is conducted, covering specific sites and associated areas potentially affected by proposed activities as well as those ongoing activities described in Attachment H, to more fully determine the existence of traditional cultural properties within these areas. The scope of this survey shall be determined in consultation with the landowner and the Hawaii SHPO and may be limited by constraints imposed by the landowner. Disagreements on the scope of the survey would be the subject of further

Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

consultation, which could lead to dispute resolution under Stipulation VI. The Navy, the Hawaii SHPO, and the landowner, shall consult concerning the manner of conducting this survey and the Navy will consider the recommendations and guidance provided by the SHPO. The SHPO may advise the Navy whether it believes the information provided adequately identifies traditional cultural properties, if any, in the project area. Any information provided to the Navy, the SHPO, or any other government agency shall be maintained confidential and no information shall be released without the written consent of the landowner, residents, and informants.

C. The Navy will continue to consult with the Hawaii SHPO to determine which, if any, of the Navy's on-going activities on Niihau, described in Attachment H, have the potential to affect historic properties on the island. The Navy shall provide sufficient documentation for any no historic property or no effect determination. However, pending completion of the ethnographic survey referred to in IV.B., the overview of archaeological settlement patterns referred to in IVE., and other surveys referred to in IV.D., and any subsequent consultation with the Hawaii SHPO or other interested parties, the Navy may continue on-going activities. For activities for which the Navy and SHPO agree there is a potential for effect on historic properties, continuation of these activities will be subject to the completion of an ethnographic survey addressing their potential effects or they would continue for a maximum period of 5 years in the absence of an ethnographic survey and any appropriate mitigation plan. Fieldwork for the survey will be initiated no later than June 30, 2000.

D. Any additional studies required to identify and inventory historic properties on the island of Niihau, either with respect to specific sites H, I, K, and M, or any broader study to establish context, will be conducted in accordance with the National Historic Preservation Act, its implementing regulations, and other appropriate guidance provided by the Secretary of the Interior. Archaeological surveys will be conducted by a professional archaeologist, meeting the requirements described in Stipulation I.C and agreeable to the landowner, and a representative of the Niihau Ranch. All surveys conducted will result in an acceptable report that will be provided to the Navy and the SHPO. The information contained in the survey, and in any reports provided to the Navy and the SHPO, shall be maintained confidential and no information shall be released without the express agreement of the landowner and residents.

E. An acceptable overview report of likely archaeological site (settlement) patterns of the specific sites and associated areas of potential impact for all planned and ongoing projects will be provided by PMRF to SHPO no later than 1 October 1999. This shall be based on existing archaeological and archival documents and probably some brief archaeological fieldwork (transects). This overview provides the context for evaluating potential impacts, for predicting likely site settlement patterns, for interpreting sites that might be found, and for evaluating the significance of those sites. The information contained in the survey, and in any reports provided to the Navy and the SHPO, shall be maintained confidential and no information shall be released without the express agreement of the landowner and residents.

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Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

F. Any planned and future undertakings will be reviewed and any required studies will be conducted in accordance with the National Historic Preservation Act, its implementing regulations, and other appropriate guidance provided by the Secretary of the Interior. Archaeological surveys will be conducted by a professional archaeologist, meeting the requirements described in Stipulation I.C and agreeable to the landowner, and a representative of the Niihau Ranch. All surveys will result in an acceptable report that will be provided to the Navy and the SHPO. The information contained in the survey, and in any reports provided to the Navy and the SHPO, shall be maintained confidential and no information shall be released without the express agreement of the landowner and residents.

G. If historic properties, including traditional cultural properties, are discovered as a result of either the ethnographic survey described in III.C. or other surveys conducted as described in III.E., the Navy will determine the potential effects on any such historic properties from activities such as facility construction (including ground clearing and subsurface excavation); instrument siting; operational activities (including those described in Attachment H); road or infrastructure improvements; construction of fire breaks or fire suppression activities; the accidental distribution and clean-up of missile launch debris; increased personnel or off-road traffic within, or in the vicinity of, proposed locations, including those on-going activities described in Attachment H.

H. If the Navy determines that its activities on Niihau will result in adverse effects to historic properties, the Navy shall determine appropriate mitigations, in consultation with the landowner, Niihau residents, and the Hawaii SHPO.

I. In all cases where historic properties, including funerary objects and/or human remains, are inadvertently discovered or disturbed, all activity in the immediate area will cease and the following individuals or organizations notified:

The Landowner
Niihau Elders
PMRF Environmental Engineer or Historic Preservation Point of Contact
U.S. Navy Archaeologist
Hawaii SHPO
Appropriate Kauai/Niihau Islands Burial Council Member

Subsequent actions will include securing the area to protect the historic property from further disturbance and appropriate treatment of these properties will be determined through consultation among the individuals and organizations described within this Stipulation.

J. Where the threat of fire exists in an operation, PMRF shall provide adequate fire suppression equipment and shall schedule and provide for a Niihau Ranch fire suppression team to be on standby on Niihau during operations.

Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

K. Briefings shall be given to non-resident personnel regarding the sensitivity of historic properties and the procedures to be followed if discoveries are made.

L. Information beyond the reports referenced above concerning archeological resources on Niihau will only be provided to the State of Hawaii through the same procedures and subject to the same commitment of confidentiality as is required for such resources on public lands, as specified in Section 470hh(b) of the Archeological Resources Protection Act.

V. Continuing Consultation

A. For Stipulations I, II, III, and IV, consultation will continue with Native Hawaiian organizations to include Na Ohana Papa O Mana, Hui Malama I Na Kupuna O Hawaii Nei, the Kauai/Niihau Islands Burial Council, and the Office of Hawaiian Affairs, and emphasis will be placed on continuing consultation with the Office of Hawaiian Affairs during the months of February and March 1999 to accommodate their internal procedures guiding the consultation process, and documents related to this consultation will be maintained in an appendix to this Memorandum of Agreement.

VI. Resolving Objections

A. Should any approving party to this MOA object in writing to the Navy regarding any action carried out or proposed with respect to implementation of this MOA, the Navy shall consult with the objecting party to resolve the objection. If after initiating such consultation the Navy determines that the objection cannot be resolved through consultation, the Navy shall forward all documentation relevant to the objection to the Advisory Council on Historic Preservation, including the Navy's proposed response to the objection. Within 30 days after receipt of all pertinent documentation, the Council shall exercise one of the following options:

1. Advise the Navy that the Council concurs in the Navy's proposed response to the objection, whereupon the Navy will respond to the objection accordingly; or

2. Provide the Navy with recommendations, which the Navy shall take into account in reaching a final decision regarding its response to the objection.

B. Should the Council not exercise one of the above options within 30 days after receipt of all pertinent documentation, the Navy may assume the Council's concurrence in its proposed response to the objection.

C. The Navy shall take into account any Council recommendation or comment provided in accordance with this stipulation with reference to the subject of the objection; the Navy's responsibility to carry out all actions under this MOA that are not the subjects of the objection shall remain unchanged.

VII. Amendments

Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

A. Any approving party to this MOA may propose to the Navy that the MOA be amended, whereupon the Navy shall consult with the other parties to this MOA to consider such an amendment. 36 CFR Section 800.5(e) shall govern the execution of any such amendment.

B. Execution of this Memorandum of Agreement and implementation of its terms evidence that the U.S. Department of Navy has afforded the ACHP an opportunity to comment on the actions proposed within the PMRF Enhanced Capabilities EIS and its potential effects on historic properties and that the U.S. Navy has taken into account the effects of the undertaking on historic properties.

UNITED STATES DEPARTMENT OF THE NAVY, PACIFIC MISSILE RANGE FACILITY

By: J.A. Bowlin **Date:** 26 Jan 99
J.A. Bowlin, Captain, U.S. Navy,
Commanding Officer, Pacific Missile Range Facility

HAWAII STATE HISTORIC PRESERVATION OFFICER

By: ______ **Date:** 1/27/99
State Historic Preservation Officer

ADVISORY COUNCIL ON HISTORIC PRESERVATION

By: John M. Fowler **Date:** 3/18/99
John M. Fowler,
Executive Director

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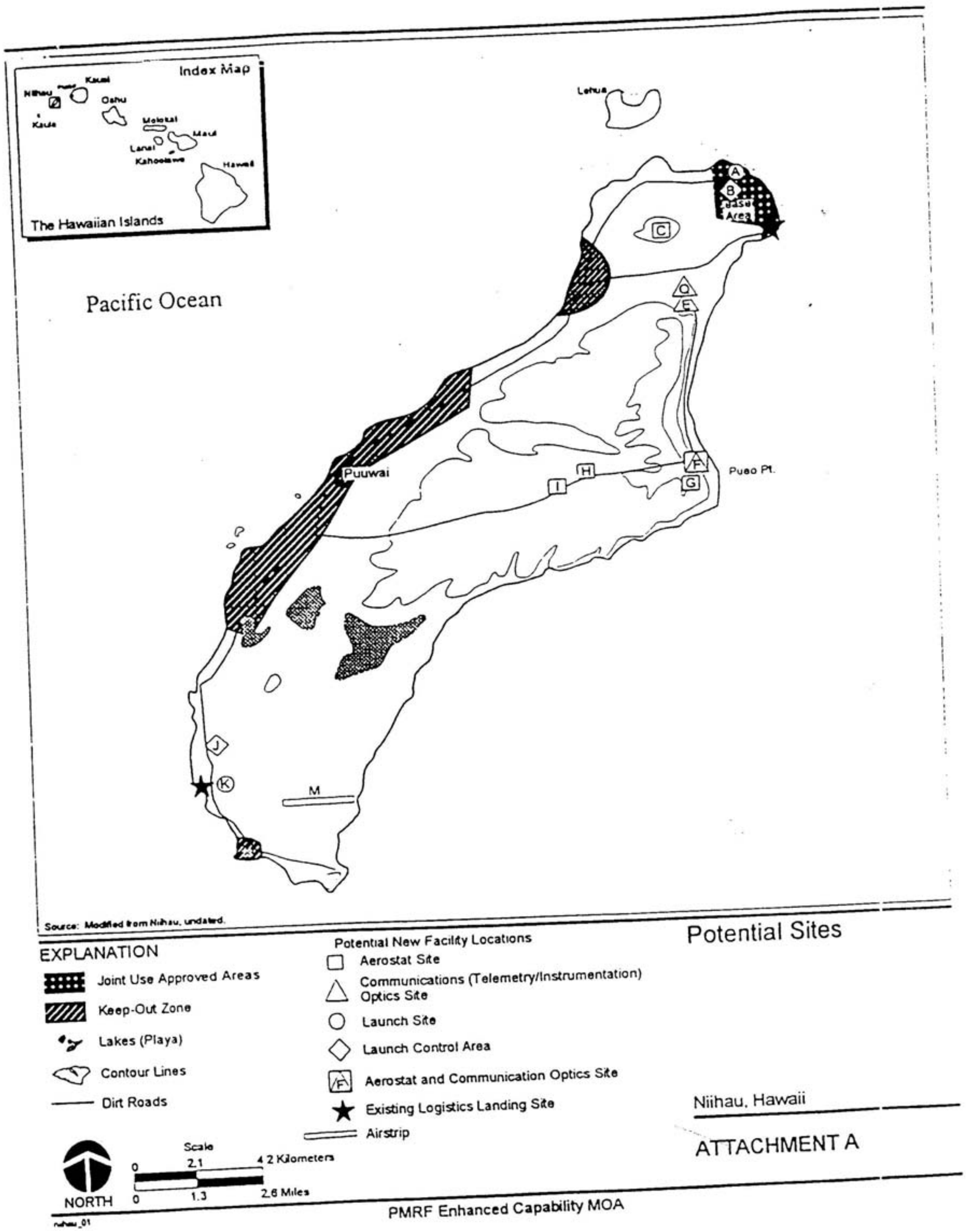
Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

APPENDIX

Documents Related to Consultation

Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)



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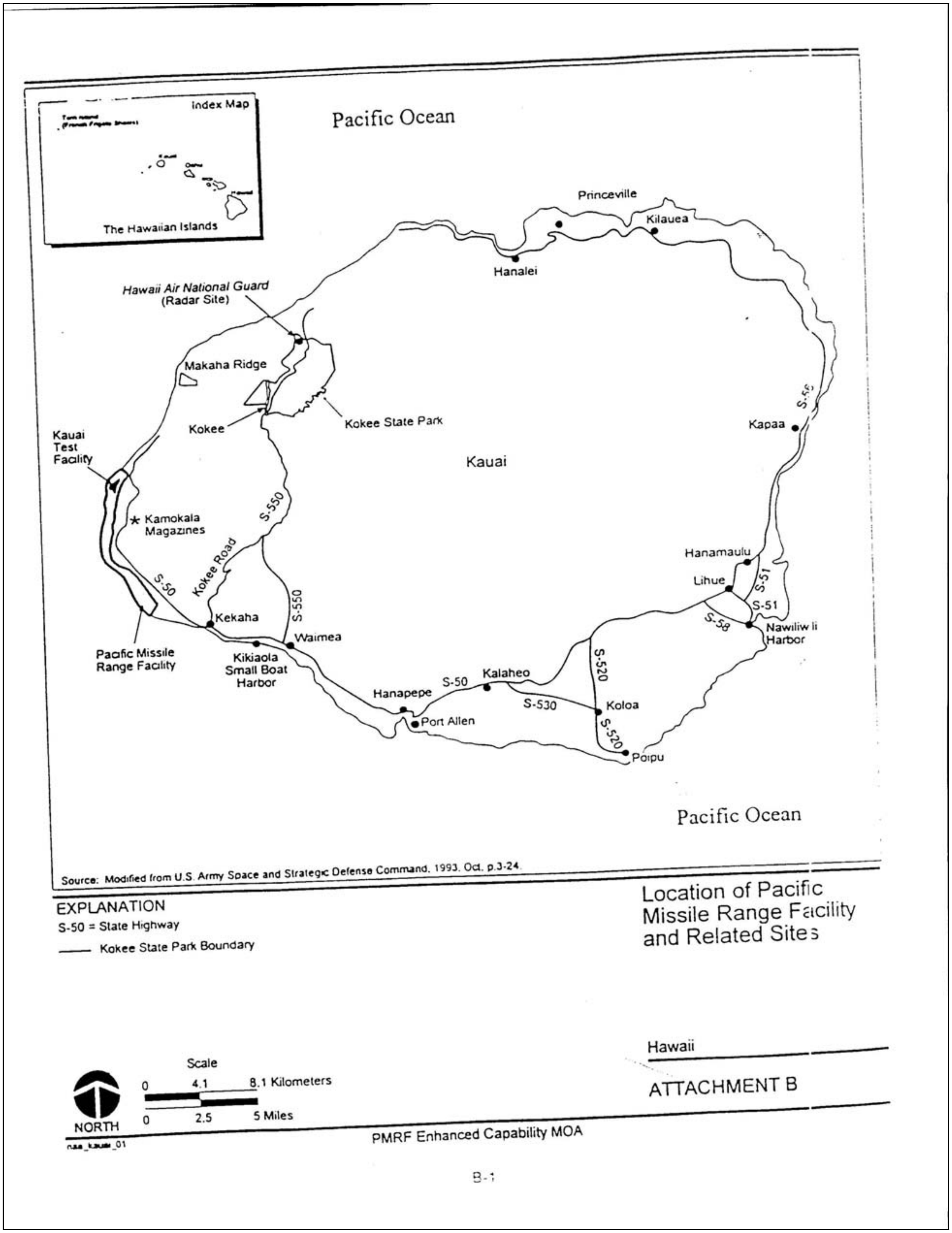
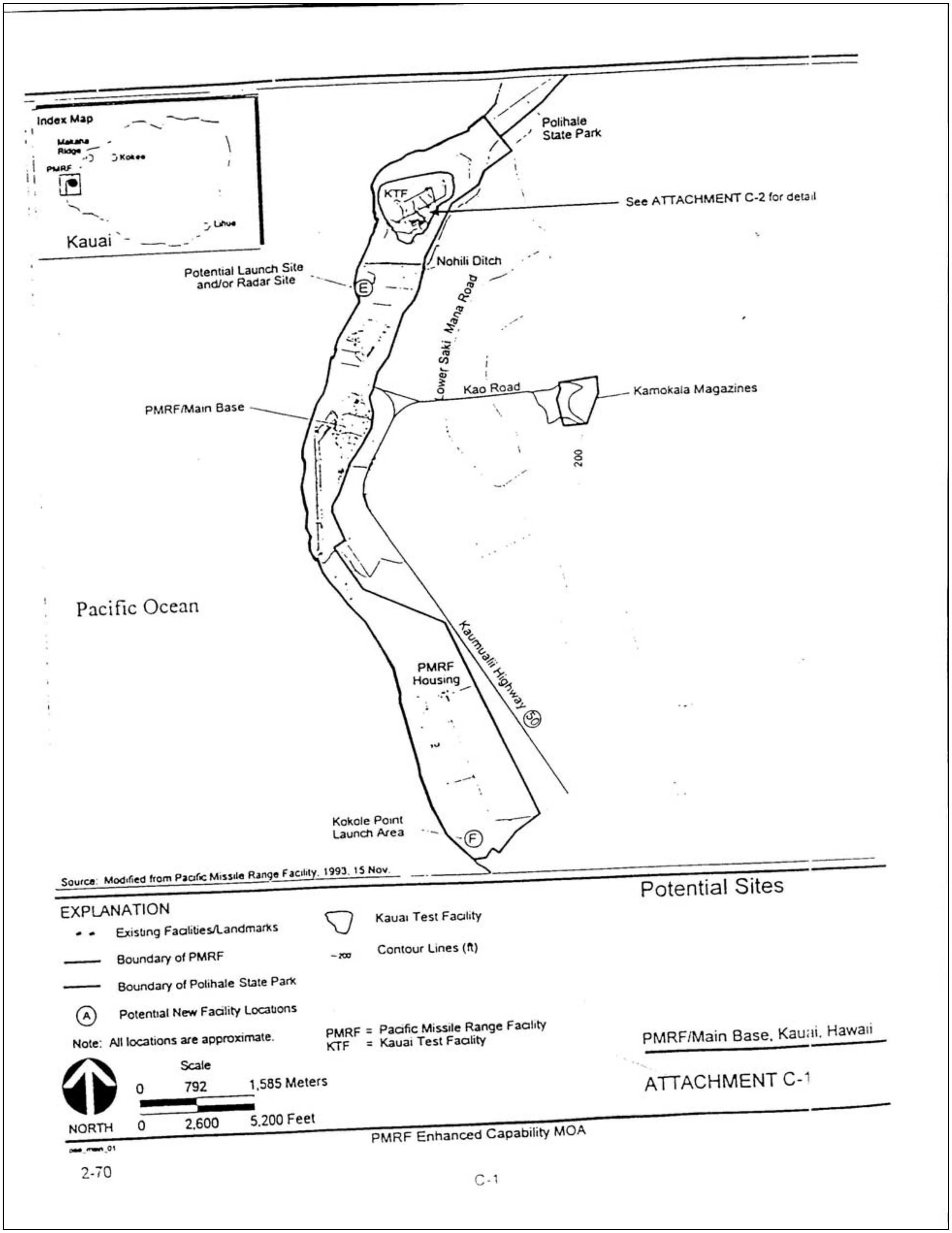
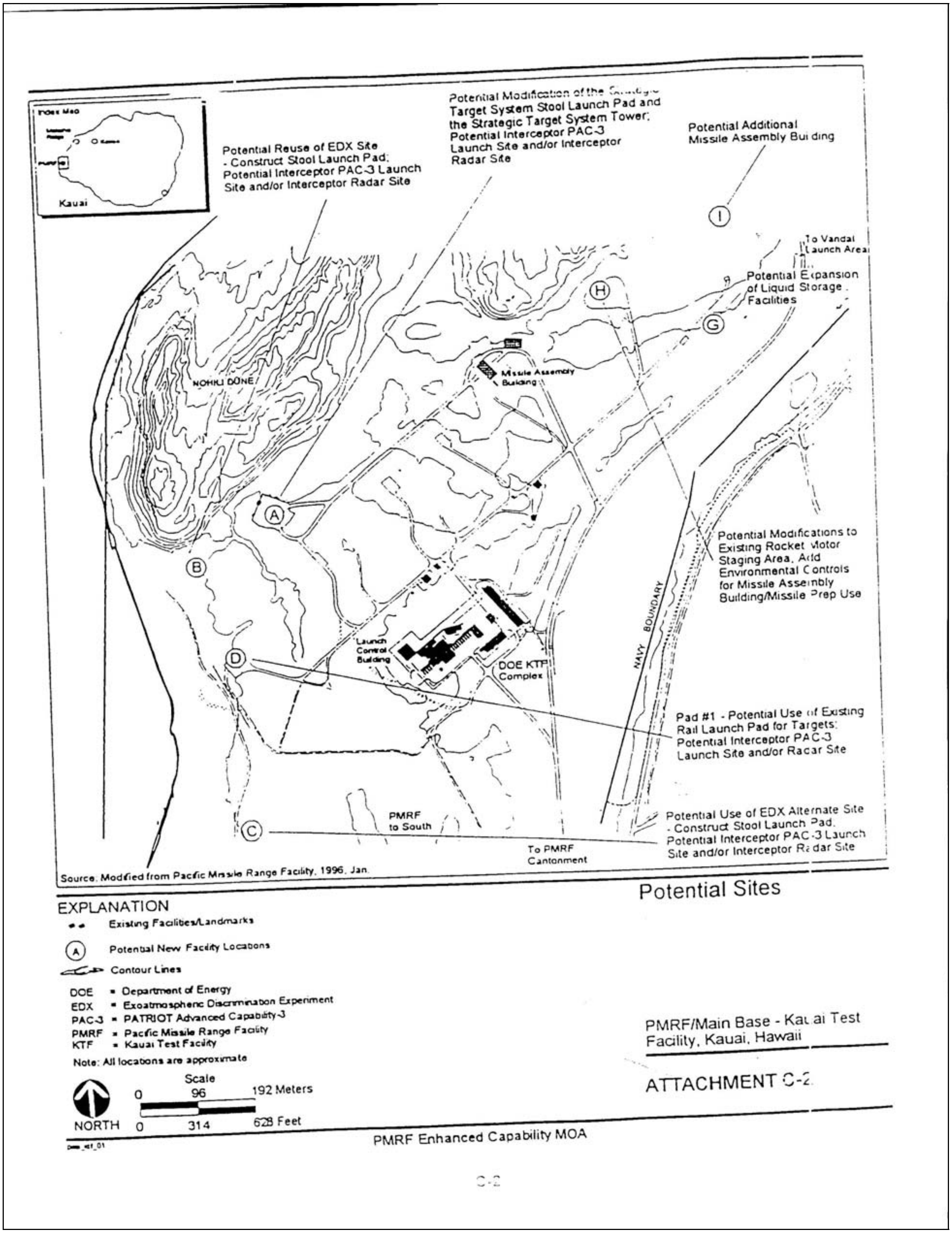
Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)



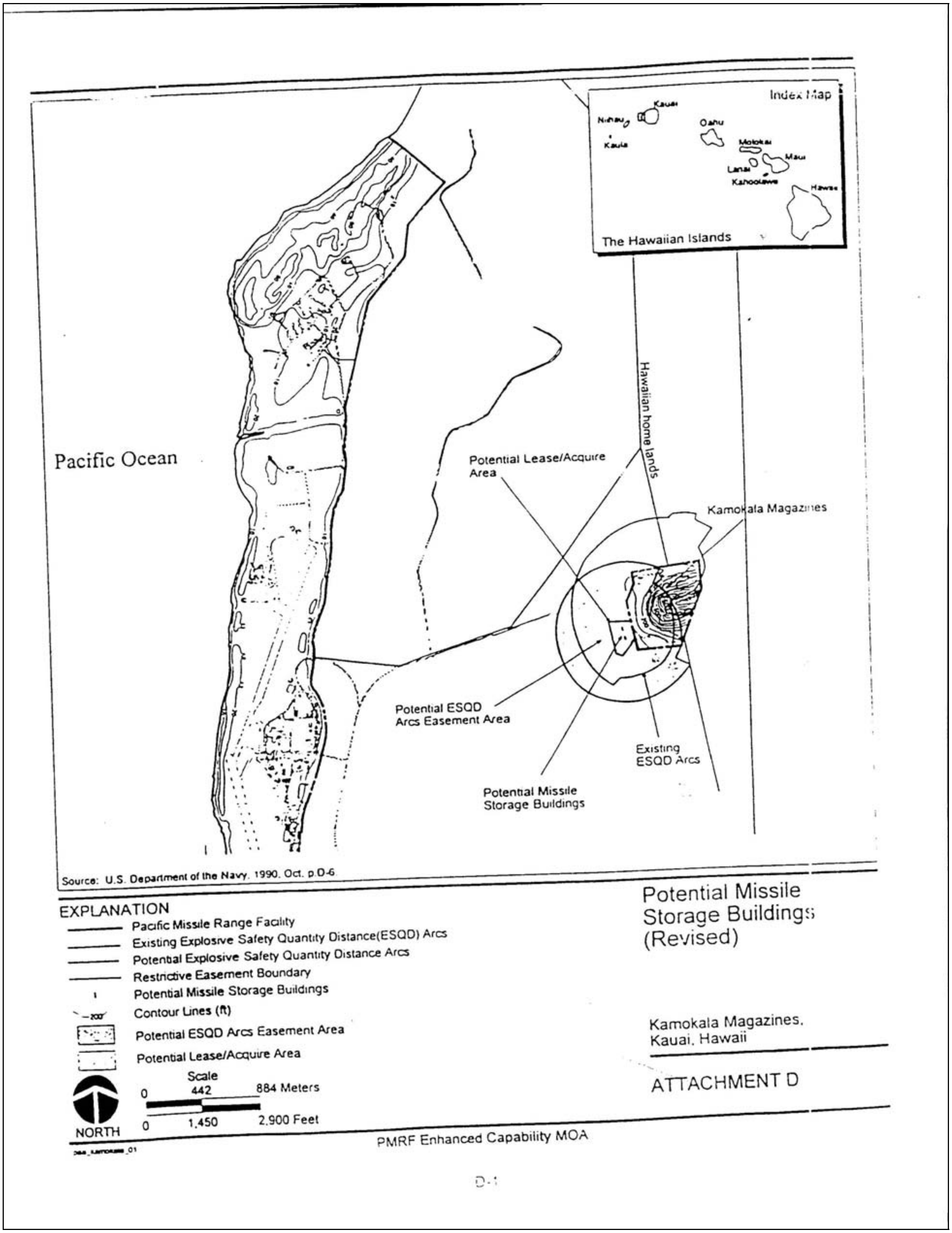
Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)



Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)



Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)



Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

COPY

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
33 SOUTH KING STREET, 6TH FLOOR
HONOLULU, HAWAII 96813

REF:HP-AMK

SEP 10

LOG NO 9118
DOC NO 9308NM69

MEMORANDUM

TO: Brian Choy, Director
Office of Environmental Quality Control

FROM: Keith Ahue, Chairperson and
State Historic Preservation Officer

SUBJECT: Draft EIS for the PMRF Easement over State Land for Safety and Ground Hazard Areas for STARS and Navy Vandal Missile Launches Historic Preservation Review & National Historic Preservation Act Compliance
TMK: 1-2-02: por. 1, 15 and por. 24
Mana, Waimea, Kaua'i

We have reviewed the above document. It should be clearly stated in the document that no 100 % archaeological inventory survey has been conducted in the ROI (2110 acres). Small portions of the area have been recently surveyed by DLNR - State Parks (Carpenter and Yent, pers. com. August 1993). However, it is presumed that no physical action will occur in this area. Therefore, since it is an easement, we concur that the ROI will have " no effect" on significant historic sites.

We do have some minor comments and concerns with this document. We do have concerns with the permanent signs. No map was provided on the location of these signs. Since they will be permanent, we need to know what type of construction will take place, along with information on the design of this signs.

The summary on the archaeological research conducted to date, should be updated and include the following: Cleeland 1974, Bordner 1976, Sunoto 1978, Kikuchi 1970, Kennedy/Jenks 1982, Yent 1982, McMahon 1988a & b, Gonzalez et al 1990, Walker, Kalima & Rosendahl 1990, Welch 1990a & b, U.S. Navy (n.d.), draft Flores and Kaohi 1992 and O' Hare & Rosendahl 1993. Appendix D-1 should be updated to include current State of Hawaii inventory sites numbers: 6017, 6018, 6019, 6020, 6021, 6024 and 724. We are unsure of the correlation of the temporary numbers listed in the table with these numbers.

If you have any questions please call Nancy McMahon at 587-0006.

NM:amk

c: Linda Ninh, U.S. Army Space and SDC

ATTACHMENT E

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Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

ATTACHMENT F

Reserved

Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

ATTACHMENT G

NIIHAU RANCH
P.O. Box 229
Makaweli, Kauai, HI 96769

PMRF Expanded Capabilities
Support and
Land Use Agreement

Proposed Addendum
to
Terms and Conditions for Use of Niihau Island Facilities and Helicopter Services

PROTECTION OF HISTORICAL/CULTURAL RESOURCES:

1. In planning for PMRF operations support, the proposed Niihau land areas required for support of any particular operation shall be identified by PMRF representatives to the NGPOC, who will forward and discuss the plan with the property owner and Niihau elders. Historically/culturally sensitive areas shall be avoided whenever possible, or measures shall be employed to prevent or minimize damage to those sites. Where threat of fire exists in any operation, PMRF shall schedule and provide for a Niihau Ranch fire suppression team to be on standby on Niihau during operations. PMRF shall provide adequate fire suppression equipment for use by the team.

2. Prior to any activity which will require known disturbance of the ground (i.e., construction) the site shall be surveyed by a professional archaeologist, if not previously surveyed. Prior to start of ground disturbance activity, construction crews shall be briefed on the sensitivity of cultural resources and the procedures to be followed if sensitive items are uncovered during work at the site. During site preparation and construction, the site shall be monitored by a representative of the Niihau Ranch. A qualified archaeologist, agreeable to the landowner, would assist the island elders in monitoring the siting areas during construction and all ground disturbing activities. If sensitive items are uncovered during surveys or construction, as confirmed by the landowner and Niihau elders, with assistance of the qualified archaeologist (including artifacts or human remains), work shall stop, the area protected and followup action initiated. The property owner and elders from the Niihau community will employ action consistent with local custom. Work may recommence upon the advice of the property owner. Survey reports will be reviewed by representatives of the Niihau Ranch. Private or commercial publishing of any information pertaining to Niihau is prohibited without permission of the landowner.

3. Should there be unexpected property damage resulting from any PMRF operations, the property owner and elders from the Niihau community will be consulted on

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Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

appropriate measures to protect, stabilize, or restore the property. The Navy will pay for cost of stabilization/restoration if desired by the landowner.

4. PMRF shall be responsible for funding and scheduling all required surveys in consultation with the NGPOC who will obtain all required approvals by the property owner.

Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

ATTACHMENT H

Niihau Island
Ongoing Activities

Downed Pilot Training:

These exercises are called TRAP (Tactical Recovery of Aircrew Personnel) missions, and provide coordination training for downed crew and recovery force personnel. The mission starts with coordination planning between PMRF program manager and Niihau Ranch Government Point of Contact (NRGPOC), D. Nekomoto). Exercise provides training for downed aircrew in escape and evasion and coordination of recovery helicopter assets. Niihau Ranch personnel are hired to locate downed aircrew, who are trying to remain hidden, and the Niihau Helicopter is contracted to provide exercise support and medevac standby. The standby exercise is scheduled and a briefing session is included, where aircrew and recovery force personnel are briefed on conducting operations on Niihau Island. Included in the pre exercise briefing, typically, is the NRGPOC, Mr. Robinson, the aircrew personnel who will be on the ground, and the recovery force team. Personnel are briefed on general rules, boundaries, hazards, and safety procedures. Personnel are also given tips by Mr. Robinson on evasion and detection avoidance. The exercise starts when the aircrew personnel are inserted at approximately 0730 by Niihau Helicopter, usually at Kaunuopou, then flies to Nanina where it remains on medevac/safety standby until the operation is complete. Aircrew execute escape and evasion plans and coordinate their rescue by helicopter at about 1600. Following the exercise, a debriefing session is held, bringing out strong and weak points of the mission. See figure 1 attached.

Impact assessment: Minimum to no impact. Personnel are taking all measures to prevent discovery, and do not overturn rocks or dig any soil. Helicopter landing areas are designated for their suitability and absence of any cultural resources.

Special Warfare Operations:

These are very similar in nature to the TRAP missions described above, and usually involve Special Warfare reconnaissance forces, whose objective is to come ashore clandestinely, remain undetected (Niihau Ranch personnel are contracted to perform island defender roles), proceed to a pre-designated reconnaissance objective, and from concealment, record activities and features at the objective site. The Niihau Helicopter provides transportation for the PMRF Operations Conductor, Special Warfare Exercise Coordinator, communications crew, and medical emergency corpsman. The medical emergency corpsman sets up a command post on island to monitor the exercise safety/conduct and performs on scene coordinator functions. Prior to the exercise, extensive briefings are conducted with Special Warfare personnel with Mr. Robinson. Following the exercise, a debriefing session is held on the island with Niihau personnel and again at PMRF with special warfare exercise personnel. See figure 1 attached.

Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

Impact assessment: Minimum to no impact. Personnel are taking all measures to prevent discovery, and do not overturn rocks or dig any soil. Reconnaissance objectives are ranch buildings, and approaches to these objectives are roads or animal trails. Alternatives to using established animal trails or roads is transit through thorny Kiawe and Lantana plants. Helicopter landing areas are designated for their suitability and absence of any cultural resources. The Command Post is established at a ranch constructed facility at Nanina Beach

Amphibious Landings:

No large scale amphibious exercises are anticipated on Niihau Island. Amphibious operations conducted to date include those which are associated with Special Warfare exercises and Mr. Robinson's own logistics efforts. Landings which are associated with Special Warfare ops are very small scale, usually a single rubber boat and a squad size element of reconnaissance personnel, whose mission is to evade detection. In these exercises, landing on the beach also includes swimming ashore from support boats or submarines offshore. Mr. Robinson's own logistics efforts includes landing with the Ranch's leased LCM-8 landing craft, which includes bringing fuel and supplies to support the ranch and Navy facilities on the island. See large Niihau map.

Impact assessment: Minimum to no impact. Personnel who participate in small scale amphibious landings are taking all measures to prevent discovery, and do not overturn rocks or dig any soil. Landings by the Ranch are conducted at several sites which have been utilized for generations.

Helicopter Terrain Flight (TERF) Operations:

USMC Helicopters use Niihau for TERF training, which is basically low level flight and navigation exercising cockpit coordination, lookout doctrine, and TERF specific pilot techniques and procedures. A route was established in about 1992 with Mr. Robinson, and tested for sound impacts to Puuwai Village (no impact). The Niihau Helicopter transports the PMRF Operations Conductor to Kaeo mountain to observe and communicate with USMC aircraft, as the on scene coordinator. USMC aircraft fly the route, report eleven checkpoints on the route to the operations conductor. The operations conductor visually establishes individual crew performance. A debrief is conducted following the exercise. TERF is occasionally combined with Electronic Warfare (EW) exercises. See figure 2 attached.

Impact assessment: Minimum to no impact. Marine Corps helicopters are involved in overflight activity. Emergency landing requirements are prebriefed and provide suitable landing zones which are routinely used by the Niihau helicopter in ranch and company operations. Operations Conductor observation site at Kaeo is a landing site used by the Niihau Ranch.

Electronic Warfare (EW) Exercises:

Electronic Warfare Exercises are conducted from various positions on Niihau for USMC helicopters as well as for surface combatants on the range. Electronic signals

Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

replicating those which may be found in a battle area are emitted from fixed (Perch Site) hardware or from mobile equipment. The Niihau Helicopter transports personnel to the Perch Site for operations which vary from single to multiple day operations. Equipment (Electronic Threat Simulators and Jammers) installed at the Perch Site are used to provide the desired signals. The Perch Site equipment is usually used for sending signals to ships in the range operations area. In the mobile EW operations, used mostly to support USMC helicopter operations, an EW team and electronic equipment are transported to the selected site by the Niihau Helicopter, and the team establishes a temporary EW position with portable Electronic Threat Simulators and Jammers. Signals are sent to helicopters for exercising Threat Warning System operation and interpretation, evasive maneuvering, and countermeasure procedures. See large Niihau map.

Impact assessment: Minimum to no impact. Marine Corps helicopters are involved in offshore flight activity. Emergency landing requirements are prebriefed and provide suitable landing zones which are routinely used by the Niihau helicopter in ranch and company operations. On island operations sites coincides with helicopter landing sites used by the Niihau Ranch. A fire extinguisher is included as part of the standard equipment taken by the EW team.

Unmanned Aerial Vehicle (UAV) Contingency Landing Support:

Several sites on Niihau have been designated for contingency landing by UAV aircraft, in the event an approach to PMRF cannot be executed for any reason such as unforecast winds, mechanical problem, etc. These sites are designated on the accompanying map, and were selected for prevailing wind conditions, and for being relatively flat and open without obstructions. The northern site is Kaunuopou, and the site east of Puuwai is Kamoilii. Both are pasture areas, and well suited for this activity. When UAV operations are in progress, Niihau Ranch is contracted to provide contingency landing support with a standby ground handling support crew. The Niihau Helicopter is contracted to transport a mobile flight control unit and personnel to the selected contingency landing site if a contingency landing is required. Niihau Ranch personnel are trained by the program requiring their support in ground handling and procedures, and supported all three world record flights by Pathfinder and Pathfinder Plus UAVs. See large Niihau map. Kaunuopou is located just north of the Minex Marker.

Impact assessment: Minimum to no impact. Landing sites are to be used in emergency only situation, so occasion for use of the site is already remote. Selected landing sites are located in pasture land, and wide open areas void of cultural resources.

Instrumentation/Test Sites:

To support a variety of programs and projects, requirements for instrumentation sites arise from time to time. Sites are selected based on geometry, and project requirement, and are usually temporary in nature. Equipment proposed for these sites could be small, compact units up to trailered units. All proposed sites are reviewed by Mr. Robinson for approval. A good example of this is the Moving Target Simulator instrumentation requirement. Three sites were selected, and instrumentation placed at those sites, consisting of a small weatherproof box about 2'x2'x1', a solar panel and a towered

Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

antenna. Niihau Ranch was contracted to support these sites with labor and transportation. Temporary fences were built around the sites to protect the instruments from intrusion and destruction by animals. Upon project completion, sites were dismantled and instrumentation removed. Another example is the Inertial Navigation Marker used for Mine Warfare Training. An orange pyramid shaped structure was surveyed and placed at Kaunuopou for use by P-3 aircraft as an inertial navigation checkpoint in executing simulated mining exercises over the range. A similar Initial Point (IP) is established on the Kauai side of the channel, however, in the event drone launch activities from PMRF launch pad conflicts with requirements for conducting Mine exercises, the Niihau IP would be used. The Niihau IP was contracted for use in RIMPAC '94, and was to be removed after the exercise. Mr. Robinson elected to leave the structure in place to allow PMRF the use of it, as it was not bothering anyone by being there. See large Niihau map.

Impact assessment: Minimum to no impact. Sites are selected in consultation with Mr. Robinson and Niihau elders to reduce the possibilities of any cultural impacts. Towered antennas are usually very small (usually less than 10' high, and tower is usually an aluminum or steel pipe. A higher antenna was used, for one project, and was mounted on a trailer. Fences are usually Kiawe wood posts, and animal control wire constructed around the immediate perimeter of the selected site.

Cruise Missile Defense/Near Land Overland AEGIS support:

The AEGIS Program, in executing tests in the littoral (nearshore) environment performs tests where BQM-74 drones or manned aircraft conduct overflight of Niihau's northern land area . This is to provide test scenarios replicating hostile missiles fired towards an AEGIS ship from a land mass which features a mountainous backdrop and a land to sea transition. Program personnel indicates that there aren't any other locations adjacent to an instrumented range which provides the desired geography. The program contracts Niihau Ranch personnel to support operations by keeping land area below the intended flight track clear of unauthorized personnel and to perform contingency support (drone recovery or fire suppression) functions should they be required. The Niihau Helicopter is contracted to provide transportation to Niihau for an AEGIS program representative and a PMRF representative to function as on site observers of the overflight operations. See figure 1 attached.

Impact assessment: Minimum or no impact. Drones are remotely piloted and manned aircraft are involved in overflight activity only. The drones fly specific profiles and are monitored visually and by radar . Departure from the established profile or loss of command link will result in the drone entering a recovery mode (proceed to a recovery point and parachute descent into the recovery area.) The actual time the aircraft flies over Niihau is less then one minute per pass. The probability of a catastrophic incident occurring is extremely low since the vehicle is under the control of an experienced pilot and the short amount of time the aircraft is actually over the island.

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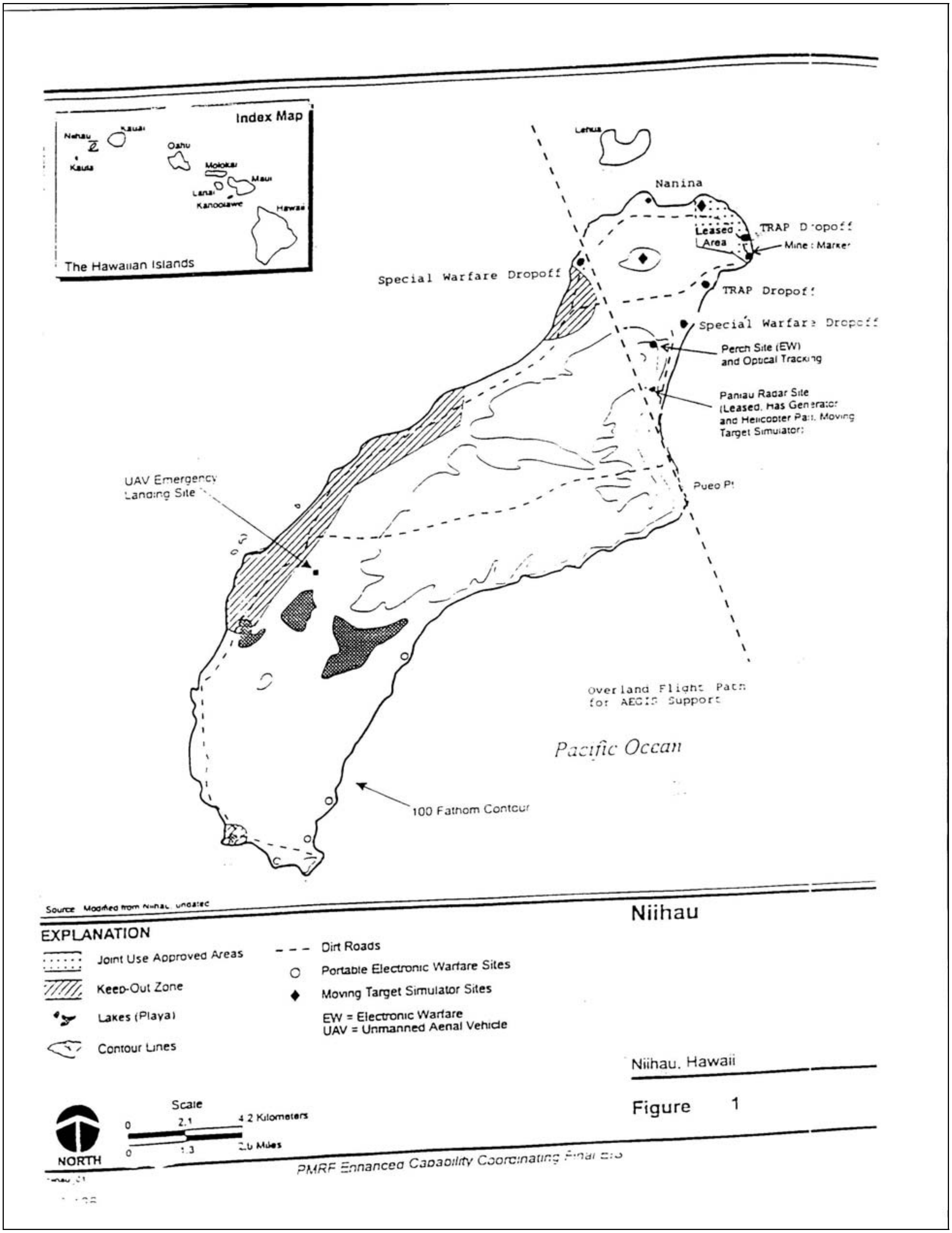
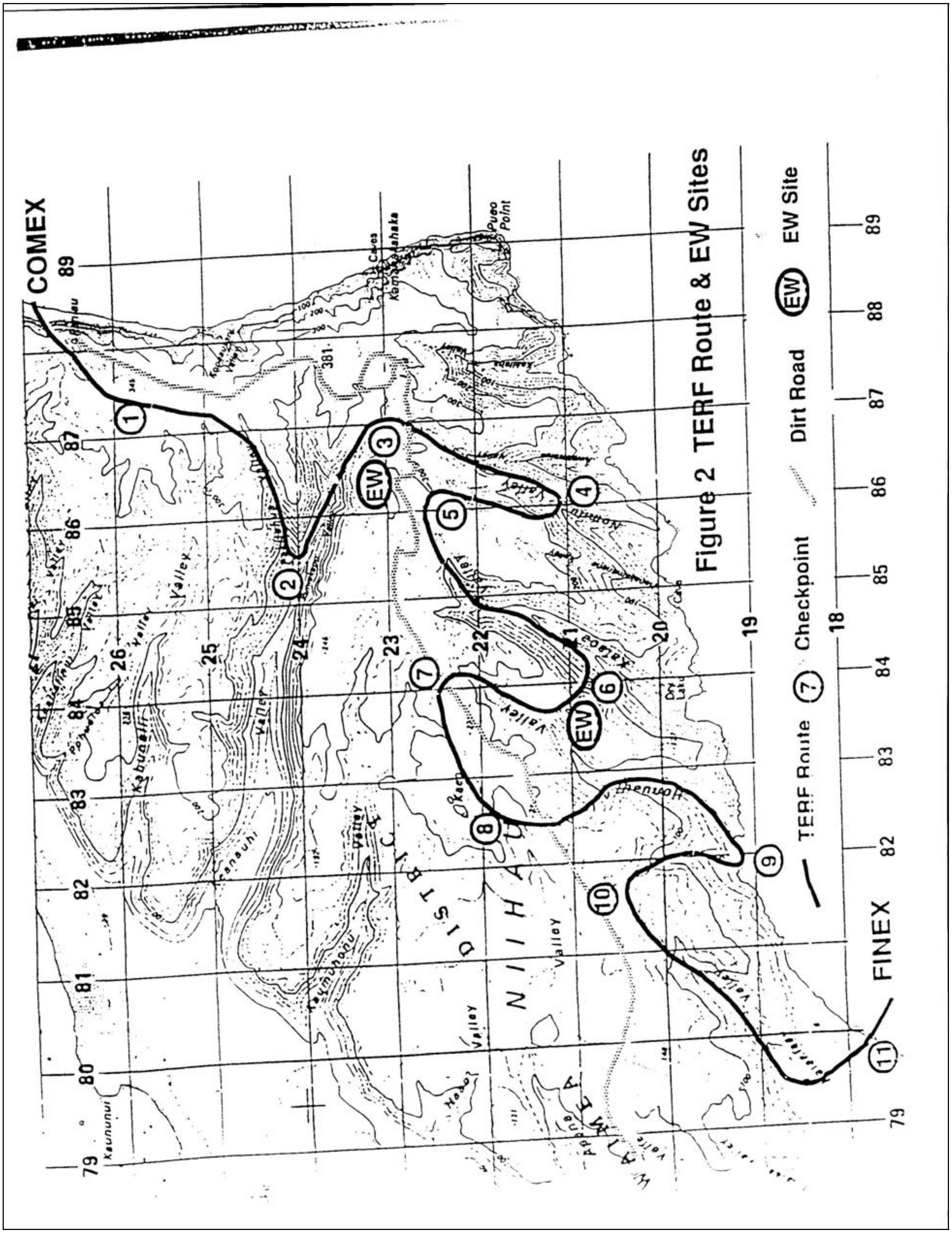
Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)



Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)



Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

ATTACHMENT I

ACRONYMS, ABBREVIATIONS, AND DEFINITIONS

ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
Council	Advisory Council on Historic Preservation
CRMP	Cultural Resources Management Plan
EIS	Environmental Impact Statement
National Register	National Register of Historic Places
OPNAVINST 5090.1B	Environmental and Natural Resources Program Manual
PMRF	Pacific Missile Range Facility
SHPO	State Historic Preservation Officer
U.S.	United States

DEFINITIONS

Grave or Ceremonial Objects. As defined by the Native American Graves Protection and Repatriation Act, these cultural items include:

1. Associated funerary objects, which shall mean objects that, as a part of the death rite or ceremony of a culture, are placed with individual human remains either at the time of death or later.
2. Unassociated funerary objects, which shall mean objects that, as a part of the death rite or ceremony of a culture, are reasonably believed to have been placed with individual human remains either at the time of death or later.
3. Sacred objects, which shall mean specific ceremonial objects that are needed by traditional Native Hawaiian religious leaders for the practice of traditional Native Hawaiian religions by their present day adherent.
4. Items of cultural patrimony, which shall mean an object having ongoing historical, traditional, or cultural importance central to the Native Hawaiian group or culture itself, rather than property owned by an individual Native Hawaiian, and which, therefore, cannot be alienated, appropriated, or conveyed by any individual regardless of whether or not the individual is a member of the Native Hawaiian organization.

Hui Malama I Na Kupuna O Hawaii Nei. As defined in Public Law 101-601 (Native American Graves Protection Repatriation Act), the nonprofit, Native Hawaiian organization incorporated under the laws of the State of Hawaii by that name on April 17, 1989, for the purpose of providing guidance and expertise in decisions dealing with Native Hawaiian cultural issues, particularly burial issues.

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Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

Native Hawaiian Organization. Any organization which (a) serves and represents the interests of Native Hawaiians, (b) has a primary and stated purpose the provision of services to Native Hawaiians, and (c) has expertise in Native Hawaiian affairs, and shall include the Office of Hawaiian Affairs and the Hui Malama I Na Kupuna O Hawaii Nei.

Office of Hawaiian Affairs. Established by the constitution of the State of Hawaii, the Office of Hawaiian Affairs (OHA) is a state agency, independent from the executive and all other branches of government. OHA is a trust entity for all individuals whose ancestors were natives of the Hawaiian Islands prior to 1778. The agency was established, in 1979, to manage and administer the resources held for the benefit of Hawaiians, and to formulate policy for them; it is governed through a board of trustees.

Professional Archaeologist. An archaeologist qualified by standards established by the Department of the Interior, National Park Service and described in 36 CFR, Part 61, Appendix A.

Restrictive Easement (Ground Hazard Area). The land area within which all debris from a terminated missile launch will fall. At the PMRF, this area encompasses a 3,048-meter (10,000-foot) arc (maximum) radiating out from centerpoint which is the STARS launch pad.

Undertaking. As defined by Section 106 of the National Historic Preservation Act, a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a federal agency, including (a) those carried out by or on behalf of such agency, (b) those carried out with federal financial assistance, (c) those requiring a federal permit, license, or approval, and (d) those subject to state or local regulation administered pursuant to a delegation or approval by a federal agency.

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Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

ATTACHMENT J

Draft Archaeological Monitoring Plan

Proposed activities associated with the U.S. Navy's Pacific Missile Range Facility (PMRF) Enhanced Capability Environmental Impact Statement (EIS) include ground disturbance from construction, military exercises, and military operations. Inasmuch as several of the locations encompassed by the proposed action and alternatives (including the No Action Alternative) are known to encompass areas with potential archaeological sensitivity, an Archaeological Monitoring Plan has been developed to deal with the possible unexpected discovery of archaeological materials (prehistoric, historic, or traditional) and burials.

1. All monitoring activities will be undertaken by a qualified archaeologist familiar with the range of cultural resources likely to be found within the project area. In the event that monitoring activities are to take place within a known contaminated site, the archaeologist will be OSHA 40-hour trained.

2. Archaeological monitoring will consist of identification, evaluation, collection, recording, analysis, and reporting of archaeological remains during ground disturbing activities. The data retrieved shall be sufficient to characterize the nature of all major deposits and strata, regardless of the cultural content, and discuss their known extent through time and space.

3. A coordination meeting shall take place between the archaeological monitor and the construction team, prior to any ground-disturbing activities taking place. The meeting shall outline the duties and responsibilities of both the archaeologists and the construction team.

4. Arrangements for the services of a physical anthropologist (or other scientists as appropriate) with a background in human osteology will be made prior to any ground disturbing activities. In the event that osteological analysis of skeletal remains is required, this work will conform with the provisions of the Draft Burial Plan, provided as Attachment K to this Memorandum of Agreement.

5. The archaeological monitor will be present while all ground disturbing activities are occurring. The monitor will inspect the backdirt removed from construction areas as well as exposed soil profiles.

6. The archaeological monitor will be authorized to halt ground disturbing operations in order to evaluate, assess, and determine what course of action should be taken for the protection of any identified cultural materials.

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Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

7. If archaeological materials are encountered, the monitor will record and collect data sufficient to determine the significance of the site. If the site is determined to be not significant, the monitor will perform appropriate procedures, including plotting the location on the project topographic map, taking samples (as appropriate), preparing site maps, and photography. If the site is determined to be significant, the monitor will notify the following individuals in order to formulate the most appropriate mitigation measures:

   - PMRF Environmental Engineer or cultural resources point-of-contact
   - U.S. Navy Archaeologist
   - Hawaii State Historic Preservation Officer

   If the site contains grave or ceremonial objects or human remains, the monitor will secure the site and notify the following individuals. Subsequent actions will follow the guidance provided in the Native American Graves Protection and Repatriation Act (NAGPRA) and the Draft Burial Plan provided as Attachment K to this Memorandum of Agreement.

   - PMRF Environmental Engineer or Cultural Resources Point of Contact
   - U.S. Navy Archaeologist
   - Hawaii State Historic Preservation Officer
   - Hui Malama I Na Kupuna O Hawaii Nei
   - Office of Hawaiian Affairs

8. Stratigraphic profiles of excavated areas containing cultural materials will be made and photographs taken. A sampling of stratigraphic profiles will be drawn of excavated areas, regardless of the presence of cultural materials, in order to provide useful information regarding the lack of cultural materials in a given area.

9. A report addressing any findings or subsequent mitigation resulting from the monitoring will be submitted to the Hawaii State Historic Preservation for review.

10. With the exception of grave or ceremonial objects, or humans remains, any cultural materials discovered during the conduct of this monitoring plan will remain the property of the PMRF and will be curated in accordance with current PMRF policy. Grave or ceremonial objects and/or human remains will be treated in accordance with the Draft Burial Plan, provided as Attachment K to this Memorandum of Agreement.

09/16/98

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Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

ATTACHMENT K

BURIAL TREATMENT PLAN

This burial treatment plan has been developed by the Commanding Officer, Pacific Missile Range Facility (PACMISRANFAC) in compliance with the Native American Graves Protection and Repatriation Act (NAGPRA) and Section 106 of the National Historic Preservation Act and provides detailed procedures to be followed when Native Hawaiian remains are inadvertently encountered during construction activities, erosion or any other natural or human activity.

The plan reflects understandings between PACMISRANFAC, SHPO, KIBC, Na Ohana Papa O Mana, Hui Malama I Na Kupuna O Hawaii Nei, and OHA regarding the inadvertent discovery, disinterment, reinterment, temporarily curate and preservation of native Hawaiian human remains. It is noted that the general policy of the signatories shall be for burials not to be moved when at all possible.

Each party will observe the following understandings. Each party may terminate this agreement upon notice to the other, and each party will give prompt consideration to any changes proposed by the other.

Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

COSTS

1. The U.S. Navy shall pay for all preservation in-place costs, as arranged in individual cases, in compliance with the National Historic Preservation Act.

2. The U.S. Navy shall pay for all archaeological costs (field, laboratory and report) in compliance with the National Historic Preservation Act.

3. PACMISRANFAC shall pay for disinterment and reinterment ceremonies provided for by this agreement. The amount of payment shall be agreed upon from time to time between PACMISRANFAC, OHA and KIBC representatives. Payments in any given Federal Government fiscal year shall not exceed $1,000 without specific approval of the Commanding Officer, PACMISRANFAC.

PREVIOUSLY IDENTIFIED HAWAIIAN BURIALS

1. Whenever a project is proposed within an area which contains previously identified Hawaiian burial sites, including burial sites identified during archaeological survey for projects under Section 106 compliance, the project proposal shall be submitted to the KIBC for its review. Within thirty days of the submittal the SHPO shall determine whether the burial sites within the project area shall be preserved in place or relocated.

2. If the remains are to be preserved in-place, they shall be preserved in-place in accordance with the preservation part of this agreement.

3. If the remains are to be relocated, they shall be disinterred in accordance with the disinterment part of this agreement.

INADVERTENT DISCOVERY OF HUMAN REMAINS

When human remains are inadvertently discovered on base, the following steps shall occur:

1. Work shall stop in the immediate area and the U.S. Navy's archaeologist at PACNAVFACENGCOM, Hui Malama I Na Kupuna O Hawaii Nei, Na Ohana Papa O Mana, OHA and SHPO, shall be notified.

2. The remains shall not be moved until the U.S. Navy's archaeologist has the opportunity to determine whether they are recent remains under the jurisdiction of police authorities or whether they are historic remains, older than 50 years in age. If they are recent remains, the remains are not considered under this agreement.

Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

3. If the remains are historic, the U.S. Navy archaeologist, or a designated professional archaeologist, shall document the context of the remains, burial features, grave goods, and attempt to establish the ethnic identity of the remains with minimal disturbance.

4. If the remains appear likely to be native Hawaiian, the SHPO, KIBC and OHA's Kauai office shall be notified. If the remains appear unlikely to be native Hawaiian, the SHPO shall be notified, and arrangements other than those covered in this agreement shall be followed.

5. If the remains are in no danger and can be preserved in-place, they shall be preserved in-place in accordance with the preservation part of this agreement.

6. If the remains are threatened by construction or erosion and cannot be preserved in-place, they shall be disinterred in accordance with the disinterment part of this agreement.

7. Steps 1-4, above, shall be executed within 5 working days of discovery.

PRESERVATION IN-PLACE

When human remains are discovered and can be preserved in-place, the following steps shall occur:

1. The remains shall be covered up in their original manner as indicated by the archaeological findings (e.g., with sand, with stone platform, etc.).

2. The remains shall be marked on PACMISRANFAC maps to ensure protection in the face of future base planning and activities.

3. The remains shall be protected by appropriate means (e.g., sign, low fence, etc.) as determined appropriate by the KIBC and OHA's Kauai field representative

4. An appropriate ceremony shall occur, as considered necessary by the KIBC and OHA's Kauai field representative.

Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

DISINTERMENT & REINTERMENT

When human remains must be disinterred, the following steps shall occur:

1. When remains are established to be native Hawaiian or are considered likely to be native Hawaiian, OHA's Kauai field representative and the KIBC shall determine if a ceremony is needed prior to disinterment. This determination shall be made within 48 hours of notification of these agencies of the decision for disinterment. If a ceremony is desired, a Federal employee acceptable to these agencies shall conduct the ceremony. If an acceptable Federal employee is not available, then a ceremony may be conducted by a nonfederal person designated by OHA's Kauai field representative and the KIBC. This ceremony may include the main elements of: ho'oponopono: mihi - an explanation and apology for the disturbance; hala - a forgiveness for the offending action; and oki - an emotional resolution that the offense of disturbing will not have future harmful consequences. This ceremony is regarded by native Hawaiians as a healing between living individuals and souls associated with burial. The ceremony will ordinarily involve one to four persons and take approximately one hour.

2. The U.S. Navy's archaeologist, in consultation with the SHPO, shall see that the remains are removed by archaeologists employed or engaged by the Federal Government. Minimal osteological analyses shall be performed within 5 days to determine or verify whether the remains are native Hawaiians (when uncertain) and to establish the number of individuals, age and sex. The proper standards of professional conduct, respect, and sensitivity shall be observed during the removal and treatment of the remains, and the integrity of each individual's remains and of any ho'omoe pu (associated grave goods) will be maintained. All osteological analyses shall be done with due recognition of native Hawaiian beliefs and respect for ancestral bones. No analyses shall be conducted which result in a destruction of bone material.

3. During the time prior to reburial, the remains shall stay on the island of Kaua'i and adequate securing for the integrity of disinterred individuals shall be assured. Further, OHA, SHPO, and KIBC shall be notified of the likely duration of time prior to reburial.

4. Human remains and their associated grave goods shall be reinterred in an underground concrete shelter at PACMISRANFAC (Facility No. 443) for permanent interment in individual casings of concrete. The shelter will have a lockable gate as the only entrance to prevent unauthorized access. The Government will maintain records for the location of the remains within the shelter.

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Appendix H.1. Memorandum of Agreement—Activities Proposed Within the Pacific Missile Range Facility Enhanced Capability Environmental Impact Statement, 1999 (Continued)

REPORTS

Archaeological reports, whether for remains preserved in-place of for remains which are disinterred/reinterred, shall be prepared. Copies shall be filed with each signatory.

ACCESS TO PACMISRANFAC

All access by SHPO, KIBC and OHA representatives to PACMISRANFAC under this memorandum shall be subject to reasonable PACMISRANFAC requirements for identification, escort and other administrative and security procedures. Individuals who are not State or Federal employees may be required to sign liability waivers as a condition of entry to PACMISRANFAC.

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii

PROGRAMMATIC AGREEMENT
AMONG
THE COMMANDER NAVY REGION HAWAII,
THE ADVISORY COUNCIL ON HISTORIC PRESERVATION
AND THE HAWAII STATE HISTORIC PRESERVATION OFFICER
REGARDING
NAVY UNDERTAKINGS IN HAWAII

WHEREAS, the Commander Navy Region (COMNAVREG) Hawaii's area of responsibility (AOR) encompasses the Pearl Harbor Naval Complex, which includes but is not limited to the Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility; outlying Oahu installations; and the Pacific Missile Range Facility at Barking Sands; Kauai; and

WHEREAS for purposes of this Programmatic Agreement (PA), the term AOR shall refer to Navy property within the State of Hawaii; and

WHEREAS, COMNAVREG Hawaii, in order to meet its national defense mission requirements, authorizes, carries out or causes to be carried out a variety of undertakings including, but not limited to, dredging of its harbor; maintenance, rehabilitation, repair, construction and demolition of buildings, structures, and roads; and work regarding grounds and associated landscaping within the State of Hawaii; and

WHEREAS, COMNAVREG Hawaii, formerly known as Commander, U.S. Naval Base, Pearl Harbor, has determined that these undertakings may have an effect upon properties listed or eligible for listing on the National Register of Historic Places (NRHP), including the Pearl Harbor Naval Base National Historic Landmark (NHL) District and four other individual NHLs; and

WHEREAS, the Commander U.S. Naval Base, Pearl Harbor (COMNAVBASE) and the Advisory Council on Historic Preservation (ACHP) entered into a Memorandum of Agreement (MOA) for the assigned missions of the U.S. Naval Base, Pearl Harbor, Hawaii, which MOA

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

was executed by the ACHP on September 4, 1979 with the concurrence of the State Historic Preservation Officer (SHPO); and

WHEREAS, said MOA is superseded by this PA; and

WHEREAS, COMNAVREG Hawaii has consulted with ACHP, and the SHPO, as well as the National Park Service (NPS), the Office of Hawaiian Affairs (OHA), the National Trust for Historic Preservation, Historic Hawaii Foundation (HHF), Oahu Council of Hawaiian Civic Clubs, Outdoor Circle, and MISSOURI Memorial Association Inc; and

WHEREAS, pursuant to Section 800.14(b) of the regulations, 36 CFR Part 800, which implement the National Historic Preservation Act (NHPA), 16 U.S.C. 470f, Section 106 and Section 110(f) of the same act, 16 U.S.C. 470h-2(f), the entities listed above have been invited to sign this PA; and

WHEREAS, COMNAVREG Hawaii has prepared an Integrated Cultural Resources Management Plan (ICRMP) addressing all Navy installations within the Pearl Harbor Naval Complex and all Navy housing on Oahu;

NOW, THEREFORE, COMNAVREG Hawaii, the ACHP, and the SHPO agree that COMNAVREG Hawaii will undertake its national defense mission and related activities within the State of Hawaii in accordance with the following stipulations to satisfy its responsibilities under Section 106 and Section 110(f) of the NHPA.

STIPULATIONS

COMNAVREG Hawaii shall ensure that the following measures are carried out:

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

I. APPLICABILITY

This PA applies to all Navy undertakings initiated within the State of Hawaii, regardless of whether they are initiated and carried out by COMNAVREG Hawaii or by another command or lessee of the Navy. Included, as of the date of this PA, within COMNAVREG Hawaii's geographic AOR in the State of Hawaii are the Pearl Harbor Naval Complex including the Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility, outlying areas on Oahu (Naval Magazine Pearl Harbor; Naval Computer and Telecommunications Area Master Station Eastern Pacific; retained lands from the former Naval Air Station Barbers Point and Fleet and Industrial Supply Center Red Hill), Pacific Missile Range Facility on Kauai and its outlying facilities; and all Navy housing areas in Hawaii. It is intended that more specific PAs or MOAs will be executed for undertakings in Stipulation IX.C.1, including but not limited to the Ford Island Master Development Plan, and construction of any housing on Ford Island.

II. PROFESSIONAL STANDARDS

A. All undertakings, cultural resource management and planning studies and historic property surveys affecting historic buildings and structures will be carried out by, reviewed by or under the oversight or supervision of a person or persons meeting the professional qualifications for Historical Architect under Standard (a) in "The Secretary of the Interior's Historic Preservation Professional Qualification Standards" (Federal Register Vol. 62, No. 119, p. 33719, 1997). Reviews will be documented by the professional making the review. Personnel qualifying under this stipulation should have documented professional experience and expertise applying the Secretary of the Interior's Standards for the Treatment of Historic Properties.

B. All archaeological undertakings pursuant to this PA, as well as surveys and mitigation planning regarding archaeological resources, will be carried out by, reviewed by or under the oversight or supervision of a person or persons meeting

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

the professional qualifications for Archeologist or Cultural Anthropologist, as appropriate, in "The Secretary of the Interior's Historic Preservation Professional Qualification Standards" (Federal Register Vol. 62, No. 119, p. 33712, 33715, 1997). Reviews will be documented by the professional making the review.

C. All reviews, to determine if, under Appendix A, Section I.C, an undertaking requires no further review, will be carried out by persons who either meet the standards set forth above in Stipulation II.A or have been trained by such persons to make the specific determinations and oversee the undertakings listed in Section I.C of Appendix A. The work performed by II.C. personnel pursuant to Appendix A will be supervised by personnel qualified under Stipulation II.A.

D. Where COMNAVREG Hawaii utilizes contracts that involve work governed by this PA on properties listed or eligible for listing on the National Register, COMNAVREG Hawaii will use appropriate contract performance requirements, and/or appropriate source selection criteria which may include minimum qualifications for historic preservation experience and satisfactory prior performance, as appropriate to the nature of the work and the type of procurement, developed with the participation of Navy professionals meeting the standards of Stipulation II.A, for projects involving historic buildings and structures, or II.B, for projects involving archaeological sites or Traditional Cultural Properties (TCPs). Appropriate historic preservation requirements may address: project planning, description or scope; adequate pre-construction survey of historic properties affected; professional qualifications of contractor personnel; refurbishment and reuse of historical materials and fixtures; minimizing demolition of historic fabric; and supervision, oversight, and accountability.

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

III. PERSONNEL TRAINING

A. COMNAVREG Hawaii shall provide suitable training in the application of "The Secretary of the Interior's Standards for the Treatment of Historic Properties" NPS, 1997 (Standards) to appropriate Navy personnel who are responsible for making decisions regarding the budgeting, programming, planning, design, contracting, construction (including oversight and quality assurance), alteration, maintenance, repair, equipment installation, preservation, or rehabilitation of historic properties. In addition, personnel qualified under Stipulations II.A and II.B will provide training in implementation of the ICRMP for appropriate treatment, preservation, and protection of cultural resources, including cultural awareness training in the appropriate treatment of Hawaiian cultural resources. Personnel qualified under Stipulations II.A and II.B should also receive continuing professional education or training, through appropriate courses or conference sessions on historic preservation or cultural resource management.

B. COMNAVREG Hawaii shall develop and implement an in-house training program to advise Navy personnel of this PA, Sections 106, 110, and 111 of the NHPA, and procedures, techniques, and related matters regarding the preservation of the historic properties and cultural resources located within the State of Hawaii.

IV. OTHER AGREEMENTS

A. World War II temporary buildings constructed from 1939-1946 are the subject of a Programmatic Memorandum of Agreement among the U.S. Department of Defense, the ACHP, and the National Conference of State Historic Preservation Officers (NCSHPO) executed on 7 July 1986 (WWII Temporary Buildings PMOA). COMNAVREG Hawaii has identified 22 remaining WWII Temporary Structures, which are listed in Appendix B. COMNAVREG Hawaii will notify the parties to this PA of any proposed change in the list of such structures, and of

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

any action, which would be adverse, to be taken with respect to any such structure under the PMOA. While the parties to this PA acknowledge that actions taken with respect to these 22 structures may be governed by the WWII Temporary Buildings PMOA, they agree to engage in future discussions to explore preservation options for any or all of these structures.

B. Historic Family Housing Units are the subject of a Programmatic Agreement among the U.S. Navy, the ACHP, and the NCSHPO executed on 17 November 2000 (Family Housing PA). Ground disturbance in archaeologically sensitive areas in the AOR will be governed by this PA instead of the Family Housing PA. NTHP and HHF will be considered "interested parties" for purposes of the Family Housing PA for any action to be taken in the AOR.

C. The Programmatic Agreement among COMNAVREG Hawaii, the ACHP and the SHPO regarding Navy undertakings in Hawaii, executed on 26 June 2002, has been terminated and is fully superceded by this agreement.

V. DEVELOPMENT AND IMPLEMENTATION OF PEARL HARBOR NAVAL COMPLEX ICRMP

COMNAVREG Hawaii completed an ICRMP in March 2002 to guide its management of historic properties while facilitating the process of designing and constructing new facilities, as required, to support COMNAVREG Hawaii's mission in Hawaii. COMNAVREG Hawaii consulted with the ACHP, the SHPO and other consulting parties in the development of this document.

A. Should COMNAVREG Hawaii choose to reconsider any treatment proposed by the ICRMP, the reconsideration will be conducted in accordance with 36 CFR Part 800.

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

B. COMNAVREG Hawaii will develop additional ICRMPs for the outlying areas within the State of Hawaii and will integrate these ICRMPs into facility management systems using methods similar to those used for Pearl Harbor to analyze, evaluate the significance of, and categorize facilities.

VI. AREA OF POTENTIAL EFFECTS

When a proposed undertaking is limited to the maintenance, repair or rehabilitation of a listed, eligible or contributing building's interior, the area of potential effects (APE) is the individual building. For projects involving exterior work not identified in Appendix A; ground disturbing activities not addressed in Stipulation X; and for projects involving new construction or additions; COMNAVREG Hawaii shall consult with the SHPO prior to determining the APE. Demolition and any proposed new construction, either on the same site or elsewhere within the AOR, which is associated with the demolition, shall be reviewed as a single project.

VII. IDENTIFICATION OF HISTORIC PROPERTIES

A. Numerous surveys have been conducted to identify National Register-eligible properties within the COMNAVREG Hawaii AOR. As other ICRMPs are developed, or existing ICRMPs are updated, Navy personnel qualified under Stipulation II.A, for historic buildings and structures, or II.B for archaeological sites or TCPs, will determine if additional properties in the AOR not previously listed or determined to be eligible for listing on the National Register are eligible for the National Register for Section 106 purposes. COMNAVREG Hawaii will make a reasonable and good faith effort to identify any Native Hawaiian organization that might attach religious and cultural significance to historic properties within the AOR and invite them to be consulting parties. If COMNAVREG Hawaii and the SHPO do not agree on a determination of

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

eligibility, or if the ACHP or NPS so request, COMNAVREG Hawaii will obtain a determination of eligibility from the Keeper of the National Register.

B. If a property in the AOR that was not previously listed or determined to be eligible for listing on the National Register is determined to be eligible by Navy personnel qualified under Stipulation II.A for historic buildings and structures or Stipulation II.B for archaeological sites and TCPs, COMNAVREG Hawaii shall treat the property as eligible for Section 106 purposes. Such determination requires no SHPO review. Any such determinations will be included in the reporting requirements described in Stipulation XII.

C. Any consulting party to this PA may bring to the attention of COMNAVREG Hawaii information relating to any property in the AOR believed by the consulting party to be eligible for listing on the National Register, with a request that the eligibility of the property be evaluated. Similarly, any consulting party may request that COMNAVREG Hawaii re-evaluate the eligibility of any property within the AOR previously determined not to be eligible for the National Register, or re-evaluate the historic resource management category assigned to any property. Such requests shall be considered and addressed by Navy personnel qualified under Stipulation II.A for historic buildings and structures, or II.B for archaeological sites or TCPs. The resulting determination will be submitted to the SHPO for review pursuant to 36 C.F.R. § 800.4(c)(2).

VIII. HISTORIC SITES AND INTERPRETIVE ACTIVITIES

In recognition of the historic and cultural significance of the PHNHL to Native Hawaiians and others, the Navy will generally look favorably on affording access for preservation and protection of historic sites to individuals and organizations, including any Native Hawaiian organization that attaches cultural significance to historic properties. Requests for such access need to be submitted in writing and will be considered in light of military operational

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

requirements and anti-terrorist / force-protection security conditions and other pertinent circumstances as determined by COMNAVREG Hawaii at the time. Final approval or disapproval will be provided by the Navy in writing. Upon request the Navy will consider events that celebrate and interpret historic activities tied to the PHNHL.

IX. REVIEW OF PROJECT EFFECTS

A. Projects Requiring No Further Review

1. If Navy personnel, as described in Stipulation II.A for projects involving historic buildings and structures or II.B for projects involving archaeological sites and TCPs, determine that an undertaking does not have the potential to cause effects on listed, contributing or eligible properties, or that such undertaking is listed in Appendix A, no further review under this PA and the NHPA is required. All such undertakings and determinations made will be documented, recorded, and reported in accordance with Stipulation XII. Such documentation will be made available upon request to the parties in accordance with Stipulation XII.

2. If personnel, as described in Stipulation II.C, determine that an undertaking is listed in Appendix A, no further review under this PA and the NHPA is required. All such undertakings and determinations made will be documented and recorded. Such documentation will be made available upon request to the parties in accordance with Stipulation XII.

B. Projects with Potential Effects but No Adverse Effects

1. If personnel, as described in Stipulation II.A, for projects involving historic buildings and structures, or II.B for projects involving archaeological sites and TCPs, determine that an undertaking, except those provided for in Stipulation

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

IX.A, has the potential to cause effects on historic properties but will have no adverse effect, COMNAVREG Hawaii will seek concurrence with the finding concurrently from the SHPO and any Native Hawaiian organization that has made known to COMNAVREG Hawaii that it attaches religious and cultural significance to the specific property subject to the finding. A copy of the finding will concurrently be provided to any consulting party who has filed a request in writing to receive such finding.

2. If the SHPO, OHA or consulting parties, including Native Hawaiian organizations, disagree with the finding, they shall, within 30 calendar days from receipt of the finding, advise COMNAVREG Hawaii of the reasons for disagreement; otherwise, concurrence will be presumed. If any consulting party advises COMNAVREG Hawaii that an additional 15 days are needed for review, COMNAVREG Hawaii will generally give such a request favorable consideration. COMNAVREG Hawaii shall consult with the objecting party to resolve the disagreement, if any, or request the ACHP to review the finding in accordance with in Stipulation XIV, Resolving Objections.

3. If the determination of no adverse effect is conditioned upon the undertaking's consistency with the Secretary of the Interior's Standards, pursuant to 36 C.F.R. §§ 800.5(a)(2)(ii) or 800.5(b), Navy personnel qualified under Stipulation II.A will review (and document their review) the plans, drawings, specifications, and any modifications, for consistency with the Secretary's Standards, and will monitor the progress of the undertaking on site in coordination with the project manager and contract personnel. Where practical, COMNAVREG Hawaii will retain the same project manager throughout the length of the contract to provide continuity in addressing preservation issues.

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

4. Navy Personnel qualified under Stipulation II.A will have the responsibility to coordinate with project managers and contracting personnel to ensure fulfillment of Section 106 stipulations or conditions during construction.

C. Projects That May Have Adverse Effects

1. Consultation will be initiated pursuant to 36 CFR 800.1(c) under 36 CFR Section 800.6 for any undertaking which may have an adverse effect on: (a) a contributing property that is within the NHL or the ICRMP historic management zones; (b) a property outside the ICRMP management zones and the NHL which is listed or eligible for listing on the National Register; or (c) an historic property identified to be of religious and cultural significance to Native Hawaiian organizations.

2. Any project, other than demolition, which may have an adverse effect on a property identified in the ICRMP as a Category III historic property, which is outside the NHL and not part of an ICRMP management zone, and is not designated as having other importance, and is documented in accordance with Level III HABS/HAER standards (or lesser standards if agreed to, in writing, by the SHPO), requires notification but no further preservation action. Notification shall be given to the SHPO, and to any consulting party who has filed a request in writing to receive such notifications, when the proposed project will have an adverse effect on the historic property, to afford the SHPO 30 calendar days, prior to execution of the project, to review existing or any new information that may change the property's significance or status. If a party disagrees with the proposed action COMNAVREG Hawaii shall consult with the objecting party to resolve the disagreement, if any, or request the ACHP to review the finding in accordance with in Stipulation XIV, Resolving Objections.

D. Design and Construction Modifications

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

1. If after completion of an undertaking's review pursuant to this PA or during the implementation of any previously reviewed project, COMNAVREG Hawaii finds that it is necessary to modify the project scope, design, materials, or construction documents, personnel as described in Stipulation II.A for projects involving historic buildings and structures, or II.B for projects involving archaeological sites and TCPs, shall review the proposed changes (and document the review) to determine if these modifications may affect an historic property, or change the nature of the adverse effect.
2. If personnel described in Stipulation II.A for projects involving historic buildings and structures, or II.B for projects involving archaeological sites and TCPs, determine that the modification will not result in adverse effects to historic properties, the professional who made the determination will document this finding, in consultation with the SHPO, if appropriate. This documentation will be filed in the project's administrative record and noted in the reporting requirements developed in accordance with Stipulation XII.
3. If COMNAVREG Hawaii personnel, as described in Stipulation II.A for projects involving historic buildings and structures, or II.B for projects involving archaeological sites and TCPs, find that the modification will result in an adverse effect, COMNAVREG Hawaii will determine in consultation with the SHPO whether the adverse effect can be avoided, thereby resolving the matter. If the adverse effect cannot be avoided, COMNAVREG Hawaii will consult with the SHPO, the ACHP, NPS (if within the NHL), and other consulting parties, including any Native Hawaiian organization that has made known to COMNAVREG Hawaii that it attaches religious and cultural significance to the affected historic property, to resolve the adverse effects in accordance with 36 CFR Section 800.6, or Stipulation XI as appropriate.

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

X. GROUND DISTURBING ACTIVITIES

A. NHL: COMNAVREG Hawaii has developed maps, in consultation with the SHPO, OHA, Oahu Council of Hawaiian Civic Clubs (OCHCC) and any Native Hawaiian organization that has made known to COMNAVREG Hawaii that they attach religious and cultural significance to historic properties within the NHL. These maps have been incorporated into the ICRMP, and depict those areas where ground-disturbing activities are to be tested or monitored by an archaeologist who meets the qualifications indicated in Stipulation II.B. For Ford Island, these maps identify strafing marks and other historic surface features. All maps will be maintained and updated as appropriate by COMNAVREG Hawaii. No monitoring is required for work outside these areas or in existing concrete utility trenches.

B. Outlying Areas: COMNAVREG Hawaii will develop, in consultation with the SHPO, OHA, OCHCC and any Native Hawaiian organization that has made known to COMNAVREG Hawaii that it attaches religious and cultural significance to historic properties within such installations, maps for the installations beyond the NHL which will identify areas for which ground disturbing activities will require monitoring by an archaeologist who meets the qualifications indicated in Stipulation II.B. No monitoring is required for work outside these areas or in existing concrete utility trenches.

C. Archaeological Work: Any required archaeological testing or monitoring shall be implemented in accordance with an archaeological work plan, which will be prepared in consultation with the SHPO, OHA, OCHCC and any Native Hawaiian organization which has made known to COMNAVREG Hawaii that it attaches religious and cultural significance to any affected historic properties.

D. Submerged Resources: Any undertakings in areas known to have a potential for submerged cultural resources will be planned in consultation with NPS, SHPO

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

and OHA, as appropriate to develop a work plan and monitoring plan that will ensure avoidance of adverse effects to the resource.

E. Contractor Notification: COMNAVREG Hawaii will establish working procedures with Navy contracting commands to ensure that (1) contractors engaged in ground disturbing activities will be required to stop work in the vicinity of any discovered archaeological deposit; and will be required to immediately notify COMNAVREG Hawaii and the contracting officer of the encounter of any such deposit, and (2) construction in the vicinity of the discovery will not be resumed until COMNAVREG Hawaii has completed consultation in accordance with Stipulation XI.

XI. DISCOVERIES AND EMERGENCIES

A. If during the performance of an undertaking, historic properties, including submerged archaeological sites and TCPs, are discovered or unanticipated effects are found, or a previously unidentified property which may be eligible for listing on the National Register is discovered, COMNAVREG Hawaii will take all reasonable measures to avoid or minimize harm to the property until it concludes consultation with the SHPO and any Native Hawaiian organization, including OCHCC, which has made known to COMNAVREG Hawaii that it attaches religious and cultural significance to the historic property.

B. COMNAVREG Hawaii will notify the SHPO and any appropriate Native Hawaiian organization as soon as practical and develop actions that will take the effects of the undertaking into account. COMNAVREG Hawaii will notify these parties of any time constraints. COMNAVREG Hawaii and these parties will seek to mutually agree upon the time frame for this consultation but in no instance will the consultation exceed ten working days. COMNAVREG Hawaii will provide the SHPO and any appropriate Native Hawaiian organization with written

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

recommendations reflecting the consultation. If the parties do not object to COMNAVREG Hawaii's recommendations within the agreed time frame, COMNAVREG Hawaii will modify the scope of work as necessary to implement the recommendations.

C. In the event that natural disasters, fires, sudden disruptions of utilities service, spill events or other emergency events occur, COMNAVREG Hawaii may take actions without consultation to stabilize any involved historic properties and prevent further damage. Where possible, such emergency measures will be undertaken in a manner that does not foreclose future preservation or restoration, with on-site monitoring by personnel, as described in Stipulation II.A for projects involving historic buildings and structures, or II.B for projects involving archaeological sites and TCPs, and advance telephone notification of the SHPO and any appropriate Native Hawaiian organization known to COMNAVREG Hawaii that attaches religious and cultural significance to the historic property involved. Emergency response work will be undertaken in a manner to avoid or minimize effects on historic properties. Should historic properties be discovered during emergency repair or response activity, work in the immediate area of the property will cease if COMNAVREG Hawaii has determined that a work stoppage at the site will not impede emergency response activities. COMNAVREG Hawaii will advise the SHPO and any appropriate Native Hawaiian organization by telephone of the emergency, the steps being taken to address the emergency, the discovered property and its apparent significance, and a description of the emergency work and potential effects on the discovered property. Within 30 calendar days following this notification, COMNAVREG Hawaii will provide the SHPO and any appropriate Native Hawaiian organization a written report documenting the actions taken to minimize effects, the work's present status and the planned treatment of the property. This action will be included in the report developed in accordance with Stipulation XII.

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

XII. REPORTING REQUIREMENTS

A. An on-site meeting between COMNAVREG Hawaii, the SHPO, ACHP, NPS and consulting parties will be coordinated on an annual basis for the duration of this PA. Local meetings with SHPO and local consulting parties will occur on a quarterly basis.

B. Topics: At least two weeks prior to these meetings COMNAVREG Hawaii will provide the consulting parties with the following information, subject to the confidentiality requirements of 36 CFR Part 800.11(c), other applicable laws and military operational requirements:

1. Summary of actions taken under Stipulations VII.A, B; and C and IX.A.1, B, C, and D; to contain:

   a. building number/name or archaeological site number , location, tax map key, and historic categorization;

   b. project name and designation with a brief description of proposed action, determination of effect and applicable provision(s) of Appendix A if any;

   c. date of project completion;

   d. summary of any photographs that document the property before and after construction, including photographs documenting conditions justifying changes in the scope of work and other relevant conditions and information;

   e. name of the reviewer with applicable date; and

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

f. list of properties determined in the reporting period by COMNAVREG Hawaii to be eligible for listing on the National Register pursuant to Stipulation VII.A or B;

g. a list of any reports that present the findings of archaeological work;

h. a summary of any training given pursuant to Stipulation III, identification of current COMNAVREG Hawaii points of contact, and notification of key historic preservation personnel changes.

2. A summary of proposed or anticipated future undertakings, with emphasis on projects with adverse effects such as demolition, new construction, and major development plans. This summary may take the form of a briefing during the scheduled meetings.

C. Assessing Overall Effectiveness. In addition to providing an opportunity for the parties to this PA to review the specific information described in paragraph B, the on-site meetings described in this Stipulation will also provide the parties an opportunity to assess the overall effectiveness of the PA in addressing the preservation of historic properties within the AOR, consistent with the operational mission and activities of COMNAVREG Hawaii. Specifically, the meetings will provide the parties an opportunity to discuss the planning, design, review, and implementation of undertakings affecting historic properties within the AOR, and to discuss and evaluate the following issues:

1. Whether consultations, when required by this PA or carried out pursuant to 36 C.F.R. § 800, have been initiated early enough in the planning process to ensure consideration of potential alternatives that avoid, minimize, or mitigate harm to historic properties.

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

2. Whether undertakings affecting historic properties within the AOR have adhered to the Secretary of the Interior's Standards for the Treatment of Historic Properties and the Navy's Historic Structures Preservation Manual (MO-913), unless otherwise provided under this PA.
3. How to increase the effectiveness of source selection criteria and/or contract performance requirements in contracts that involve work affecting historic properties to ensure appropriate treatment of such properties.
4. Whether there has been effective coordination between personnel qualified under Stipulation II of this PA and appropriate project managers and assigned contract personnel with responsibilities involving work affecting historic properties.
5. Whether problems or misunderstandings have arisen in the course of consultations and, if so, how those problems could be avoided in the future.

In addition, the meeting will enable the consulting parties to discuss overall stewardship of historic properties by COMNAVREG Hawaii, to include historic preservation achievements for the past year and historic preservation goals for the upcoming year and any recommendations to amend this PA or improve communications among the parties.

XIII. REVIEW

The ACHP and the SHPO may review activities carried out pursuant to this PA and will review such activities, if so requested. COMNAVREG Hawaii will cooperate with the ACHP and the SHPO in carrying out their review responsibilities.

XIV. RESOLVING OBJECTIONS

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

A. Should any signatory to this PA object in writing to COMNAVREG Hawaii regarding any action carried out or proposed with respect to the implementation of this PA, COMNAVREG Hawaii shall consult with the objecting party. If after initiating such consultation COMNAVREG Hawaii determines that the objection cannot be resolved through consultation, it shall forward all documentation relevant to the objection to the ACHP, including COMNAVREG Hawaii's proposed response to the objection. Within 30 calendar days after receipt of all pertinent documentation, the ACHP shall exercise one of the following options:

1. Advise COMNAVREG Hawaii that the ACHP concurs in COMNAVREG Hawaii's proposed response to the objection, whereupon COMNAVREG Hawaii will respond to the objection accordingly;
2. Provide COMNAVREG Hawaii with recommendations, which COMNAVREG Hawaii shall take into account in reaching a final decision regarding its response to the objection; or
3. Notify COMNAVREG Hawaii that the objection will be referred to the Council membership for formal comment and proceed to refer the objection and comment within 45 calendar days. The resulting comment shall be taken into account by the Navy in accordance with Section 110(1) of the NHPA.

B. Should the ACHP not exercise one of the above options within 30 calendar days after receipt of the pertinent documentation, COMNAVREG Hawaii may assume the ACHP's concurrence in its proposed response to the objection.

C. COMNAVREG Hawaii shall take into account any ACHP recommendation or comment provided in accordance with this stipulation with reference only to the subject of the objection; COMNAVREG Hawaii's responsibility to carry out all

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

actions under this PA that are not the subjects of the objection shall remain unchanged.

D. At any time during implementation of any stipulation in this PA, should an objection to any such stipulation or its manner of implementation be raised by a member of the public, COMNAVREG Hawaii shall take the objection into account and consult as needed with the objecting party, the ACHP and the SHPO to resolve the objection.

XV. AMENDMENT

The ACHP, the SHPO or COMNAVREG Hawaii may request that this PA be amended, whereupon they will consult in accordance with 36 CFR Part 800 to consider such amendment. In particular, they will consider the information developed in COMNAVREG Hawaii's reports under Stipulation XII to determine if COMNAVREG Hawaii can effectively or efficiently carry out activities to support its mission through revisions to this PA. No amendment shall take effect until it has been executed by authorized representatives of the ACHP, the SHPO and COMNAVREG Hawaii.

XVI. TERMINATION

The ACHP, the SHPO or COMNAVREG Hawaii may propose to terminate this PA by providing 30 calendar days notice to the other two explaining the reasons for the proposed termination. The ACHP, the SHPO and COMNAVREG Hawaii will consult during this period to seek agreement on amendments or other actions that would avoid termination. In the event of termination, COMNAVREG Hawaii will comply with 36 CFR Sections 800.3 through 800.7 with regard to individual undertakings covered by this PA.

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

XVII. FAILURE TO CARRY OUT AGREEMENT

In the event COMNAVREG Hawaii does not carry out the terms of this PA or if the ACHP determines under 36 CFR Section 800.14(b)(2)(v) that the terms of this PA are not being carried out, COMNAVREG Hawaii will comply with 36 CFR Sections 800.3 through 800.7 with regard to individual undertakings covered by this PA.

XVIII. DURATION

This PA shall become effective upon execution by COMNAVREG Hawaii and the ACHP and shall remain in effect until terminated in accordance with Stipulation XVI.

EXECUTION AND IMPLEMENTATION of this Programmatic Agreement evidences that COMNAVREG Hawaii has satisfied its Section 106 and Section 110(f) responsibilities for all undertakings relative to its national defense mission requirements, including, but not limited to, dredging of its harbor; maintenance, rehabilitation, repair, construction and demolition of buildings, structures, roads; and work regarding grounds and associated landscaping within the area of responsibility of COMNAVREG Hawaii, which encompasses the Pearl Harbor Naval Complex including the Pearl Harbor Naval Shipyard and Intermediate Maintenance Facility; outlying Oahu installations; and the Pacific Missile Range Facility, Barking Sands, Kauai.

The Anti-Deficiency Act, 31 USC § 1341, prohibits federal agencies from incurring an obligation of funds in advance of or in excess of available appropriations. Accordingly, the parties agree that any requirement for the obligation of funds arising from the terms of this agreement shall be subject to the availability of appropriated funds for that purpose, and that this

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

agreement shall not be interpreted to require the obligation or expenditure of funds in violation of the Anti-Deficiency Act.

Each of the undersigned certifies that they have full authority to bind the party that they represent for purposes of entering into this agreement.

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

COMNAVREG Hawaii PA June 2003

COMMANDER, NAVY REGION HAWAII

By: _______________ Date: 7 July 03

BERNARD J. MCCULLOUGH III
Rear Admiral, U.S. Navy

STATE HISTORIC PRESERVATION OFFICER

By: _______________ Date: 07/08/03

Mr. Peter Young
Chairperson and State Historic Preservation Officer

ADVISORY COUNCIL ON HISTORIC PRESERVATION

By: _______________ Date: 8-5-03

John L. Nau III
Chairman

23 of 32

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

COMNAVREG Hawaii PA June 2003

INVITED SIGNATORIES:

NATIONAL PARK SERVICE

By: ____________________ Date: ______________

NATIONAL TRUST FOR HISTORIC PRESERVATION

By: Paul W. Edmondson Date: June 20, 2003

Paul W. Edmondson

Vice President & General Counsel

OFFICE OF HAWAIIAN AFFAIRS

By: ____________________ Date: ______________

HISTORIC HAWAII FOUNDATION

By: David Scott Date: June 25, 2003

David Scott

Executive Director

OAHU COUNCIL OF HAWAIIAN CIVIC CLUBS

By: ____________________ Date: ______________

Shad Kane

Chairman of Committee on the Preservation of Historic Sites and Cultural Properties

24 of 32

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

COMNAVREG Hawaii PA June 2003

INVITED SIGNATORIES:

NATIONAL PARK SERVICE

By: ______________________ Date: ______________

NATIONAL TRUST FOR HISTORIC PRESERVATION

By: ______________________ Date: ______________
Richard Moe
President

OFFICE OF HAWAIIAN AFFAIRS

By: ______________________ Date: ______________

HISTORIC HAWAII FOUNDATION

By: ______________________ Date: ______________
David Scott
Executive Director

OAHU COUNCIL OF HAWAIIAN CIVIC CLUBS

By: Shad Kane Date: 6/18/03
Shad Kane
Chairman of Committee on the Preservation of Historic Sites and Cultural Properties

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Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

THE OUTDOOR CIRCLE

By: ______________________________ Date: ___________________________

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

APPENDIX A

UNDERTAKINGS THAT REQUIRE NO FURTHER REVIEW

I. SPECIFIED UNDERTAKINGS

A. Provided that personnel, as described in Stipulation II.A. determine that the proposed work: (1) will be carried out in accordance with "The Secretary of the Interior's Standards for the Treatment of Historic Properties," NPS, 1997 (Standards) and COMNAVREG Hawaii's "Historic Structures Preservation Manual," NAVFAC MO-913 (Sept. 1991); or (2) is excluded by a provision within this appendix, the following undertakings will not, as indicated in Stipulation IX.A.2., undergo further review or consultation.

1. Undertakings other than demolition or ground-disturbing activities on a property identified as a Category III historic property, which is outside the NHL, and is not part of an ICRMP management zone, and is designated as not having other importance by a professional qualified under Stipulation II.A, and is documented in accordance with Level III HABS/HAER standards.

2. Replacement in kind of siding, trim, or hardware.

3. Replacement of glazing with best available match to existing or original material and design, including retention of window lights and muntin bars. Not included is changing the visual appearance of the original glazing by replacing with tinted glass or by adding tinted or reflective film.

4. Replacement in-kind of steel casement windows and their glazing and hardware to match existing or original materials and design.

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

5. Replacement of roofs or parts of a roof that are deteriorated, when replacement matches or is compatible with existing or original material and design; maintenance procedures, such as the oiling of cut cedar shingles, that do not alter the integrity of the original material.

6. Replacement of porches and stairs if replacement matches historic or existing character, material, and design.

7. Removal of building additions and mechanical equipment determined by personnel, as described in Stipulation II.A, not to be contributing.

8. Replacement of exterior lighting when in accordance with the Secretary's Standards.

9. Replacement or installation of screens providing the materials and design match the existing screen or match the existing window frame material or match specifications previously approved by SHPO for buildings of similar period and type.

10. Replacement or installation of gutters, down spouts or roofing materials providing the material and design match existing or are compatible with the building's period and of a type approved by personnel, as described in Stipulation II.A.

11. Removal of existing fixtures, accessories, and cabinets determined by personnel, as described in Stipulation II.A, not to be contributing.

12. Installation of interpretive signs or exhibit structures that are not attached to a historic property and that do not visually intrude on a historic property. Such signs or exhibits shall be constructed of materials and painted colors that are compatible with the historic property and its setting.
13. Maintenance or repair of aboveground utilities, such as gas, fuel, electrical and telephone lines, provided that no disturbance occurs outside existing infrastructure.

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

14. Replacement of non-original interior light fixtures in historic interiors

B. Provided that personnel described in Stipulation II.B. determine that the proposed work listed below in this Section of the Appendix, the following undertakings will not undergo further review or consultation.

1. Maintenance or repair of underground utilities, such as sewer, water, storm, electrical, gas and fuel lines, provided that no excavation or ground disturbance occurs outside existing trenches.

2. Landscaping, grounds maintenance, ongoing maintenance of existing landscaping, or removal of dead or dying trees that does not result in subsurface disturbance or root grubbing.

3. Ground disturbing activities that occur outside of the archaeologically sensitive areas indicated on maps prepared in accordance with Stipulation X.

4. Ground disturbing activities that occur above depths established during the map development process described in Stipulation X.

C. Provided that personnel, as described in Stipulation II.A, or II.C, when trained by II.A personnel, determine that the proposed work is listed below, the following undertakings will not, as indicated in Stipulation IX.A.2, undergo further review or consultation.

1. Undertakings affecting properties confirmed in writing by the SHPO as not contributing to the NHL, not eligible for the NRHP or determined by the Keeper of the Register as not contributing to the NHL or eligible for the NRHP.

2. Repairs in kind of siding, trim, or hardware that match original or existing material and architectural finish.

3. Repair without replacement of window frames or sashes by patching, splicing,

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

consolidating or otherwise reinforcing existing materials.

4. Maintenance and repair without replacement of windows and doors and their frames, transom windows, sashes, jambs and moldings. Appropriate maintenance actions include surface treatments and preparation to apply finishes, such as cleaning, rust removal, limited paint removal, application of epoxy consolidates and fillers, and reapplication of protective coating systems.

5. Refurbishment and repair of steel casement windows and their original glazing and hardware.

6. Maintenance and repair of roofs or parts of a roof that are deteriorated, when repair materials match existing or original material and design, maintenance procedures, such as the oiling of cut cedar shingles, do not alter the integrity of the original material.

7. Repair of porches and stairs if work matches existing configuration, material, and design.

8. Removal of non-original surface applied elements such as conduit, pipes, wiring, junction boxes and air conditioners.

9. Painting exterior surfaces when the new paint matches the existing or original color. Damaged or deteriorated paint may be removed to the next sound layer, using the most gentle methods possible, such as hand scraping or hand sanding. Abrasive methods, such as sandblasting and water blasting, are not covered in this appendix.

10. Repair and filling of spalling concrete and cracks if patched to hide repairs. Excluded are patches to historic bomb damage, shrapnel, strafing or bullet marks.

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

11. Maintenance, repair, or rewiring of exterior lighting when original appearance is retained.

12. Replacement or installation of caulking and weather-stripping around windows, doors, walls, and roofs.

13. Excavations for repair or replacement of building footings or foundation work within two (2) feet of existing footings and foundations, if there are no visual effects to aboveground structures and their finishes.

14. Maintenance, repair or replacement in-kind of screens providing the materials and design match the existing screens, match the existing window frame material or match specifications previously approved by SHPO for buildings of similar period and type.

15. Maintenance, repair or replacement in-kind of gutters, down spouts or roofing materials providing the material and design match existing or are compatible with the building's period and of a type approved by personnel, a described in Stipulation II.A.

16. Replacement or installation of building fixtures, exterior or interior, with a type previously approved or selected by personnel described in Stipulation II.A.

17. Interior surface treatments, repaired or replaced in-kind, including but not limited to floors, walls, ceilings, woodwork, providing the work is restricted to repainting, refinishing, re-papering, or laying carpet, linoleum, or other recognized floor systems.

18. Interior repair, renovation, or alteration of properties identified in the ICRMP as Category III historic properties not within the NHL or ICRMP management zones.

19. Interior rehabilitation of non-eligible buildings within ICRMP management zones.

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

20. Maintenance or repair to equipment, plumbing, electrical, ventilation or air conditioning systems, including replacement in concealed areas, provided such work is not visible from the exterior.

21. Replacement, removal or upgrading of electrical wiring if historic architectural finishes, moldings, and millworks are not affected by the electrical work.

22. Replacement of interior light fixtures in non-historic interiors.

23. Installation of energy conservation materials that are not readily visible, such as concealed installation of thermal insulation and vapor barrier, or repair of roof ventilation.

24. Repair, renovation or alteration, not requiring a MILCON appropriation, of properties identified as Category IV (non-historic) or any facilities less than 50 years of age at contract award.

25. Work on properties not within ICRMP management zones and determined not eligible for the NRHP, in accordance with Stipulation VII, except where such work or new construction is directly adjacent to ICRMP management zones, buildings, cultural sites or archaeologically sensitive areas.

26. Re-paving of streets, parking lots, driveways, sidewalks, curbs or gutters or storm drainage structure repairs with matching materials and configuration.

27. Repairs in kind and maintenance of wharves, piers, berths, or dry-docks, dolphins, quays, pilings, bulkheads, decking, cleats, bitts, or bollards, capstans, cranes, trains or support equipment to maintain operational capability.

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

28. Maintenance or repair of swimming pools; outdoor playground and athletic equipment; and related items.

II. REVISION OF APPENDIX

This appendix may be revised with the written agreement of the ACHP, the SHPO, and COMNAVREG Hawaii without a revision being made to the underlying PA. Any such revision will be documented in the report described in Stipulation XII.

Appendix H.2. Programmatic Agreement—Navy Undertakings in Hawaii (Continued)

APPENDIX B
WORLD WAR II TEMPORARY STRUCTURES

32	PWC
212	Ford Is
553	FISC
1144	Barber's Point
1149	Barber's Point
1150	Barber's Point
1152	Barber's Point
1153	Barber's Point
1520	Barber's Point
1562	Barber's Point
1570	Barber's Point
17BE	Makalapa
MQ39	LLL Westloch
Q13	Ford Is
Q14	Ford Is
Q345	LLL Westloch
T15	NSY
T15A	NSY
T47	NSY
T48	NSY
X24	PWC
X8	PWC
X9	PWC

Appendix H.3. Significant Archaeological and Historical Resources Identified within the Boundary of the Pacific Missile Range Facility

Site No.*	Description	Inferred Function	Historic Context	Eligibility Evaluation	National Register Criteria
01-0007	"Major ancient burial ground;" habitation sites; within Nohili Dune (Site 01-1860)	Habitation, burials	Traditional Hawaiian	Not relocated; but culturally sensitive	—
01-0008	Elekuna Heiau; inland side of Nohili Dune (Site 01-1860)	Ceremonial	Traditional Hawaiian	Not relocated; but culturally sensitive	—
01-0009	House sites marked by "single rows of stone … or by low walls;" inland side of Nohili Dune (Site 01-1860)	Habitation	Traditional Hawaiian	Not relocated	—
05-0616	Japanese cemetery; 34 headstones, 4 stone piles of broken tomb markers; may extend to Site 05-0825	Burial	Plantation	Culturally sensitive	cultural
05-0721	Kawaiele (cross-listed as a historic structure; see Table ES-2)	Cultural place	Traditional Hawaiian/ plantation	Cultural place; pond/marsh tied to traditions related to mirages, also used as a fishpond; an original iteration of the ditch said to have been constructed by *menehune*; important as key component of 19th century sugar industry	cultural
05-0825	Burials; unmarked coffin cemetery (5 coffins); may be part of Site 05-0616; coffins uncovered during utility trenching	Burial	Plantation	Culturally sensitive	cultural
05-0826	Habitation deposits, burial (disturbed) in dune	Habitation, burial	Traditional Hawaiian	Potential for informing on traditional Hawaiian occupation of Mana Plain; culturally sensitive	d
05-1829	Extensive cultural deposit north of Nohili Ditch; includes human bone; radiocarbon dates; part of Site 05-1830	Habitation	Traditional Hawaiian	Significant, rich, extensive cultural deposit	d
05-1830	Cultural deposit exposed in south face of Nohili Ditch; part of Site 05-1829	Habitation	Traditional Hawaiian	Significant, rich, extensive cultural deposit	d
05-1831	Burial; found eroding out of dune; within Site 05-2035 area	Burial	Traditional Hawaiian	Culturally sensitive	cultural
05-1832	Burial; found during construction of Range Operations Building (Fac. 105, about 450 m inland of coast); possibly Plantation period	Burial	Traditional Hawaiian?/ plantation?	Culturally sensitive	cultural

Appendix H.3. Significant Archaeological and Historical Resources Identified within the Boundary of the Pacific Missile Range Facility (Continued)

Site No.*	Description	Inferred Function	Historic Context	Eligibility Evaluation	National Register Criteria
05-1833	Burial (scattered bone fragments); found eroding out of dune; may be same as Site 1885	Burial	Traditional Hawaiian	Culturally sensitive	cultural
05-1834	Burials; possibly 10 acres but extent of site and burials not professionally verified	Burial	Traditional Hawaiian	Culturally sensitive	cultural
01-1860	Nohili Dune	Cultural place	Traditional Hawaiian	Cultural place; numerous traditions; site of Elekuna Heiau, habitation deposits; culturally sensitive	cultural
05-1861	Kuaki`i (Pohaku)	Cultural place	Traditional Hawaiian	Cultural place; story of stone image related to group of people going from Mana to Niihau	cultural
05-1884	Burial (partially articulated remains of single individual); found in dune	Burial	Traditional Hawaiian	Culturally sensitive	cultural
05-1885	Burial (scattered bone fragments); found eroding from dune; associated with midden scatter; may be same as Site 05-1833	Habitation, burials	Traditional Hawaiian	Culturally sensitive	cultural
05-2003	Trash deposit	Dump	Plantation	Potential for informing on use of beach areas during Plantation period	d
05-2007	Concrete pillbox; similar to Site 05-2048	Defense	WWII	Associated with WWII development; defense against possible attack in early days of war; interpretive potential	a, c
01-2008	Concrete box; related to Site 01-2050	Fuel delivery	WWII	Associated with early WWII development; fuel delivery through underwater pipeline from offshore tanker; example of poor design that was ultimately abandoned; interpretive potential	a, c
01-2013	Concrete piers, metal gun turret	Road barricade	WWII	Associated with WWII development; installation defense; metal gun turret has interpretive potential	a
01-2017	Midden deposit; inland location between North Nohili Road and PMRF boundary	Habitation	Traditional Hawaiian	Potential for informing on traditional Hawaiian occupation of Mana Plain, particularly in wetlands area	d
01-2019	Midden deposit	Habitation	Traditional Hawaiian	Potential for informing on traditional Hawaiian occupation of Mana Plain	d
01-2021	Midden deposit	Habitation	Traditional Hawaiian	Potential for informing on traditional Hawaiian occupation of Mana Plain	d
05-2023	Concrete box, possible pillbox	Defense?	WWII	Associated with early WWII development; defense against possible attack? requires additional research	a, c
05-2027	Midden deposit	Habitation burials	Traditional Hawaiian	Potential for informing on traditional Hawaiian occupation of Mana Plain; culturally sensitive	d
05-2028	Concrete structure (1), wooden structures (2)	Gun emplacement	WWII	Associated with early WWII development; defense against possible attack	a

Appendix H.3. Significant Archaeological and Historical Resources Identified within the Boundary of the Pacific Missile Range Facility (Continued)

Site No.*	Description	Inferred Function	Historic Context	Eligibility Evaluation	National Register Criteria
05-2031	Midden deposit	Habitation	Traditional Hawaiian	Potential for informing on traditional Hawaiian occupation of Mana Plain	d
05-2032	Revetment; remains of Fac. 442; built in 1942; relatively intact	Defense	WWII	Associated with early WWII development of airfield; defense against possible attack	a
05-2033	Revetment; similar to Site 2032	Defense	WWII	Associated with early WWII development of airfield; defense against possible attack	a
05-2034	Revetment; similar to Site 2032	Defense	WWII	Associated with early WWII development of airfield; defense against possible attack	a
05-2035	Midden deposit	Habitation burials	Traditional Hawaiian	Potential for informing on traditional Hawaiian occupation of Mana Plain; culturally sensitive	d
05-2036	Revetment; similar to Site 2032	Defense	WWII	Associated with early WWII development of airfield; defense against possible attack	a
05-2037	Revetment; similar to Site 2032	Defense	WWII	Associated with early WWII development of airfield; defense against possible attack	a
05-2038	Revetment; similar to Site 2032	Defense	WWII	Associated with early WWII development of airfield; defense against possible attack	a
05-2039	Revetment; similar to Site 2032; but most of berm has been removed	Defense	WWII	Associated with WWII development of airfield; defense against possible attack	a
05-2040	Revetment; M-shaped	Defense	WWII	Associated with WWII development of airfield; defense against possible attack	a
05-2047	Concrete structures (2)	Gun emplacement	WWII	Associated with early WWII development of airfield; defense against possible attack	a
05-2048	Concrete pillbox; similar to Site 01-2007 and in better condition	Defense	WWII	Associated with early WWII development of airfield; defense against possible attack; interpretive potential	a, c
01-2050	Concrete tank; related to Site 01-2008	Fuel delivery	WWII	Associated with early WWII development; fuel delivery through underwater pipeline from offshore tanker; example of poor design that was ultimately abandoned; only four other tanks of this design built in Hawaii; only one that was bomb-proofed with 4 ft-4 in thick concrete slab; interpretive potential	a, c
05-4016	Fire pit remnant; RC date	Habitation	Traditional Hawaiian	Potential for informing on traditional Hawaiian occupation of Mana Plain	d
01-6027	Habitation deposit, midden scatter in dune; part of Nohili Dune (Site 01-1860)	Habitation	Traditional Hawaiian	Potential for informing on traditional Hawaiian occupation of Mana Plain	d

Source: International Archaeological Resources Institute, Inc., 2005

* Site Number – Hawai‘i State Inventory Number (SIHP number) preceded by “50-30-”

Appendix H.4. Significant Historic Buildings and Structures within the Boundary of the Pacific Missile Range Facility

Facility Number		Historic Context Period	Original or Historic Function	Integrity	Eligibility Evaluation	National Register Criteria
				MANAGEMENT CATEGORY I +		
300	BS ES-2b	Cold War	Operations and Crash Station	All new interior finishes, but exterior has high level of integrity, despite small additions	Associated with fighter interceptor defensive system, important in Cold War	a
3992	BS ES-2b	WWII	Radio Room	High level—retains integrity of location, design, setting, materials, workmanship, feeling, association	Associated with history of response to Dec. 7, 1941 attack; distinctive underground splinter-proof building	a, c
4003	BS ES-2c	WWII	Command Post	High level—retains integrity of location, design, setting, materials, workmanship, feeling, association	Associated with history of response to Dec. 7, 1941 attack; distinctive underground splinter-proof building	a, c
				MANAGEMENT CATEGORY II +		
1	Kamokala	WWII	Bomb Storage Magazine (80' length)	Relatively high level, despite sprayed concrete on walls and new concrete floors	Associated with WWII base development; unique group of excavated magazines on Kauai	a, c
2	Kamokala	WWII	Small Arms & Pyrotechnics Magazine (55' length)	Same as Facility 1	Same as Facility 1	a, c
3	Kamokala	WWII	Bomb Storage Magazine (80' length)	Same as Facility 1	Same as Facility 1	a, c
4	Kamokala	WWII	Bomb Storage Magazine (80' length)	Same as Facility 1	Same as Facility 1	a, c
5	Kamokala	WWII	Fuse Magazine (20' length)	Same as Facility 1	Same as Facility 1	a, c
6	Kamokala	WWII	Fuse Magazine (20' length)	Same as Facility 1	Same as Facility 1	a, c
7	Kamokala	WWII	Bomb Storage Magazine (80' length)	Same as Facility 1	Same as Facility 1	a, c
8	Kamokala	WWII	Bomb Storage Magazine (80' length)	Same as Facility 1	Same as Facility 1	a, c
9	Kamokala	WWII	Small Arms & Pyrotechnics Magazine (55' length)	Same as Facility 1	Same as Facility 1	a, c

Appendix H.4. Significant Historic Buildings and Structures within the Boundary of the Pacific Missile Range Facility (Continued)

Facility Number		Historic Context Period	Original or Historic Function	Integrity	Eligibility Evaluation	National Register Criteria
10	Kamokala	WWII	Bomb Storage Magazine (80' length)	Same as Facility 1	Same as Facility 1	a, c
284	BS ES-2b	WWII	Telephone Exchange	Medium level—some interior walls and doors removed. It retains integrity of location, setting, (overall) materials, feeling, association	Associated with history of response to Dec. 7, 1941 attack; distinctive underground splinter-proof building	a, c
350	BS ES-2b	WWII	Command Post	Medium level—retains integrity of location, design, setting, materials, workmanship, feeling, association, despite small addition and minor alterations	Associated with history of response to Dec. 7, 1941 attack; distinctive underground splinter-proof building	a, c
387	Port Allen	Plantation Period	Warehouse	Relatively high level—retains integrity of location, design, setting, workmanship, feeling, and association	Associated with history of harbor development and McBryde Sugar Company, and, thus, with the economic history of Kauai.	a
05-0721 (SIHP no.)	BS ES-2c	Plantation Period	Kawaiele Ditch **	Integrity uncertain, due to lack of information, drawings, or photos of original alignment & dimensions	Associated with history of Kekaha Sugar Co. and changes in agricultural uses of land on west Kauai in the 19th and 20th centuries	a
no #	BS ES-2c	Plantation Period	Kinikini Ditch **	Integrity uncertain, due to lack of information, drawings, or photos of original alignment & dimensions	Associated with history of Kekaha Sugar Co. and changes in agricultural uses of land on west Kauai in the 20th century	a
no #	BS ES-2c	Plantation Period	Nohili Ditch **	Integrity uncertain, due to lack of information, drawings, or photos of original alignment & dimensions	Associated with history of Kekaha Sugar Co. and changes in agricultural uses of land on west Kauai in the 20th century	a
				MANAGEMENT CATEGORY III +		
101	BS ES-2b	Cold War	Regulus missile assembly & storage	Minimal level of integrity—retains integrity of location, setting, materials, association, despite numerous additions	Associated with offensive weapon system important in Cold War	a

Appendix H.4. Significant Historic Buildings and Structures within the Boundary of the Pacific Missile Range Facility (Continued)

Facility Number		Historic Context Period	Original or Historic Function	Integrity	Eligibility Evaluation	National Register Criteria
104	—	Cold War	Dehumidified Aircraft Storage Container (Regulus missile storage)	Relatively high level of integrity—not known if openings original; no renovation drawings in Navy files	Associated with offensive weapon system important in Cold War	a
158	BS ES-2b	Cold War	Dehumidified Aircraft Storage Container (Regulus missile storage)	Medium level of integrity—roll-up doors are recent; date of other openings not known; no renovation drawings in Navy files	Associated with offensive weapon system important in Cold War	a
324	BS ES-2b	Cold War	Hawaii Air National Guard Mess Hall	Relatively high level of integrity—retains integrity of location, design, setting, workmanship, feeling, association	Associated with history of HANG Cold War alert interceptor deployments	a
372	—	Cold War	Hawaii Air National Guard (HANG) War Readiness Material Equipment (Vehicles) Storehouse	Relatively high level of integrity—retains integrity of location, design, setting, workmanship, feeling, association	Associated with history of HANG Cold War alert interceptor deployments	a

Source: International Archaeological Resources Institute, Inc., 2005

* Location as shown in the PMRF Integrated Cultural Resources Management Plan (2005)

\+ Management Categories I, II, and III are defined in Section III.5 of the PMRF Integrated Cultural Resources Management Plan (2005)

** More research needed, tentatively categorized as Category II

SIHP Number – Hawai‘i State Inventory Number

Appendix H.5. Traditional Hawaiian Sites Identified within the Boundary of the Pacific Missile Range Facility

Site No. *	Description	Inferred Function	Environ Zone	Recommended National Register Criteria	Level of Study	References
01-0007	"Major ancient burial ground;" habitation sites; located in Nohili Dune (Site 01-1860)	Habitation burials	Dune	—	Survey	Bennett 1931 Soehren 1965-67 Ching 1974 Drolet et al. 1996
01-0008	Elekuna Heiau; inland side of Nohili Dune (Site 01-1860)	Ceremonial	Dune	—	Survey	Thrum 1907 Bennett 1931 Ching 1974
01-0009	House sites marked by "single rows of stone … or by low walls;" inland side of Nohili Dune (Site 01-1860)	Habitation	Dune	—	Survey	Bennett 1931 Ching 1974
01-0652	Mound	Agricultural	Inland edge	ns	Survey shovel test	McGerty/Spear 1997b
01-0653	Mounds (7)	Agricultural	Inland edge	ns	Survey shovel test	McGerty/Spear 1997b
01-0657	Terrace complex	Agricultural	Inland edge	ns	Survey shovel test	McGerty/Spear 1997b
05-0826	Habitation deposits, burial (disturbed) in dune	Habitation burials	Dune	d	Survey	Soehren 1965-67 Drolet et al. 1996
05-1829	Extensive cultural deposit north of Nohili Ditch; includes human bone; radiocarbon dates; part of Site 05-1830	Habitation	Dune	d	Survey shovel test trench test pit	Soehren 1965-67 ASI 1990b Gonzalez 1991b Williams 1996 Drolet et al. 1996 Drolet 1999 PACDIV 2002c
05-1830	Cultural deposit exposed in south face of Nohili Ditch; part of Site 05-1829	Habitation	Dune	d	Survey shovel test test pit	Kikuchi 1979 Drolet et al. 1996 Drolet 1999
05-1831	Burial; found eroding out of dune; falls within Site 05-2035 boundary	Burial	Dune	Cultural	Reported	Inouye n.d. Drolet et al. 1996
05-1832	Burial; found during construction of Facility 105, Range Operations Building (about 450 m inland of coast); possibly plantation origin	Burial	Dune	Cultural	Reported	Inouye n.d. Drolet et al. 1996
05-1833	Burial (scattered bone fragments); found eroding out of dune; may be same as Site 05-1885	Burial	Dune	Cultural	Survey	Inouye n.d. Drolet et al. 1996

Appendix H.5. Traditional Hawaiian Sites Identified within the Boundary of the Pacific Missile Range Facility (Continued)

Site No. *	Description	Inferred Function	Environ Zone	Recommended National Register Criteria	Level of Study	References
05-1834	Burials; possibly 10 acres but nature of burials and size of site never verified	Burial	Dune	Cultural	Reported	Inouye n.d. Drolet et al. 1996
01-1860	Nohili Dune; includes Sites 01-0007 (dune burials and camps between Polihale and Nohili), 01-0008 (Elekuna Heiau), and 01-0009 (house sites on inland side of Nohili Dune).	Habitation ceremonial burial?	Dune	Cultural	Reported survey	Thrum 1907 Bennett 1931 Soehren 1965-67 Ching 1974 Drolet et al. 1996
05-1861	Kuaki'i (pohaku)	Place	Off-shore	Cultural	Reported	Aipoalani 1991 Kilauano 1991
05-1884	Burial (partially articulated remains of single individual); found in dune within Site 05-2035 area	Burial	Dune	Cultural	Survey	Drolet et al. 1996
05-1885	Burial (scattered bone fragments); found eroding from dune; associated with midden scatter; may be same as Site 05-1833	Habitation burials	Dune	Cultural	Survey	Drolet et al. 1996
01-2017	Midden deposit; surface scatter; adze frag in root throw	Habitation	Back beach marsh edge	d	Survey	Wulzen et al. 1997
01-2019	Midden deposit, between Nohili Dune and Nohili Site	Habitation	Dune	d	Survey	Wulzen et al. 1997
01-2021	Midden deposit, between Nohili Dune and Nohili Site	Habitation	Dune	d	Survey	Wulzen et al. 1997
05-2027	Midden deposit	Habitation burials	Dune	d	Survey	Wulzen et al. 1997
05-2031	Midden deposit	Habitation	Dune	d	Survey	Wulzen et al. 1997
05-2035	Midden deposit; 900 m long dune deposit; includes Sites 05-1831, 05-1884	Habitation burials	Dune	d	Survey	Wulzen et al. 1997
05-4016	Fire pit remnant; RC date; layer of origin contains no cultural material	Habitation	Dune	d	Test pit	Sweeney 1994 Drolet et al. 1996
01-6027	Midden deposit; surface scatter in dune	Habitation	Dune	d	Survey	Nagata 1994 Wulzen et al. 1997

Source: International Archaeological Resources Institute, Inc., 2005

* Site Number – Hawaii State Inventory Number (SIHP number) preceded by "50-30-"

ns = not significant

Appendix H.6. Archaeological Sites at Marine Corps Training Area–Bellows from 2005 MCBH Integrated Cultural Resources Management Plan

Table L-1 Archaelogical Sites at Marine Corps Training Area Bellows

Site No.	Type	Age	Human Remains Present	Artifacts Present	C14	NHRP Status	Reference
383	Hill of Haununaniho (a pu`uhonua or place of refuge	Pre-Contact				Eligible	McAllister 1933
3309	Agricultural	?				Eligible	Hurlbett and Haun 1987
3311	Irrigation Channel	?				Eligible	Hurlbett and Haun 1987
3312	Grave Complex	Historic	Yes			Eligible	Farrell and Spear 2002
4850	Subsurface Cultural Deposits	Pre-Contact		buried flake deposit	A.D. 1459-1954	Eligible	Tuggle 1997
4851	Subsurface Cultural Deposits	Pre-Contact/ Historic	Yes	basalt flakes, volcanic glass flakes, metal, glass, adz fragment, adz preforms	A.D. 780 to Modern	Eligible	Tuggle 1997
4852	Subsurface Cultural Deposits (O 18)	Pre-Contact	Yes	Fishhooks, adzes, lithics, coconut shell grater		NHRP Registered	Tuggle 1997
4853	Subsurface Cultural Deposits	Pre-Contact	Yes	fishhook fragments	A.D. 380-660	Eligible	Tuggle 1997

Appendix H.6. Archaeological Sites at Marine Corps Training Area–Bellows from 2005 MCBH Integrated Cultural Resources Management Plan (Continued)

Site No.	Type	Age	Human Remains Present	Artifacts Present	C14	NHRP Status	Reference
				basalt flakes, adz fragments, hammerstones, glass beads	A.D. 1400-1800		
4854	Habitation-burial Complex	Pre-Contact	Yes		A.D. 1292-1455	Eligible	Tuggle 1997
4855	Subsurface Cultural Deposit	Pre-Contact/ Historic		basalt flakes, concrete slabs, military artifacts	A.D. 1281-1644 A.D. 1420-1954	Eligible	Tuggle 1997
4856	Subsurface Cultural Deposit	Pre-Contact/ Historic	Yes	ceramics, glass, *ulu maika,* worked dog tooth, octopus lure, volcanic glass,	A.D.1476-1955 A.D. 1513-1955	Eligible	Tuggle 1997
4857	Subsurface Cultural Deposit		Yes	basalt fragments,		Eligible	Tuggle 1997
4858	Subsurface Cultural Deposit	Pre-Contact		basalt flakes, adze blanks and preforms		Eligible	Tuggle 1997
4859	Concrete Pads, Structures	Historic WWII				Eligible	Hurlbett and Haun 1987
4860	Concrete Bunkers	Historic WWII				Eligible	Cordy and Tuggle 1976
4861	Concrete Foundations/Artifacts	Historic WWII				?	Leidemann and Cleghorn 1983

Appendix H.6. Archaeological Sites at Marine Corps Training Area–Bellows from 2005 MCBH Integrated Cultural Resources Management Plan (Continued)

Site No.	Type	Age	Human Remains Present	Artifacts Present	C14	NHRP Status	Reference
4862	Military Debris	Historic WWII				?	Leidemann and Cleghorn 1983
4863	House(s)	Historic WWII				?	?
5464	Complex	Pre-Contact		lithic debris		?	Tuggle 1997

Source: U.S. Army Corps of Engineers, Honolulu Engineer District, 2005

Appendix H.7. Army Programmatic Agreement—Makua

Content of the Programmatic Agreement between the United States Army, the Hawai`i State Historic Preservation Officer, and the Advisory Council on Historic Preservation for the Protection and Mitigation of Impacts to Cultural Resources at the Mauka Military Reservation

Source: Supplemental Environmental Assessment for Routine Training at Makua Military Reservation and PFC Pilila`au Range Complex Hawai`I, May 2001 (The Onyx Group, 2001)

4.11.2 Cultural Resources Component of the Proposed Action

On September 18, 2000, a Section 106 PA was finalized with the SHPO and the Advisory Council on Historic Preservation (ACHP). This PA was developed in consultation with Native Hawaiian groups and regulatory agencies over a period of two years. It contains specific programs and efforts to protect and mitigate impacts to cultural resources at Makua.

The PA for Section 106 responsibilities required additional surface surveys of all training and training related activity areas and the initiation of a survey for Traditional Cultural Places (TCP) before training in its proposed modified form could begin. The surface survey of the entire action area has been completed and the report is being reviewed by the SHPO. A contract for the TCP survey was awarded in FY 2000 and is ongoing. In addition, the target objectives have been changed and other actions have been implemented to de-conflict training and archaeological sites. There are 17 archaeological sites within the proposed training area that will be additionally protected by the measures outlined below. Twenty-five percent of the lands at Makua have been surveyed for the presence of archaeological sites. Areas outside the south firebreak road (with the exception of the bivouac area) cannot be surveyed because of the presence of unexploded ordnance. The remaining portion of MMR that may contain historic artifacts is unsafe to survey, without extensive UXO detection [usually preceded by a controlled burn, which also threatens endangered species] and demolition by Explosive Ordnance Disposal experts. The proposed maneuver corridor, the small arms target objectives and the mortar/artillery objectives have been surveyed for both surface and subsurface sites. The area of the 1994 CCAAC modifications was cleared of overburden by bulldozers; subsurface deposits, if present, were examined by archaeologists. The completion of these actions mitigates the potential effects of training on cultural sites to no significant impact.

In addition, to the above actions which permit resumption of training with no significant impact, the Army will undertake other longer term conservation measures in accordance with the PA. The PA for Section 106 compliance over the next five years is appropriate for projects where effects are difficult to define in advance, that would take place over a relatively long period of time, or that involve the routine management of federal installations, facilities, or property.

The additional stipulations of the Makua PA for Section 106 responsibilities for routine training are as follows:

- Additional sub-surface surveys will be done within the training area circumscribed by the south firebreak road. These surveys will be done south of the main live-fire maneuver corridors within the CCAAC. The live-fire maneuver corridors have been surveyed in the past and contain no further subsurface features. Surveys outside the proposed training area will be done as needed after further Section 106 consultation. The presence of UXO in these areas makes survey hazardous. Also, according to the PA, detonation of UXO outside the training area or close to existing sites is subject to consultation under the agreement.

- An annual status report would be provided to the SHPO, the ACHP, and consulting native/indigenous Hawaiian organizations to review implementation of the PA and determine whether amendments are needed.
- The Army would identify native/indigenous Hawaiian organizations, groups, families, and individuals that may ascribe traditional religious and cultural importance to historic properties at Makua. The Office of Hawaiian Affairs and Hui Malama I Na Kupuna O Hawaii Nei would be considered interested parties for the purposes of Section 106 consultation and review.
- Expanded education of Army personnel in cultural resource awareness and protection, as well as avoidance of cultural resources during training, will be undertaken. Instruction could include field trips, classroom training, and printed literature. This information is also included in the cultural resources annex of the range standing operating procedure.
- The Army will actively seek to identify and evaluate cultural resources at Makua. The identification plan is based on a five-year schedule, prioritized according to the potential for the presence of cultural resources and frequency of training activities.
- A database will be prepared using existing cultural data and will be revised as new information becomes available.
- Geographical information system (GIS) mapping of resource locations will be prepared and distributed to the Hawaii SHPO and native Hawaiian groups if requested.
- Cultural resources will be monitored to identify effects from training. For the first year a qualified archeologist will do the monitoring whenever a unit departs the training area immediately following the training exercise. Monitoring records will be kept and included in the annual report to the Hawaii SHPO.
- Cultural resources will be protected from damage during training exercises. Protection measures include managing resources in place as exclusion areas without barriers, establishing physical barriers, and data recovery. Routine detonation of UXO within the training area does not require consultation.
- The Cultural Resources Manager will work with the Wildland Fire Manager to develop acceptable fire containment/control strategies to suppress wildfires while at the same time protecting cultural resources. This coordination will occur during site planning preparation and pre-season fire suppression operations.

In 1998, the Army began a program in cooperation with members of the Waianae community to open Ukanipo Heiau to native Hawaiian religious practitioners under the American Indian Religious Freedom Act of 1978. Meetings took place over a period of two and a half years, culminating in a PA signed in October 2000, giving access to Ukanipo Heiau to members of the native Hawaiian community. This access is independent of training activities in the valley. Access to other sites within the valley has been given on a case-by-case basis as is consistent with training and safety concerns. The potential for increased access to other sites within Makua is being examined.

Appendix H.8. Identified Archaeological Sites in the Makua Valley

Site No.+	Site Description	Source	Report Date
178	Kumuakuopio Heiau*	McAllister	1933
179	Fishing Shrine*	McAllister	1933
180	Kaahihi Heiau*	McAllister	1933
181	Heiau Ukanipo	McAllister	1933
182	Swimming Pool*	McAllister	1933
9518	Makua Trail	Rosendahl	1977
9520	Stone Walls and Enclosure	Rosendahl	1977
9521	Terraces	Rosendahl	1977
9522	Terraces and Walls	Rosendahl	1977
9523	Occupation Complex	Rosendahl	1977
9524	Occupation Complex	Rosendahl	1977
9525	Stacked Stone Wall	Rosendahl	1977
9526	Occupation Complex	Rosendahl	1977
9531	Stone Walls and Platforms	Rosendahl	1977
9532	Subsurface Deposit	Rosendahl	1977
9533	Large Platform	Rosendahl	1977
4627	Agricultural Complex	Carlson et. al.	1993
4629	Several Stone Mounds	Carlson et. al.	1993
4628	Stone Mound and Cupboard	Carlson, et.al.	1993
4630	Habitation Site	Carlson, et.al.	1993
4536#	Stone Walls and Well	Eble et. al.	1993
4537#	Complex of 14 Stone Walls	Eble et. al.	1993
4538#	Enclosure and C-shape	Eble et. al.	1993
4539#	Small Retaining Wall	Eble et. al,	1993
4540#	Agricultural/Habitation Site	Eble et. al.	1993
4541#	Kuleana Plots	Eble et. al.	1993
4542#	Agricultural/Habitation Site	Eble et. al. MMR DPW	1993 2000
4543#	Agricultural/Habitation Site	Eble et. al. MMR DPW	1993 2000
4544#	Agricultural/Habitation Site	Eble et. al. MMR DPW	1993 2000
4545#	Agricultural/Habitation Site	Eble et. al.	1993
4546#	Enclosure/Platform/Possible Heiau	Eble et. al.	1993
4547#	Agricultural Complex-Historic	Eble et. al.	1993
5456#	Subsurface Habitation Features	Williams and Patolo	1998
5587#	Agricultural/Habitation Site	Williams and Patolo	1998
5588#	Agricultural/Habitation Site	Williams and Patolo	1998
5589#	Agricultural/Habitation Site	Williams and Patolo	1998

Appendix H.8. Identified Archaeological Sites in the Makua Valley (Continued)

Site No.+	Site Description	Source	Report Date
5590#	Agricultural/Habitation Site	Williams and Patolo	1998
5775	Complex of 72 features in	Cleghorn, et.al.	1999
5776	Complex of 111 features in	Cleghorn, et.al.	1999
5777	Shrine/Upright Stone in vicinity of Ukanipo Heiau	Cleghorn, et.al.	1999
5778	Complex of 10 features in vicinity of Ukanipo Heiau	Cleghorn, et.al.	1999
5920	Mounds, Terraces	MMR DPW	2000
5921	Mound, Alignment, Terrace	MMR DPW	2000
5922	Mound, Modified Outcrop, Alignment	MMR DPW	2000
5923	Platforms, Walls, Terraces, C-shaped Shelter, Mounds	MMR DPW	2000
5924	Alignment	MMR DPW	2000
5925	Predominantly Walls	MMR DPW	2000
5926	Walls, Platform	MMR DPW	2000
5927	Retaining Wall, Walls, Enclosures, Alignment	MMR DPW	2000
5928	Retaining Wall	MMR DPW	2000
5929	Bunker, Gun Emplacement, Platform	MMR DPW	2000
5930	Platform	MMR DPW	2000
5931	Wall	MMR DPW	2000
5932	Path	MMR DPW	2000
5933	Platform	MMR DPW	2000

Source: The Onyx Group 2001

= Located within the Piliaau Range Complex. No sites located within the live-fire maneuver corridor or mortar or artillery target areas

* = Destroyed

+ - All site number are provided by the Hawai'i State Historic Preservation Officer and carry the prefix 50-80-03 (e.g., 50-80-03-178)

Appendix H.9. Archaeological Sites at Kahuku Training Area (US Department of the Army, 2004)

Table 7-24
Archaeological Sites at KTA

Site Number	Site Type	Site Description
50-80-02-0259	Spring	Waikane Stone
50-80-02-0260	Heiau	Pu'uala Heiau (4,930 terrace facing)
50-80-02-0599	Bunkers	Three bunkers at Punamanō Communication Station
50-80-02-1043	Complex	Kawela agricultural terraces
50-80-02-2357	Wall	Plantation era stone wall remnant
50-80-02-2358	Single feature	House site 13m x 10m
50-80-02-2359	Two adjacent terraces	Terraces 22.5m x 6m
50-80-02-2360	Single feature	Terrace 20m x 10m
50-80-02-2501	Heiau	Hanakaoe platform 4m x 7m
50-80-02-4882	Bunker	Military bunker 8.7m x 4.5m
50-80-02-4883	Historic house site	Plantation era house site
50-80-02-4884	Imu	Imu site 3m
50-80-02-4885	Heiau	Pahipahi'āluaHeiau 17m x 12m
50-80-02-4886	Bunker	Pentagonal military bunker 3.5m x 3m
50-80-02-4887	Terrace complex	Habitation complex with related agricultural features 24m x 14m
50-80-02-4888	Wall/depressions	Agricultural earthen depressions/rock alignment 20m?
50-80-02-4930	Linear mound	Linear rock mound (remnants Site 260?) 7m x 2m
50-80-02-5534	Rock shelter	Temporary shelter 5m x 2.5m
50-80-02-5536	Rock shelter	Temporary shelter? 15m x 3m
50-80-02-5537	Enclosure	Enclosure (pre-Contact) 62m x 40m
50-80-02-5538	Wall	Wall (pre-Contact) 15m x 1m

Appendix H.9. Archaeological Sites at Kahuku Training Area (Continued)

Table 7-24
Archaeological Sites at KTA *(continued)*

Site Number	Site Type	Site Description
50-80-02-5539	Terraces	Retaining wall and stone concentration 40m x 20m
50-80-02-5540	Terraces	Terraces 15m x 15m
50-80-02-5684	Enclosure	Enclosure 50m x 25m
50-80-02-5685	Rock shelter	Temporary shelter 9m x 5m
50-80-02-5686	Ahupua'a boundary	Wall 4m x 1m
50-80-02-5688	Roadway	Historic roadway 30m x 6m
50-80-02-5689	Bunker	Underground bunker 3m x 2m
50-80-02-5690	Enclosure	Bunker 4m x 3m
50-80-02-9506	Historic irrigation	Kea'aulu Ditch (hist. stone faced irr. ditch)
50-80-02-9507	Historic (?) terrace	'O'io Stream terrace (ag. terrace)
50-80-02-9508	Platform	East 'O'io Gulch platform (stepped stone platform)
50-80-02-9509	Complex	'O'io Gulch complex (agricultural terraces)
50-80-02-9517	Terraces	Kāneali'i agricultural terraces (possible remnants)
50-80-02-9745	Landmark	'Opana Mobile Radar Site
SCS Temp# 1	Military	Fox holes
SCS Temp# 2	Military	Fox holes with rock wall
SCS Temp# 3	Military	Leveled area behind outcrop
SCS Temp# 16	Military	Rock terrace
SCS Temp# 19	Military	Concrete structure
SCS Temp# 30	Military	Bunker
SCS Temp# 36	Military	Concrete slab
SCS Temp# 38	Military	Concrete slab
SCS Temp# 39	Military	Concrete blocks
SCS Temp# 40	Military	Concrete slabs
SCS Temp# 41	Military	Concrete slab
SCS Temp# 42	Military training	Fire pit with trash
SCS Temp# 43	Military	Concrete slabs
SCS Temp# 44	Military	Concrete Slab with metal tank
SCS Temp# 45	Military	Concrete slab
SCS Temp# 47	Military	Concrete slabs
SCS Temp# 48	Military	Foundations with bottle glass
SCS Temp# 49	Military	Concrete drainage
SCS Temp# 53	Military training	Collapsed concrete box
SCS Temp# 54	Military training	Intact concrete box
SCS Temp# 56	Military training	Fire pit with metal fragments and other trash
SCS Temp# 60	Military	Two fire pits with trash

Appendix H.9. Archaeological Sites at Kahuku Training Area (Continued)

Table 7-24
Archaeological Sites at KTA *(continued)*

Site Number	Site Type	Site Description
SCS Temp# 4	Plantation/Agriculture possible	Boulder concentration
SCS Temp# 10	Unknown	Rectangular boulder platform
SCS Temp# 11	Unknown/stabilization	Terrace down slope of a level area
SCS Temp# 12	Pre-military	Multiple features, including mounds and fox holes
SCS Temp# 13	Historic	Linear terrace
SCS Temp# 20	Historic	Terrace and a road
SCS Temp# 21	Historic	Rock mound
SCS Temp# 22	Historic	Rock mound
SCS Temp# 24	Historic	Boulder concentration
SCS Temp# 25	Historic	Tow linear boulder concentrations
SCS Temp# 26	Historic	Rock mound
SCS Temp# 32	Historic	Cobble and boulder terrace
SCS Temp# 33	Historic	Rock mound
SCS Temp# 50	Historic	Linear boulder concentration
SCS Temp# 52	Historic	Boulder and cobble piles
SCS Temp# 55	Historic	Linear boulder concentration
SCS Temp# 57	Historic	Boulder mound and terrace
SCS Temp# 61	Historic	Rock mound and depression
SCS Temp# 63	Historic	Rock mound
SCS Temp# 64	Historic	Multiple rock mounds
SCS Temp# 5	Undetermined	Paved terrace and rock mounds
SCS Temp# 6	Undetermined	Terrace
SCS Temp# 7	Prehistoric	Enclosure and mounds
SCS Temp# 8	Undetermined	Mounds with glass bottles
SCS Temp# 9	Undetermined	Enclosure with entryway
SCS Temp# 14	Prehistoric	Rock mound
SCS Temp# 15	Prehistoric/Historic	Rock concentration
SCS Temp# 17	Undetermined	Modified outcrop, rock mounds
SCS Temp# 18	Agriculture/undetermine d	Linear rock mound
SCS Temp# 29	Traditional	Tow fire pits
SCS Temp# 34	Undetermined	Wall with sub-features
SCS Temp# 46	Undetermined	Large retaining terrace
SCS Temp# 51	Undetermined	Terraces and rock mounds
SCS Temp# 58	Prehistoric	Lithic scatter
SCS Temp# 59	Prehistoric	Rock mound, possible trail marker
SCS Temp# 65	Traditional	Fire pit

Source: IARII 2003 ; GANDA 2003c; SCS 2003.

Appendix H.9. Archaeological Sites at Kahuku Training Area (Continued)

Table 7-25
Historic Military Buildings at KTA

Facility No.	Description (original use)	Year Built	Historical Period
0001	Administrative building	1961	Cold War
0003	Flagpole (gone)	1961	Cold War
0004	Pump house (water supply/treatment building)	1961	Cold War
0005	Barracks and mess hall	1961	Cold War
0008	Water storage tank	1961	Cold War
0009	Water supply/treatment building; pump house	1961	Cold War
0013	Control station; air/fallout shelter	1961	Cold War
0014	Control station; air/fallout shelter	1961	Cold War
0018	Control station; air/fallout shelter	1961	Cold War
00020	Sentry box	1961	Cold War
0022	Protective barrier	1961	Cold War
0023	Protective barrier	1961	Cold War
0026	Protective barrier	1961	Cold War
0027	Protective barrier	1961	Cold War
0028	Sentry control station	1961	Cold War
0030	Protective barrier	1961	Cold War
0036	Protective barrier	1961	Cold War
0037	Warhead building	1961	Cold War
0045	Missile assembly and test building	1961	Cold War
0047	Generator building	1961	Cold War
0048	Transformer building	1955	Cold War
0060	Sentry box	1961	Cold War
0061	ACQ tower (gone)		Cold War
0063	Administration building	1961	Cold War
0064	Flagpole	1961	Cold War
0067	Barracks and mess hall	1961	Cold War
0070	Generator building	1961, 1963	Cold War
0071	Transformer pad	1963	Cold War
0075	MTR & TTR pad	1963	Cold War
0078	MTR & TTR pad	1963	Cold War
0079	MTR & TTR pad	1963	Cold War
0080	Interconnecting corridor	1961	Cold War
0081	Pad for control vans	1961	Cold War
0082	Pad for control vans	1961	Cold War
0083	Pad for control vans	1961	Cold War
0087	HIPAR tower (gone)	1961	Cold War
0089	Water tank	1961	Cold War
0090	Bore site mast (gone)	1961	Cold War
T-150	Guard tower	c. 1961	Cold War
T-151	Guard tower	c. 1961	Cold War

Source: IARII 2003

Source: US Department of the Army, 2004

Appendix H.10. Archaeological Sites Recommended as Eligible to the National Register of Historic Places at Pohakuloa Training Area (US Department of the Army, 2004)

Table 8-25
Archaeological Sites Recommended as Eligible to the NRHP at PTA

State Site Number 50-10-31-	Site Type	Site Function
05000	Lava Tube	Shelter
05001	Lava tube	Shelter
05002	Wall	Ranching
05003	Lava tube	Shelter/habitation
05004	Lava tube	Shelter/habitation/religious
05005	Lava tube	Shelter/habitation/religious
05006	Trail	Transportation
05007	Trail	Transportation
05008	Trail	Transportation
05009	Trail	Transportation
07119	Wall	Ranching
10220	Lava tube	Shelter/habitation
10221	Lava tube	Shelter/habitation
10222	Lava tube	Shelter/habitation
10265	Lava tube	Shelter/habitation
10266	Lava tube	Resource procurement
10267	Lava tube	Shelter/habitation
10268	Lava tube	Resource procurement
10269	Lava tube	Shelter/habitation
10270	Lava tube	Water procurement
10271	Lava tube	Resource procurement
10271	Ahu	marker
10272	Overhang shelter	Shelter
10644	Lava tube	Shelter
10645	Lava tube	Shelter
10646	Lava tube	Shelter
10647	Lava tube	Shelter
10648	Lava tube	Shelter
10649	Lava tube	Shelter
10650	Lava tube	Shelter
10651	Lava tube	Shelter
10652	Lava tube	Shelter
10653	Lava tube	Shelter
10654	Lava tube	Shelter

Appendix H.10. Archaeological Sites Recommended as Eligible to the National Register of Historic Places at Pohakuloa Training Area (Continued)

Table 8-25
Archaeological Sites Recommended as Eligible to the NRHP at PTA *(continued)*

State Site Number 50-10-31-	Site Type	Site Function
10655	Lava tube	Shelter
10656	Lava tube	Shelter
10657	Lava tube blister	Shelter
10658	Lava tube	Resource procurement
14638	Site-complex (enclosures, lava tube blisters, wall, C-shape, lithic scatter, overhang shelter	Lithic workshop, resource (lithic) Procurement/shelter/workshop/trail?
17116	Lava tube	Shelter/habitation
17117	Ahu	Marker
17118	Ahu	Marker
17119	Ahu complex	Unknown
17120	Ahu	Marker
17121	Ahu	Marker
17122	Ahu	Marker
17123	Ahu	Marker
17124	Ahu	Marker
17125	Lava tube	Resource procurement
17126	Overhang shelter	Shelter
17127	Overhang shelter	Shelter
17128	Overhang shelter	Shelter
17129	Overhang shelter	Shelter
17130	Ahu	marker
17131	Overhang shelter	Shelter
17132	Overhang shelter	Shelter
17133	Overhang shelter	Shelter
17134	Overhang Shelter	Shelter
17135	Overhang shelter	Shelter
17136	Lava Tube blister	Shelter
17137	Quarry	Resource procurement
17138	Ahu complex	Unknown
17139	Lava tube	Shelter/historic butchering site
17140	Ahu	Marker
17142	Ahu	Marker
17143	Quarry	Resource procurement
17144	Overhang shelters	Shelter
17145	overhang shelter	Shelter

Appendix H.10. Archaeological Sites Recommended as Eligible to the National Register of Historic Places at Pohakuloa Training Area (Continued)

Table 8-25
Archaeological Sites Recommended as Eligible to the NRHP at PTA *(continued)*

State Site Number 50-10-31-	Site Type	Site Function
17147	Ahu	Marker
17148	Overhang shelter	Shelter
17149	Overhang shelter	Shelter
17150	Lava tube	Shelter/habitation
17151	Lava tube	Shelter/habitation
17153	Ahu	Marker
17154	Overhang shelter	Shelter
17155	Lava tube	Shelter (historic)
17156	Lava tube	Resource procurement/religious
17157	Overhang shelter	Shelter
17158	Lava tube	Shelter
17159	Ahu	Marker
17160	Quarry	Resource procurement
17161	Overhang shelter	Shelter
17162	Quarry	Resource procurement
17163	Lava tube	Historic shelter
17164	Quarry	Resource procurement
17165	Quarry	Resource procurement
17166	Quarry	Resource procurement
18671	Lava tube	Shelter/habitation
18672	Lava tube	Shelter/habitation
18673	Lava tube	Shelter/habitation/religious
18674	Shrine	Religious
18675	Quarry	Resource procurement
18676	Shrine	Religious
18677	Site complex	Religious
18678	Platform	Religious
18679	Trail	Transportation
18680	C-shape	Shelter
19490	Lava tube, C-shape, trail	Shelter/habitation/transportation
19491	Lava tube	Sandalwood resource procurement
19492	Lava tube	Shelter/resource procurement
19493	Overhang shelter	Shelter
19494	Overhang shelter	Shelter
19495	Lava tube	Shelter/habitation
19496	Lava tube	Water procurement
19497	Lava tube	Shelter/habitation

Appendix H.10. Archaeological Sites Recommended as Eligible to the National Register of Historic Places at Pohakuloa Training Area (Continued)

Table 8-25
Archaeological Sites Recommended as Eligible to the NRHP at PTA *(continued)*

State Site Number 50-10-31-	Site Type	Site Function
19498	Lava tube blister	Shelter
19499	Lava tube	Shelter/habitation/resource procurement
19500	Lava tube	Shelter
19501	Lava tube	Shelter/habitation/water and resource procurement
19502	Lava tube	Water procurement
19503	Lava tube	Shelter
19504	Lava tube	Water procurement
19505	Lava tube	Shelter/resource procurement
19506	Lava tube	Shelter/water procurement
19507	Overhang shelter	Shelter
19508	Lava tube	Water procurement
19509	Lava tube	Water procurement
19510	Quarry	Resource procurement
19511	Lava tube	Water procurement
19512	Lava tube	Shelter
19513	Lava tube	Shelter/water procurement
19514	Lava tube	Shelter/habitation/resource procurement
19515	Lava tube	Shelter/habitation/resource procurement
19516	Lava tube	Water procurement
19517	Lava tube	Water procurement
19518	Lava tube	Shelter/habitation
19519	Lava tube	Resource procurement
19520	Lava tube	Shelter
19521	Lava tube	Shelter
19522	Lava tube	Shelter
19523	Lava tube	Shelter/habitation/resource procurement
19524	Lava tube	Shelter
19525	Lava tube	Shelter
19526	Lava tube	Shelter
19527	Lava Tube	Resource procurement
19528	Na Ohule Elua Trail	Transportation
19529	Lava tube	Shelter/habitation
21164	Lava tube	Shelter/habitation
21165	Lava tube	Shelter/habitation
21166	Lava tube	Shelter/habitation
21167	Quarry	Resource procurement

Appendix H.10. Archaeological Sites Recommended as Eligible to the National Register of Historic Places at Pohakuloa Training Area (Continued)

Table 8-25
Archaeological Sites Recommended as Eligible to the NRHP at PTA *(continued)*

State Site Number 50-10-31-	Site Type	Site Function
21168	Ahu	Marker
21169	C-shape	Shelter
21170	Ahu	Marker
21171	Trail	Transportation
21172	Trail	Transportation
21281	Lava tube	Shelter/habitation
21282	Lava tube	Shelter/habitation
21283	Site complex, lava tube	Shelter/habitation/resource procurement
21284	Ahu complex	Unknown
21285	Lava tube	Shelter/habitation
21286	Lava tube	Shelter/habitation
21287	Lava tube	Shelter/habitation
21288	Ahu complex	Marker, unknown
21289	Shrine	Religious
21290	Shrine	Religious
21291	Lava tube	Shelter/habitation
21292	Lava tube	Shelter/habitation
21293	C-shape	Shelter
21294	Lava tube	Shelter/habitation
21295	Lava tube	Shelter/habitation
21296	Lava tube	Shelter/habitation
21297	Lava tube	Shelter/habitation
21298	Ahu complex	Marker, unknown
21300	Excavated pit	Unknown
21301	Pavement	Unknown
21302	Ahu, petroglyph	Marker, unknown
21303	Lava tube	Shelter/habitation
21304	Quarry	Resource procurement
21305	Lava tube	Shelter/habitation
21306	C-shape	Shelter
21307	Ahu	Marker
21308	C-shape	Shelter
21309	Lava tube	Shelter/habitation
21310	Ahu	Marker
21311	Ahu, platform	Marker, religious
21312	Lava tube	Shelter/habitation
21313	Pits, area I	Unknown

Appendix H.10. Archaeological Sites Recommended as Eligible to the National Register of Historic Places at Pohakuloa Training Area (Continued)

Table 8-25
Archaeological Sites Recommended as Eligible to the NRHP at PTA *(continued)*

State Site Number 50-10-31-	Site Type	Site Function
21314	Pits, area II	Unknown
21315	Pits, area III	Unknown
21316	Pits, area IV	Unknown
21351	Site complex	Workshop
21483	Lava tube	Shelter/habitation
21484	Lava tube	Shelter/habitation
21485	Lava tube	Shelter/habitation
21486	Lava tube	Shelter/habitation
21487	Lava tube	Shelter/habitation
21488	Lava tube	Shelter/habitation
21489	Lava tube	Shelter/habitation
21490	Lava tube	Shelter/habitation
21491	Lava tube	Shelter/habitation
21492	Lava tube	Shelter/habitation
21493	Quarry, excavated pit	Resource procurement, unknown
21494	Lava tube	Shelter/habitation
21495	Site complex	Unknown
21496	Lava tube	Shelter/habitation
21497	Lava tube	Shelter/habitation
21498	Lava tube	Shelter/habitation
21499	Ahu complex	Unknown
21500	Ahu complex	Unknown
21501	Lava tube	Shelter/habitation
21502	Lava tube	Shelter/habitation
21503	Site complex	Religious
21665	Lava tube	Shelter/habitation
21666	Quarry	Resource procurement
21667	Quarry	Resource procurement
21668	Quarry	Resource procurement
21669	Quarry	Resource procurement
21670	Quarry	Resource procurement
21671	Quarry	Resource procurement
21672	Quarry	Resource procurement
21673	Quarry	Resource procurement
21674	Quarry	Resource procurement
21744	Lithic, pavement	Resource procurement, lithic workshop
21745	Lava tube	Shelter/habitation

Appendix H.10. Archaeological Sites Recommended as Eligible to the National Register of Historic Places at Pohakuloa Training Area (Continued)

Table 8-25
Archaeological Sites Recommended as Eligible to the NRHP at PTA *(continued)*

State Site Number 50-10-31-	Site Type	Site Function
21746	Site complex	Unknown
21747	Lava tube	Shelter/habitation
21748	Excavated pit	Unknown
21749	Lava tube	Shelter/habitation
21750	Shrine	Religious
21807	Lava tube	Shelter/habitation
21809	Lava tube	Shelter/habitation
22941	Lava tube, lithic	Resource procurement
23450	Ahu	Marker
23451	Lava tube	Shelter
23452	Enclosure	Unknown
23453	Enclosure	Unknown
23454	Modified outcrop	Unknown
23455	Excavated pit complex	Resource procurement
23456	Enclosure	unknown
23457	Trail	Transportation
23458	Quarry	Resource procurement
23459	Enclosure	Shelter
23460	Lava tube/modified outcrop	Shelter
23461	Enclosure	Shelter
23462	Ahu	marker
23463	Excavated pit complex	Resource procurement
23464	Site-complex	Shelter/habitation
23465	Lithic scatter	Lithic workshop
23466	Lava tube	Shelter/habitation
23621	Excavated pit complex	unknown
23622	Excavated pit complex	unknown
23625	Lava tube	Shelter/habitation
23626	Lava tube	Shelter/habitation

Source: IARII 2003

Source: US Department of the Army, 2004

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Appendix I
Land Use

APPENDIX I
LAND USE

APPENDIX E
LAND TITLE

The 103rd Congress enacted Public Law 103-150 on November 23, 1993, apologizing to Native Hawaiians for the U.S. role in the 1893 overthrow of the monarchy. The Joint Resolution is not applicable to the disposition of ceded lands at PMRF or support sites. Specifically, the Resolution neither recognizes nor creates rights to any of the ceded lands in Native Hawaiian or any other group defined by race or ancestry, and contains the following express disclaimer: "Nothing in this Joint Resolution is intended to serve as a settlement of any claims against the government." The Resolution provides no direction to any individual Federal agency as to any specific implementing action. There is no instruction with respect to ceded lands. The Resolution can be seen as an appeal to Federal agencies having dealings with the Native Hawaiian community to be alert to the special sensitivities of that community with respect to the ending of the monarchy.

For the EIS process, such sensitivity is already mandated by the statutes and regulations governing the process, particularly those concerning scoping and subsequent public input. It was precisely the public input during scoping that prompted an examination of the ceded lands issue. An assessment of this issue for the EIS would have occurred whether or not the Resolution had been passed.

Many who offered testimony or wrote letters in response to the scoping notice questioned the military's title to PMRF and support sites. They asserted that persons of Hawaiian descent have claims to the land or may be entitled to have some sort of special control over the disposition of these lands. In response to these concerns, a review of the title to these ceded lands was conducted. The possibility that Hawaiians or native Hawaiians (as those terms are used in existing legislation to denote classes defined by race or ancestry) should have special consideration in decisions concerning ceded lands has been carefully evaluated.

The circumstances by which the lands now known as PMRF came into Federal ownership are described at the end of this appendix. This report shows that valid legal title to these lands was vested in the United States either by condemnation, by conveyance, or by set-aside of ceded public lands of the Territory.

The claims advanced during the scoping process focused on ceded lands, i.e., the lands known as Crown or government lands during the period of the monarchy, which were ceded (granted) to the United States when Hawaii was annexed to the United States in 1898. The claims seek "return" of these lands to the "Hawaiian people," to "native Hawaiians" or to "Hawaiians." It is noted that the terms "native Hawaiian" and "Hawaiian" are defined in a number of state and Federal statutes solely in terms of race or ancestry; that is, as referring to persons descended from inhabitants of the Hawaiian Islands just prior to the discovery of the islands by Captain Cook in 1778. There is no accepted definition of "the Hawaiian people" in state or Federal law, but it is assumed for purposes of the discussion below that the term as used during the scoping process referred generally to persons who are either "native Hawaiians" or "Hawaiians" as otherwise defined by law.

The basis for the claims advanced during scoping was not explained in detail, so the status of the Crown and government lands under the monarchy was reviewed to determine whether any basis for such claims might exist.

PMRF Enhanced Capability Final EIS E-1

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a)

Both the Crown and government lands were set apart from the lands under the exclusive control of the king at the time of the Great Mahele. Under the monarchy, the government lands were dedicated to public purposes. The instrument by which Kamehameha III conveyed the lands that would eventually become known as "government lands" stated, with respect to the lands conveyed, that:

> These lands are to be in the perpetual keeping of the Legislative Council (Nobles and Representatives) or in that of the superintendents of said lands, appointed by them from time to time, and shall be regulated, leased, or sold, in accordance with the will of said Nobles and Representatives, for the good of the Hawaiian Government, and to promote the dignity of the Hawaiian Crown.

The Crown lands were intended for the support of the king in what might be called his official capacity. Any doubt on this point was resolved in 1865, when legislation was enacted making the Crown lands inalienable and forbidding leases for more than 30 years. The preamble to this legislation, after noting the history of the Crown Lands, stated:

> *And whereas,* the history of the lands shows that they were vested in the King for the purpose of maintaining the Royal State and Dignity; and it is therefore disadvantageous to the public interest, that the lands should be alienated, or the said Royal Domain diminished. *And whereas, further,* during the two late reigns, the said Royal Domain has been greatly diminished, and is now charged with mortgages to secure considerable sums of money; now therefore,...

This was followed by the text of the law. Leasing was placed under the control of a body known as the Commissioners of Crown Lands. Bonds were authorized for the purpose of retiring mortgages against the property, and the proceeds of the leases, less a portion to be used for discharging the bonds, were made payable to the king. By this statute, the status of the Crown lands as a public resource for the support of the head of the government, rather than the personal property of the King, was confirmed in the law of the kingdom.

Thus, it clearly appears that during the monarchy, both Crown lands and the government lands were essentially dedicated to governmental purposes. At least during the later years of the monarchy, many citizens of the kingdom were not of Hawaiian descent, but the government lands appear to have been administered for the benefit of the citizenry as a whole rather than solely for those of Hawaiian ancestry. There is no indication that during the monarchy any individual (except the king, his wife, and his successors with respect to Crown lands) or any group or category of persons defined by Hawaiian ancestry alone had any claim to the Crown or government lands. Indeed, even the right of the monarch to dispose of the Crown lands at his will was rejected not only by the courts and the legislature, but ultimately by Kamehameha V himself when he signed the 1865 legislation making the Crown lands inalienable.

Beyond the historical documents themselves, a review of respected historical works discloses no support for a position that during the existence of the kingdom, Crown or government lands were somehow intended only for the benefit of persons of Hawaiian ancestry, except perhaps for the monarch's claim to the Crown lands[1]. With respect to the personal rights of the monarch,

[1] Perhaps the single most valuable resource on the subject is R.S. Kuykendall, *The Hawaiian Kingdom* (3 vols., 1938), esp. Vol. I, Chapter XV, "The Land Revolution." Other writers with thoughtful if varying viewpoints include L.H. Fuchs, *Hawaii Pono: A Social History* (1961) pp. 14-17 and Gavan Daws, *Shoal of Time: A History of the Hawaiian Islands* (1974), esp. pp. 124-128. More technical works include L.

E-2 *PMRF Enhanced Capability Final EIS*

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

it should be noted that Queen Liliuokalani's claim that she held an interest in the Crown lands as her individual property, and was entitled to compensation from the United States for its loss, was carefully considered and specifically rejected by the U.S. Claims Court in 1910. In that case, entitled *Liliuokalani v. U.S.,* 45 St. Cl. 418 (1910), the Queen argued that she held a vested equitable life estate in the Crown lands. After discussing the history of the establishment of the Crown lands, their treatment under the kingdom, and the 1865 legislation that made Crown lands inalienable, the court stated:

> The [1848] reservations [of Crown lands] were made to the Crown and not the King as an individual. The Crown lands were the resourceful methods of income to sustain, in part at least, the dignity of the office to which they were inseparably attached. When the office ceased to exist they became as other lands of the Sovereignty and passed to the defendants as part and parcel of the public domain.

During both the Republic and the Territorial periods, ceded lands were treated as public property, and under the Territory they were explicitly dedicated to public purposes. With the possible exception of the Hawaiian Homes Commission Act, the governing statutes neither acknowledged nor created property rights in any of these lands based on Hawaiian ancestry.

At statehood, the special status of these lands as dedicated to governmental purposes was confirmed by section 5(f) of the Admission Act, which limited the uses of ceded lands to the following:

- Support of the public schools and other public education institutions
- Betterment of the conditions of native Hawaiians, as defined in the Hawaiian Homes Commission Act, 1920, as amended
- Development of farm and home ownership on as widespread a basis as possible
- Making public improvements
- Provision of lands for public use

This statute established no requirement that any specific portion of the ceded lands be used for "native Hawaiians," or that any portion of the ceded lands be so used. It is simply included such use among those permitted. No property rights were established in any individual or group simply by virtue of Hawaiian ancestry.

Taken together, the foregoing facts indicate that no individual has a legal claim, based on any right of property, to any federally-retained ceded lands simply by virtue of Hawaiian ancestry. As against any such claim, the government's chain of title, from a purely legal standpoint, is unimpeachable. Even if such a claim might once have existed, it would appear to be barred by the 12-year statute of limitations in the Federal Quiet Title Act.

No other valid basis was offered during the scoping process for the claim that some or all Hawaiians, racially defined, should have special status in determining the disposition of ceded lands, and no such basis has been independently identified. Of course, persons of Hawaiian

Cannelora, *The Origin of Hawaii Land Titles and of the Rights of Native Tenants* (1974); Jon J. Chinen, *Original Land Titles in Hawaii* (1961); Neil M. Levy, *Native Hawaiian Land Rights*, 63 Cal. L. R. 848 (1975).

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

ancestry, like all members of the community who are or may be affected by the decisions concerning PMRF, have a variety of rights under Federal law to participate in the process leading up to those decisions.

For all of these reasons, the only legal and legitimate course for the DOD in making decisions concerning ceded lands is to treat these lands just like any other lands owned in fee simple by the government, and to afford to all persons, including Hawaiians and native Hawaiians, who may wish to be involved in those decisions the full range of rights provided by law, without discrimination.

Resolving claims that the ceded lands were wrongfully taken by the United States, and that they should be returned (or compensation provided) to a class defined by race or ancestry, is beyond the scope of this EIS and the discretion committed to this action to the DOD. In the final analysis, such resolution is a political issue for which such redress as may be due must be provided by Congress within the boundary of constitutional law.

E-4 *PMRF Enhanced Capability Final EIS*

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

DEPARTMENT OF THE NAVY

PACIFIC MISSILE RANGE, BARKING SANDS
(Formerly Known as Mana Airport Military Reservation)

1,925.090	Acres - Fee (Set aside)
201.927	Acres - Lease
1.864	Acres - Easement
2,128.881	Acres - Total

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

Department of the Navy
Pacific Missile Range
Barking Sands

CEDED LANDS—I

1. LOCATION OF PROPERTY: Pacific Missile Range, Kekaha; Waimea District, Kauai, HI

2. DATE CEDED AND HOW: June 29, 1940, Governor's Executive Order Number 887.

3. RESTRICTIONS ON USE OR DISPOSAL:

a. Set aside "for a site for the Mana Airport Military Reservation."

b. Executive Orders Numbers 945 and 887 contain provisions that "the land herein described is set aside upon the understanding that access to the shore for the purpose of fishing will be denied only on the portion used for bombing and that only while same is actually in progress or about to commence."

4. ACREAGE: 548.57 acres (Original)
548.57 acres (Current)

5. CONTROLLING DOD SERVICE COMPONENT: U.S. Navy Pacific Missile Range Facility, Barking Sands.

6. STATUS OF TITLE: U.S.-owned

7. ENCUMBRANCES:

a. Host-Tenant Real Estate Agreement dated October 1, 1992, for a term of five years, with the Department of the Air Force for use of certain buildings, runways, taxiways, aircraft parking space, and associated lands.

8. NARRATIVE: Prior to 1967 was used as an auxiliary landing field for Army and Air Force purposes. The field was transferred to the Navy on February 2, 1968, for use as a missile range. Since transfer, the facility has been used for missile launching as well as the appurtenant housing and administrative buildings and landing strip.

a. PRESENT USE: Missile launching with supporting facilities.

b. PAST USE: Air Field

c. CODE: 1. "Missile Launching Site and Supporting Facilities"

E-6 *PMRF Enhanced Capability Final EIS*

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

Department of the Navy
Pacific Missile Range
Barking Sands

CEDED LANDS - II

1. LOCATION OF PROPERTY: Pacific Missile Range, Kekaha; Waimea District, Kauai, HI

2. DATE CEDED AND HOW: June 10, 1941, Governor's Executive Order Number 945.

3. RESTRICTIONS ON USE OR DISPOSAL:

a. Set aside "for additions to Mana Airport Military Reservation."

b. Executive Orders Numbers 945 and 887 contain provisions that "the land herein described is set upon the understanding that access to the shore for the purpose of fishing will be denied only on the portion used for bombing and that only while same is actually in progress or about to commence."

4. ACREAGE: 1,509.00 acres (Original)
1,376.52 acres (Current)

5. CONTROLLING DOD SERVICE COMPONENT: U.S. Navy Pacific Missile Range Facility, Barking Sands.

PMRF Enhanced Capability Final EIS E-7

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

6. STATUS OF TITLE:

a.	U.S.-owned (Navy)	1,376.52 acres
b.	Conveyed to Hawaii	132.48 acres
	TOTAL	1,509.00 acres

7. ENCUMBRANCES:

a. Subject to three easements for drainage ditches, each 80 feet in width, as shown on a plan attached to, and made a part of, GEO Number 945.

b. Use Agreement dated May 5, 1969 for an unlimited term issued to the Department of Commerce and amended on October 13, 1969, to modify the original use area. The current Use Agreement covers the exclusive use of 31.8 acres and is to be used in connection with the National Bureau of Standards Frequency-time Broadcast Station, WWVH, BARSAN site.

8. NARRATIVE: Governor's Executive Order Number 945 was issued on June 10, 1941 and set aside 1,509 acres for the Mana Airport Military Reservation. 132.48 acres of the set-aside land was conveyed to the State of Hawaii by Quitclaim Deed dated January, 1963.

See discussion of Governor's Executive Order Number 887 for current and past uses and code.

E-8 *PMRF Enhanced Capability Final EIS*

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

Department of the Navy
Pacific Missile Range
Barking Sands

ACQUIRED LANDS

1. LOCATION OF PROPERTY: Pacific Missile Range, Kekaha; Waimea District, Kauai, HI

2. LANDS ACQUIRED UNDER LEASE: 201.927 acres are under lease from the State of Hawaii, dated August 20, 1964, for purposes of road and pipeline rights-of-way.

3. LANDS ACQUIRED BY TRANSFER: An easement for electric line and water pipeline comprising 1.864 acres was transferred from the Department of the Air Force by letter dated August 26, 1964.

PMRF Enhanced Capability Final EIS E-9

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

DEPARTMENT OF THE NAVY

PACIFIC MISSILE RANGE REMOTE RADAR FACILITY

245.321	Acres - Lease
245.321	Acres - Total

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

Department of the Navy
Pacific Missile Range
Remote Radar Facility

ACQUIRED LANDS

1. LOCATION OF PROPERTY: Pacific Missile Range Remote Radar Facility; Makaha Ridge, Kekaha, Kauai, HI

2. LANDS UNDER LEASE: 245.321 acres are used under General Lease Number S-3952, dated December 17, 1965, from the State of Hawaii.

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

DEPARTMENT OF THE NAVY

KAULA ROCK BOMBING TARGET

108	Acres - Fee (Set aside)
108	Acres - Total

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

Department of the Navy
Kaula Rock Bombing Target

CEDED LANDS

1. LOCATION OF PROPERTY: Kaula Rock Bombing Target, Kaula Island; approximately 20 miles SW of the Island of Niihau in the Hawaiian Islands.

2. DATE CEDED AND HOW: December 13, 1924, Governor's Executive Order Number 173.

3. RESTRICTIONS ON USE OR DISPOSAL: United States Lighthouse Reservation for Lighthouse Station to be under the management and control of the Department of Commerce.

4. ACREAGE: 108 acres (Original)
108 acres (Current)

5. CONTROLLING DOD SERVICE COMPONENT: Naval Air Station Barbers Point.

6. STATUS OF TITLE: U.S.-owned

7. ENCUMBRANCES: None

8. NARRATIVE: Kaula Island was originally set-aside for use by the Lighthouse Service as a lighthouse station on December 13, 1924. The United States Coast Guard, successor to the Lighthouse Service, granted a revocable permit to the Department of the Navy on September 9, 1952, to use Kaula Rock as an aerial bombing target involving the use of live ammunition. The Department of the Navy reported to the Bureau of the Budget, in their Hawaii Property Review Report dated June 28, 1961, that Kaula Rock was being utilized as a bombing target and it was expected to continue being used as such until after August 21, 1964. The United States Coast Guard transferred Kaula Island to the Department of the Navy by letter dated June 11, 1965, under the terms and conditions of 10 U.S.C. 2571, as amended, and under authorization of the Director of the Budget.

In 1978, the State of Hawaii contemplated the inclusion of Kaula Island into a State Seabird Sanctuary and in a memorandum dated May 30, 1978, to the Chairman, Board of Land and Natural Resources, the Deputy Attorney General for the State took the position that the Island belonged to the State. Also, that since the property was no longer being used for lighthouse purposes by the United States the set aside in Governor's Executive Order Number 173 should be canceled by appropriate documentation.

The Legal Counsel for the Pacific Division Naval Facilities Engineering Command in written "Opinion on Title to the Island of Kaula" dated July 27, 1978, took the position that the Island is owned by the United States and that transfer of jurisdiction, control, accountability and custody of Kaula Island to the Department of Navy from the United States Coast Guard was proper and in conformance with United States law.

a. PRESENT USE: It was reported that approximately 9.5 acres or 8.8% of the Island is being used as an aerial bombing impact area and the remainder as a bird sanctuary. The use of the impact area is under the control of the Commander Third Fleet.

PMRF Enhanced Capability Final EIS E-13

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

b. PAST USE: From 1924 to 1952, used as a lighthouse station by the Lighthouse Service and its successor the United States Coast Guard. 1952 to 1965 it was used jointly by the United States Coast Guard and the Department of the Navy as a lighthouse station and an aerial bombing target. From 1965 to the present time, the Island has continued to be used as an aerial bombing target.

c. CODE: 1. (Aerial Bombing Target)

E-14 *PMRF Enhanced Capability Final EIS*

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

DEPARTMENT OF THE AIR FORCE

KOKEE AIR FORCE STATION

9.61	Acres - Lease
0.48	Acres - Lease (Non-exclusive)
10.09	Acres - Total

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

Department of the Air Force
Kokee Air Force Station
(Transferred to NASA)

ACQUIRED LANDS

1. LOCATION OF PROPERTY: Kokee Air Force Station; 22 miles NW of Lihue, Island of Kauai, HI

2. LANDS USED UNDER LEASE: 9.61 acres are used under no-cost leases from the State of Hawaii for purposes of an Aircraft Control and Warning System. In addition, there are non-exclusive lease interests from the State of Hawaii covering 0.48 acres for water and power lines.

E-16 *PMRF Enhanced Capability Final EIS*

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

DEPARTMENT OF THE AIR FORCE

KAENA POINT SATELLITE TRACKING STATION

0.01	Acres - Easement
1.91	Acres - License
20.00	Acres - Lease
131.01	Acres - Lease (Non-exclusive)
152.93	Acres - Total

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

Department of the Air Force
Kaena Point Satellite Tracking Station

ACQUIRED LANDS

1. LOCATION OF PROPERTY: Kaena Point Satellite Tracking Station; Waialua and Waianae Districts, Oahu, HI

2. LANDS USED UNDER LICENSE: 1.91 acres are used under no-cost license for water line right-of-way.

3. LANDS USED UNDER LEASE: 20 acres are leased from the State of Hawaii at no cost. In addition, there are non-exclusive use rights from the State of Hawaii, covering 130.01 acres for road, water line and power line rights-of-way.

4. LANDS ACQUIRED BY RESERVATION: Easement interest in 0.01 acre was reserved by the United States in a Quitclaim Deed dated December 28, 1966.

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

DEPARTMENT OF THE AIR FORCE

MAUI DEEP SPACE SURVEILLANCE SITE
(formerly ARPA Midcourse Optical Station)

3.58	Acres - Lease
0.19	Acres - License
3.77	Acres - Total

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

Department of the Air Force
Maui Deep Space Surveillance Site

ACQUIRED LANDS

1. LOCATION OF PROPERTY: 21 miles SE of Wailuka, County of Maui, Island of Maui, HI

2. LANDS USED UNDER LEASE: 3.58 acres are leased from the University of Hawaii as a site for a research observatory.

3. LANDS USED UNDER LICENSE: 0.19 acres of right-of-way for an access road is used under license from the State of Hawaii.

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

OTHER LOCATIONS PROPERTY LAND TITLE

User/Location	Instrument	Property Owner
PMRF/Kokee, Kauai	Lease through NASA	State of Hawaii
DOE/Mount Kahili Repeater Station, Kauai	Lease	County of Kauai
DOE/Mauna Kapu Communication Site, Oahu	Memorandum of Agreement	Federal Aviation Administration
DOE/Makua Radio/Repeater/Cable Head, Oahu	Memorandum of Agreement	U.S. Air Force
PMRF/Mauna Kapu Electronic Warfare Site, Oahu	Lease	Campbell Estate
DOE/Mount Haleakala, Maui	Memorandum of Agreement	Federal Aviation Administration
Maui High Performance Computing Center, Maui	Lease	Private Landholders
Wheeler Army Airfield, Oahu	N/A	U.S. Army
Mt Kaala Air Force Station, Oahu	N/A	U.S. Air Force
Tern Island	N/A	U.S. Department of Interior
Johnston Atoll	N/A	U.S. Air Force

PMRF Enhanced Capability Final EIS E-21

Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

PMRF MISCELLANEOUS IN-GRANTS (Page 1 of 2)

PROJECT CONTRACT	DNLR NUMBER	INSTRUMENT	PARTY	ACTIVITY	AREA/LOCATION	TERM START	TERM END
63323 NOy(R)		IN-LEASE	STATE C&C HONO	PMRF HAWAREA	SOUTH POINT, HI/CABLES & LINE OF SIGHT		65 YRS
54650 NOy(R)		IN-LEASE	HUTCHINSON SUGAR CO	PMRF HAWAREA	KAMAOA, HAWAII		
54649 NOy(R)		IN-LEASE	HUTCHINSON SUGAR CO.	PMRF HAWAREA	PAKINI IKI, HAWAII		
3217 NF(R)		IN-REVOC PERMIT	STATE DOT	PMRF HAWAREA	PORT ALLEN KAUAI 4,970SF WAREHOUSE SPACE	11/1/69	INDEF
3202 NF(R)		IN-PERMIT	COUNTY OF KAUAI	PMRF HAWAREA	KEKAHA DUMPING GROUNDS KOKOLE PT, KAUAI	5/1/69	INDEF
28896 NF(R)		IN-AGRMT	STATE DLNR	PMRF HAWAREA	BRIDGE WIDENING/ROAD 6000 SF	1/28/77	1/27/27
80RP00037		IN-ESMT GRNT/SURR	STATE	PMRF HAWAREA	ELEC/WATER ESMT ALONG KAUMUALII HWY, KAUAI	5/20/80	INDEF
80RP00007		IN-LEASE	STATE	PMRF HAWAREA	MANA, WAIMEA(KONA) ROAD ESMT B5 & B6	10/29/79	INDEF
79RP00066	9-2-103E	IN-ESMT CORRECTON	CAMBELL ESTATE	PMRF HAWAREA	MAUNA KAPU/UNDGND DUCT LINE ESMT 110 COOR NOY(R)6802		
79RP00030	10-5-132	IN-LEASE	STATE DLNR	PMRF HAWAREA	MANA, WAIMEA, KAUAI DRAINAGE ESMTS	9/8/78	8/19/29
79RP00019	10-5-127	IN-LEASE	STATE	PMRF HAWAREA	WIDEN BRIDGE NO. 96, MANA, WAIMEA, KAUAI	1/28/77	1/27/27
68046 NOy(R)	10-4-001	IN-LEASE	STATE	PMRF HAWAREA	BONHAM AFB, TRACTS 1-4 AMEND 5/31/73	4/26/65	
68020 NOy(R)	9-2-103E	IN-ESMT	CAMPBELL ESTATE	PMRF HAWAREA	MAUHA KAPU ROADWAY	11/5/64	

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Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

PMRF MISCELLANEOUS IN-GRANTS (Page 2 of 2)

PROJECT CONTRACT	DNLR NUMBER	INSTRUMENT	PARTY	ACTIVITY	AREA/LOCATION	TERM START	TERM END
86RP016P COAST GUARD		IN-PERMIT	COAST GUARD	PMRF HAWAREA	ACCESS & UTIL TO NAVY KOKOLE PT FAC ON KAUAI	5/20/86	4/30/96
84RP00040	10-5-136	IN-LEASE	ALEXANDER & BALDWIN	PMRF HAWAREA	PORT ALLEN WAREHOUSE/OPEN STORAGE	7/16/91	7/15/93
84RP00036	NOT DLR	IN-LEASE	STATE HARBOR DIV	PMRF HAWAREA	PORT ALLEN PIER SHED 12,079 SF/TORPEDO SHOP	7/1/85	6/30/04
84RP00035	NOT DLR	IN-LEASE	STATE HARBOR DIV	PMRF HAWAREA	PORT ALLEN, OFFICE/WAREHOUSE SPACE/4,108 SF	7/1/91	6/30/93
80RP00063	9-2-115	IN-PERMIT	ARMY	PMRF HAWAREA	UNDERGROUND ELEC SYS MAUNA KAPU COMM STA	8/1/80	7/31/95
78RP00040	9-2-104	IN-LEASE	CAMPBELL ESTATE	PMRF HAWAREA	LOT 340, 0.426 AC. SUPPORT MAUNA KAPU COM	7/1/63	6/30/18
65222 NOy(R)		IN-PERMIT	COAST GUARD	PMRF HAWAREA	MAKAHUENA PT, KAUAI MOBILE RADAR SITE	5/1/57	INDEF
		IN-PERMIT	COAST GUARD	PMRF HAWAREA	KILAUEA PT. LIGHT STA KAUAI/MOBIL RADAR SITE	5/1/57	INDEF
83RP00007		IN-LEASE	ROBINSON HELEN M. (NIIHAU)	PMRF HAWAREA	PAHIAU RIDGE, NIIHAU 2.93 AC/RADAR SITE	6/4/84	6/7/99
KA DACA84-5-68-38 S-3746-7-101		IN-LEASE TO ARMY	STATE DLNR	PACMISRANFAC HAWAREA	INSTALL NAVY MICROWAVE ON MT KAALA/5,333 SF LAND	5/14/68	9/9/99
EC 90RP00011		IN-PERMIT	STATE	PACMISRANFAC	PIER SHED SPACE, PORT ALLEN/2,325 SF	10/1/89	9/9/99
N6274289RP00003		IN-LEASE	ROBINSON HEIEN M. (NIIHAU)	PACMISRANFAC	LANDING AND RECOVERY SITE, NIIHAU, 1,167 ACRES	11/1/88	10/31/99

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Exhibit I-1. Land Title from the 1998 PMRF Enhanced Capability Final EIS (U.S. Department of the Navy, 1998a) (Continued)

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Appendix J
Acoustic Impact Modeling

APPENDIX J
ACOUSTIC IMPACT MODELING

J.1 SOUND PRESSURE LEVEL, ENERGY FLUX DENSITY, AND UNDERWATER EXPLOSIVES MODELING

J.1.1 BACKGROUND AND OVERVIEW

All marine mammals are protected under the Marine Mammal Protection Act (MMPA). The MMPA prohibits, with certain exceptions, the take of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States.

The Endangered Species Act of 1973 (ESA) provides for the conservation of species that are endangered or threatened throughout all or a significant portion of their range, and the conservation of their ecosystems. A "species" is considered endangered if it is in danger of extinction throughout all or a significant portion of its range. A species is considered threatened if it is likely to become an endangered species within the foreseeable future. There are marine mammals, already protected under MMPA, listed as either endangered or threatened under ESA, and afforded special protections. Actions involving sound in the water include the potential to harass marine animals in the surrounding waters. Demonstration of compliance with MMPA and the ESA, using best available science, has been assessed using criteria and thresholds accepted or negotiated, and described here.

Sections of the MMPA (16 United States Code [U.S.C.] 1361 et seq.) direct the Secretary of Commerce to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity, other than commercial fishing, within a specified geographical region. Through a specific process, if certain findings are made and regulations are issued, or if the taking is limited to harassment, notice of a proposed authorization is provided to the public for review.

Authorization for incidental takings may be granted if National Marine Fisheries Service (NMFS) finds that the taking will have no more than a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses, and that the permissible methods of taking, and requirements pertaining to the mitigation, monitoring, and reporting of such taking are set forth.

NMFS has defined negligible impact in 50 Code of Federal Regulations (CFR) 216.103 as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.

Subsection 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the United States can apply for an authorization to incidentally take small numbers of marine mammals by harassment. The National Defense Authorization Act of 2004 (NDAA) (Public Law 108-136) removed the small numbers limitation and amended the definition of "harassment" as it applies to a military readiness activity to read as follows:

> (i) *any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A Harassment]; or*
> (ii) *any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B Harassment].*

The primary potential impact on marine mammals from underwater acoustics is Level B harassment from noise. For explosions, in the absence of any mitigation or monitoring measures, there is a very small chance that a marine mammal could be injured or killed when exposed to the energy generated from an explosive force on the sea floor. Analysis of noise impacts on cetaceans is based on criteria and thresholds initially presented in Navy Environmental Impact Statements for ship shock trials of the Seawolf submarine and the Winston Churchill (DDG 81; U.S. Department of the Navy, 2001) and the Incidental Harassment Authorization (National Marine Fisheries Service, 2005) and the Letter of Authorization (National Marine Fisheries Service, 2006) for Eglin Air Force Base.

Non-lethal injurious impacts (Level A Harassment) are defined in those documents as tympanic membrane (TM) rupture and the onset of slight lung injury. The threshold for Level A Harassment corresponds to a 50% rate of TM rupture, which can be stated in terms of an energy flux density (EFD) value of 205 decibels (dB) re 1 micropascal squared–second (μPa^2-s). TM rupture is well-correlated with permanent hearing impairment. Ketten (1998) indicates a 30% incidence of permanent threshold shift (PTS) at the same threshold.

The criteria for onset of slight lung injury were established using partial impulse because the impulse of an underwater blast wave was the parameter that governed damage during a study using mammals, not peak pressure or energy (Yelverton, 1981). Goertner (1982) determined a way to calculate impulse values for injury at greater depths, known as the Goertner "modified" positive impulse. Those values are valid only near the surface because as hydrostatic pressure increases with depth, organs like the lung, filled with air, compress. Therefore the "modified" positive impulse thresholds vary from the shallow depth starting point as a function of depth.

The shallow depth starting points for calculation of the "modified" positive impulses are mass-dependent values derived from empirical data for underwater blast injury (Yelverton, 1981). During the calculations, the lowest impulse and body mass for which slight, and then extensive, lung injury found during a previous study (Yelverton et al., 1973) were used to determine the positive impulse that may cause lung injury. The Goertner model is sensitive to mammal weight; such that smaller masses have lower thresholds for positive impulse so injury and harassment will be predicted at greater distances from the source for them. Impulse thresholds of 13.0 and 31.0 pounds per square inch-millisecond (psi-ms), found to cause slight and extensive injury in a dolphin calf, were used as thresholds in the analysis contained in this document.

Metrics for Physiological Effect Thresholds

Effect thresholds used for acoustic impact modeling in this document are expressed in terms of Energy Flux Density (EFD) / Sound Exposure Level (SEL), which is total energy received over time in an area, or in terms of Sound Pressure Level (SPL), which is the level (root mean square) without reference to any time component for the exposure at that level. Marine and terrestrial mammal data show that, for continuous-type sounds of interest, Temporary Threshold Shift (TTS) and Permanent Threshold Shift (PTS) are more closely related to the energy in the sound exposure than to the exposure SPL.

The Energy Level (EL) for each individual ping is calculated from the following equation:

EL = SPL + 10log10(duration)

The EL includes both the ping SPL and duration. Longer-duration pings and/or higher-SPL pings will have a higher EL.

If an animal is exposed to multiple pings, the energy flux density in each individual ping is summed to calculate the total EL. Since mammalian TS data show less effect from intermittent exposures compared to continuous exposures with the same energy (Ward, 1997), basing the effect thresholds on the total received EL is a conservative approach for treating multiple pings; in reality, some recovery will occur between pings and lessen the effect of a particular exposure. Therefore, estimates are conservative because recovery is not taken into account (given that generally applicable recovery times have not been experimentally established) and as a result, intermittent exposures from sonar are modeled as if they were continuous exposures.

The total EL depends on the SPL, duration, and number of pings received. The TTS and PTS thresholds do not imply any specific SPL, duration, or number of pings. The SPL and duration of each received ping are used to calculate the total EL and determine whether the received EL meets or exceeds the effect thresholds. For example, the TTS threshold would be reached through any of the following exposures:

- A single ping with SPL = 195 dB re 1 µPa and duration = 1 second.
- A single ping with SPL = 192 dB re 1 µPa and duration = 2 seconds.
- Two pings with SPL = 192 dB re 1 µPa and duration = 1 second.
- Two pings with SPL = 189 dB re 1 µPa and duration = 2 seconds.

Derivation of an Effects Threshold for Marine Mammals based on Energy Flux Density

As described in detail in Section 4.1.2, SEL (EFD level) exposure threshold established for onset-TTS is 195 dB re 1 µPa^2-s. This result is corroborated by the short-duration tone data of Finneran et al. (2000, 2003) and the long-duration sound data from Nachtigall et al. (2003a, b). Together, these data demonstrate that TTS in small odontocetes is correlated with the received EL and that onset-TTS exposures are fit well by an equal-energy line passing through 195 dB re 1 µPa^2-s. Absent any additional data for other species and being that it is likely that small odontocetes are more sensitive to the mid-frequency active/high-frequency active (MFA/HFA) frequency levels of concern, this threshold is used for analysis for all cetacea.

A similar process has been used to establish a TTS threshold for the Hawaiian monk seal based on research by Kastak et al. (1999; 2005). Of the three pinniped groups studied by Kastak et al., elephant seals are the most closely related to the Hawaiian monk seal (the family *Monachinae*). The onset-TTS number, provided by Kastak et al. for elephant seals and used to analyze TTS impacts on monk seals in this document, is 204 dB re 1μPa^2-s.

The PTS thresholds established for use in this analysis are based on a 20 dB increase in exposure EL over that required for onset-TTS. The 20 dB value is based on estimates from terrestrial mammal data of PTS occurring at 40 dB or more of TS, and on TS growth occurring at a rate of 1.6 dB/dB increase in exposure EL. This is conservative because: (1) 40 dB of TS is actually an upper limit for TTS used to approximate onset-PTS, and (2) the 1.6 dB/dB growth rate is the highest observed in the data from Ward et al. (1958, 1959). Using this estimation method (20 dB up from onset-TTS) for the Hawaii Range Complex (HRC) analysis, the PTS threshold for cetacea is 215 dB re 1μPa^2-s and for monk seals it is 224 dB re 1μPa^2-s.

Level B (non-injurious) Harassment also includes a TTS threshold consisting of 182 dB re 1 μPa^2-s maximum EFD level in any 1/3-octave band above 100 hertz (Hz) for toothed whales (e.g., dolphins). A second criterion, 23 psi, has recently been established by NMFS to provide a more conservative range for TTS when the explosive or animal approaches the sea surface, in which case explosive energy is reduced, but the peak pressure is 1 μPa^2-s is not (Table J-1). NMFS applies the more conservative of these two.

For Multiple Successive Explosions (MSEs), the acoustic criterion for sub-TTS behavioral disturbance is used to account for behavioral effects significant enough to be judged as harassment, but occurring at lower sound energy levels than those that may cause TTS. The sub-TTS threshold is derived following the approach of the Churchill Final Environmental Impact Statement (FEIS) for the energy-based TTS threshold. The research on pure-tone exposures reported in Schlundt et al. (2000) and Finneran and Schlundt (2004) provided a threshold of 192 dB re 1 μPa^2-s as the lowest TTS value. This value for pure-tone exposures is modified for explosives by (a) interpreting it as an energy metric, (b) reducing it by 10 dB to account for the time constant of the mammal ear, and (c) measuring the energy in 1/3 octave bands, the natural filter band of the ear. The resulting TTS threshold for explosives is 182 dB re 1 μPa^2-s in any 1/3 octave band. As reported by Schlundt et al. (2000) and Finneran and Schlundt (2004), instances of altered behavior in the pure-tone research generally began five dB lower than those causing TTS. The sub-TTS threshold is therefore derived by subtracting 5 dB from the 182 dB re 1 μPa^2-s in any 1/3 octave band threshold, resulting in a 177 dB re 1 μPa^2-s (EL) sub-TTS behavioral disturbance threshold for MSE.

Table J-1. Level A and B Harassment Threshold–Explosives

Threshold Type (Explosives)	Threshold Level
Level A – 50% Eardrum rupture (full spectrum energy)	205 dB
Temporary Threshold Shift (TTS) (peak one-third octave energy)	182 dB
Sub-TTS Threshold for Multiple Successive Explosions (peak one-third octave energy)	177 dB
Temporary Threshold Shift (TTS) (peak pressure)	23 psi
Level A – Slight lung injury (positive impulse)	13 psi-ms
Mortality – 1% Mortal lung injury (positive impulse)	31 psi-ms

Derivation of a Behavioral Effect Threshold for Marine Mammals Based on Sound Pressure Level (SPL)

Over the past several years, the Navy and NMFS have worked on developing alternative criteria to replace and/or to supplement the acoustic thresholds used in the past to estimate the probability of marine mammals being behaviorally harassed by received levels of MFA and HFA sonar. Following publication of the Draft EIS/OEIS the Navy continued working with the NMFS to refine a mathematically representative curve for assessment of behavioral effects modeling associated with the use of MFA/HFA sonar. As detailed in Section 4.1.2, the NMFS Office of Protected Resources made the decision to use a risk function and applicable input parameters to estimate the probability of behavioral responses that NMFS would classify as harassment for the purposes of the MMPA given exposure to specific received levels of MFA/HFA sonar. This decision was based on the recommendation of the two NMFS scientists, consideration of the independent reviews from six scientists, and NMFS MMPA regulations affecting the Navy's use of Surveillance Towed Array Sensor System Low-Frequency Active (SURTASS LFA) sonar (U.S. Department of the Navy, 2002; National Oceanic and Atmospheric Administration, 2007).

The particular acoustic risk function developed by the Navy and NMFS is derived from a solution in Feller (1968) with input parameters modified by NMFS for MFA/HFA sonar for mysticetes, odontocetes, and pinnipeds. In order to represent a probability of risk in developing this function, the function would have a value near zero at very low exposures, and a value near one for very high exposures. One class of functions that satisfies this criterion is cumulative probability distributions, a type of cumulative distribution function. In selecting a particular functional expression for risk, several criteria were identified:

- The function must use parameters to focus discussion on areas of uncertainty;
- The function should contain a limited number of parameters;
- The function should be capable of accurately fitting experimental data; and
- The function should be reasonably convenient for algebraic manipulations.

As described in U.S. Department of the Navy (2001), the mathematical function below is adapted from a solution in Feller (1968).

$$R = \frac{1-\left(\frac{L-B}{K}\right)^{-A}}{1-\left(\frac{L-B}{K}\right)^{-2A}}$$

Where: R = risk (0 – 1.0);
L = Received Level (RL) in dB
B = basement RL in dB; (120 dB)
K = the RL increment above basement in dB at which there is 50 percent risk
A = risk transition sharpness parameter (10)

It is important to note that the probabilities associated with acoustic modeling do not represent an individual's probability of responding; they identify the proportion of an exposed population (as represented by an evenly distributed density of marine mammals per unit area) that is likely to respond to an exposure. In addition, modeling does not take into account reductions from any of the Navy's standard protective mitigation measures which should significantly reduce or eliminate actual exposures that may have otherwise occurred during training.

J.1.2 ACOUSTIC SOURCES

The HRC acoustic sources are categorized as either broadband (producing sound over a wide frequency band) or narrowband (producing sound over a frequency band that that is small in comparison to the center frequency). In general, the narrowband sources within the HRC are anti-submarine warfare (ASW) sonars, and the broadband sources are explosives. This delineation of source types has a couple of implications. First, the transmission loss used to determine the impact ranges of narrowband ASW sonars can each be adequately characterized by model estimates at a single frequency. Broadband explosives, on the other hand, produce significant acoustic energy across several frequency decades of bandwidth. Propagation loss is sufficiently sensitive to frequency as to require model estimates at several frequencies.

Second, energy metrics are defined for both types. However, explosives are impulsive sources that produce a shock wave that dictates additional pressure-related metrics (peak pressure and positive impulse). Detailed descriptions of both types of sources are provided in the following subsections.

J.1.2.1 Sonars

The majority of training and research, development, testing, and evaluation activities in the HRC involve five types of narrowband sonars. Exposure estimates are calculated for each sonar according to the manner in which it operates. For example, the AN/SQS 53 and AN/SQS 56 are hull-mounted, mid-frequency active (MFA) surface ship sonars that operate for many hours at a time (although sound is output—the "active" portion—only a small fraction of that time), so it is most useful to calculate and report surface ship sonar exposures per hour of operation. The BQQ-10 submarine sonar is also reported per hour of operation. However, the submarine sonar is modeled as pinging only twice per hour. The AN/AQS-22 is a helicopter-deployed sonar, which is lowered into the water, pings several times, and then moves to a new location; this sonar is used for localization and tracking a suspected contact as opposed to searching for contacts. For the AN/AQS-22, it is most helpful to calculate and report exposures per dip. The AN/SSQ-62 is a sonobuoy that is dropped into the water from an aircraft or helicopter and pings about 10 to 30 times in an hour. For the AN/SSQ-62, it is most helpful to calculate and report exposures per sonobuoy. For the MK-48 torpedo the sonar is modeled for a typical training event and the MK-48 reporting metric is the number of torpedo runs. Table J-2 presents the deployment platform, frequency class, the metric for reporting exposures, and the units for each sonar.

Table J-2. Active Sonars Modeled in the Hawaii Range Complex

Sonar	Description	Frequency Class	Exposures Reported	Units per hour
MK-48	Torpedo sonar	High-frequency	Per torpedo	One torpedo run
AN/SQS-53	Surface ship sonar	Mid-frequency	Per hour	120 sonar pings
AN/SQS-56	Surface ship sonar	Mid-frequency	Per hour	120 sonar pings
AN/SSQ-62	Sonobuoy sonar	Mid-frequency	Per sonobuoy	8 sonobuoys
AN/AQS-22	Helicopter-dipping sonar	Mid-frequency	Per dip	2 dips
BQQ-10[1]	Submarine sonar	Mid-frequency	Per hour	2 sonar pings

[1] BQQ-10 is modeled as representative of all MFA submarine sonar (BQQ-10, BQQ-5, and BSY-1)

Note that MK-48 source described here is the high-frequency active (HFA) sonar on the torpedo; the explosive source of the detonating torpedo is described in the next subsection.

The acoustic modeling that is necessary to support the exposure estimates for each of these sonars relies on a generalized description of the manner of the sonar's operating modes. This description includes the following:

- "Effective" energy source level—The total energy across the band of the source, scaled by the pulse length (10 $\log_{10}$ [pulse length]), and corrected for source beam width so that it reflects the energy in the direction of the main lobe. The beam pattern correction consists of two terms:
  - Horizontal directivity correction: 10 $\log_{10}$ (360 / horizontal beam width)
  - Vertical directivity correction: 10 $\log_{10}$ (2 / [sin(θ_1) – sin(θ_2)]), where θ_1 and θ_2 are the 3-dB down points on the main lobe.
- Source depth—Depth of the source in meters.
- Nominal frequency—Typically the center band of the source emission. These are frequencies that have been reported in open literature and are used to avoid classification issues. Differences between these nominal values and actual source frequencies are small enough to be of little consequence to the output impact volumes.
- Source directivity—The source beam is modeled as the product of a horizontal beam pattern and a vertical beam pattern. Two parameters define the horizontal beam pattern:
  - Horizontal beam width—Width of the source beam (degrees) in the horizontal plane (assumed constant for all horizontal steer directions).
  - Horizontal steer direction—Direction in the horizontal in which the beam is steered relative to the direction in which the platform is heading

  The horizontal beam is rectangular with constant response across the width of the beam and with flat, 20-dB down sidelobes. (Note that steer directions ϕ, $-\phi$, $180^o - \phi$, and $180^o + \phi$ all produce equal impact volumes.)

Similarly, two parameters define the vertical beam pattern:

- Vertical beam width—Width of the source beam (degrees) in the vertical plane measured at the 3-dB down point. (The width is that of the beam steered towards broadside and not the width of the beam at the specified vertical steer direction.)

- Vertical steer direction—Direction in the vertical plane that the beam is steered relative to the horizontal (upward looking angles are positive).

To avoid sharp transitions that a rectangular beam might introduce, the power response at vertical angle θ is

$$\max \{ \sin^2 [n(\theta_s - \theta)] / [n \sin (\theta_s - \theta)]^2, \; 0.01 \}$$

where $n = 180^o / \theta_w$ is the number of half-wavelength-spaced elements in a line array that produces a main lobe with a beam width of θ_w. θ_s is the vertical beam steer direction.

- Ping spacing—Distance between pings. For most sources this is generally just the product of the speed of advance of the platform and the repetition rate of the sonar. Animal motion is generally of no consequence as long as the source motion is greater than the speed of the animal (nominally, three knots). For stationary (or nearly stationary) sources, the “average” speed of the animal is used in place of the platform speed. The attendant assumption is that the animals are all moving in the same constant direction.

Many of the actual parameters and capabilities of these sonars are classified. Parameters used for modeling were derived to be as representative as possible taking into account the manner with which the sonar would be used in various training scenarios. However, when there was a wide range of potential modeling input values, the default was to model using a nominal parameter likely to result in the most impact, so that the model would err towards the maximum potential exposures. For instance, a submarine’s use of MFA sonar (because they do not want to be detected) is generally rare, very brief, using minimal power, and may be narrowly focused. Modeling for the BQQ 10 use, however, errs on the side of maximum potential exposures by assuming sonar use twice an hour, for one second, at 235 dB, and using an omnidirectional transmission.

For the sources that are essentially stationary (AN/SSQ-62 and AN/AQS-22), emission spacing is the product of the ping cycle time and the average animal speed.

J.1.2.2 Explosives

Explosives detonated underwater introduce loud, impulsive, broadband sounds into the marine environment. The acoustic energy of an explosive is, generally, much greater than that of a sonar, so careful treatment of them is important, since they have the potential to injure. Three source parameters influence the effect of an explosive: the weight of the explosive warhead, the type of explosive material, and the detonation depth. The net explosive weight (or NEW) accounts for the first two parameters. The NEW of an explosive is the weight of only the explosive material in a given round, referenced to the explosive power of TNT (trinitrotoluene).

The detonation depth of an explosive is particularly important due to a propagation effect known as surface-image interference. For sources located near the sea surface, a distinct interference pattern arises from the coherent sum of the two paths that differ only by a single reflection from the pressure-release surface. As the source depth and/or the source frequency decreases, these two paths increasingly, destructively interfere with each other, reaching total cancellation at the surface (barring surface-reflection scattering loss). Since most HRC explosive sources are munitions that detonate essentially upon impact, the effective source depths are quite shallow, and therefore the surface-image interference effect can be pronounced. In order to limit the cancellation effect (and thereby provide exposure estimates that tend toward the worst case), relatively deep detonation depths are used. Consistent with earlier VAST/IMPASS modeling, a source depth of 1 foot is used for gunnery rounds. For the missile and bombs, a source depth of 2 meters (m) is used. For Extended Echo Ranging/Improved Extended Echo Ranging (EER/IEER) a nominal depth of 20 m is used to ensure that the source is located within any significant surface duct, resulting in maximum potential exposures. Table J-3 gives the ordnances of interest in the HRC, their NEWs, and their expected detonation depths.

Table J-3. Explosive Sources Modeled in Hawaii Range Complex

Ordnance	Net Explosive Weight for Modeling	Detonation Depth for Modeling
5" Naval gunfire	9.54 lbs	1 ft
76 mm Rounds	1.6 lbs	1 ft
Maverick	78.5 lbs	2 m
Harpoon	448 lbs	2 m
MK-82	238 lbs	2 m
MK-83	574 lbs	2 m
MK-84	945 lbs	2 m
MK-48	851 lbs	50 ft
Demolition Charges	20 lbs	Bottom
EER/IEER	5 lbs	20m

The exposures expected to result from these ordnances are generally computed on a per in-water explosive basis. The cumulative effect of a series of explosives can often be derived by simple addition if the detonations are spaced widely in time or space, allowing for sufficient animal movement as to ensure that a different population of animals is harassed by each ordnance detonation. There may be rare occasions when MSEs are part of a static location event such as during Mine Exercise (MINEX), Missile Exercise (MISSILEX), Bombing Exercise (BOMBEX), Sinking Exercise (SINKEX), Gunnery Exercise (GUNEX), and Naval Surface Fire Support (NSFS). For these events, the Churchill FEIS approach was extended to cover MSE events occurring at the same location. For MSE exposures, accumulated energy over the entire training time is the natural extension for energy thresholds since energy accumulates with each subsequent shot; this is consistent with the treatment of multiple arrivals in Churchill. For positive impulse, it is consistent with Churchill FEIS to use the maximum value over all impulses received.

For MSEs, the acoustic criterion for sub-TTS behavioral disturbance is used to account for behavioral effects significant enough to be judged as harassment, but occurring at lower sound energy levels than those that may cause TTS. Preliminary modeling undertaken for other Navy compliance documents using the sub-TTS threshold of 177 dB EL has demonstrated that for events involving MSEs using small (NEW) explosives (MINEX, GUNEX, and NSFS), the footprint of the threshold for explosives onset TTS criteria based on the 23 psi pressure component dominates and supersedes any exposures at a received level involving the 177 dB EL threshold. Restated in another manner, modeling for the sub-TTS threshold should not result in any estimated impacts that are not already quantified under the larger footprint of the 23 psi criteria for small MSE. Given that modeling for sub-TTS should not, therefore, result in any additional harassment takes for MINEX, GUNEX, and NSFS, analysis of potential for behavioral disturbance using the sub-TTS criteria was not undertaken for these events (MINEX, GUNEX, and NSFS).

For the remainder of the MSE events (BOMBEX, SINKEX, and MISSILEX) where the sub-TTS exposures may need to be considered, these potential behavioral disturbances were estimated by extrapolation from the acoustic modeling results for the explosives TTS threshold (182 dB re 1 mPa^2-s in any 1/3 octave band). To account for the 5 dB lower sub-TTS threshold, a factor of 3.17 was applied to the TTS modeled numbers in order to extrapolate the number of sub-TTS exposures estimated for MSE events. This multiplication factor is used calculate the increased area represented by the difference between the 177 dB sub-TTS threshold and the modeled 182 dB threshold. The factor is based on the increased range 5 dB would propagate (assuming spherical spreading), where the range increases by approximately 1.78 times, resulting in a circular area increase of approximately 3.17 times that of the modeled results at 182 dB.

A special case in which simple addition of the exposure estimates may not be appropriate is addressed by the modeling of a “representative” Sink Exercise (SINKEX). In a SINKEX, a decommissioned surface ship is towed to a specified deep-water location and there used as a target for a variety of weapons. Although no two SINKEXs are ever the same, a representative case derived from past exercises is described in the *Programmatic SINKEX Overseas Environmental Assessment* (March 2006) for the Western North Atlantic.

In a SINKEX, weapons are typically fired in order of decreasing range from the source with weapons fired until the target is sunk. A torpedo may be used after all munitions have been expended if the target is still afloat. Since the target may sink at any time during the exercise, the actual number of weapons used can vary widely. In the representative case, however, all of the ordnances are assumed expended; this represents the worst case of maximum exposure.

The sequence of weapons firing for the representative SINKEX is described in Table J-4. Guided weapons are nearly 100% accurate and are modeled as hitting the target (that is, no underwater acoustic effect) in all but two cases: (1) the Maverick is modeled as a miss to represent the occasional miss, and (2) the MK-48 torpedo intentionally detonates in the water column immediately below the hull of the target. Unguided weapons are more frequently off-target and are modeled according to the statistical hit/miss ratios. Naval gunfire from 5-inch and 76-mm weapons onboard surface ships is also very accurate and may include a both live and inert rounds. Note that these hit/miss ratios are artificially low in order to demonstrate a worst-case scenario; they should not be taken as indicative of weapon or platform reliability.

The MK 48 torpedo is modeled as detonating immediately below the target's hull. A nominal depth of 50 feet is used as its source depth in this analysis. Modeling, however, for impacts from the MK 48 is conservative and errs on side of maximum potential exposures because in a SINKEX this torpedo would be the last piece of ordnance fired (given it will sink the target). Range clearance procedures at the start of the event and previous ordnance hitting the target hull should have resulted in any marine species previously in the vicinity would have left the area before the MK 48 was ever fired. Note that MK-48 source described here is the explosive source of the detonating torpedo; the active pinger on the torpedo is described in the previous subsection. Again, however, a torpedo homing in on a target hull that has been subjected to naval gunfire and bombardment is unlikely to encounter marine animals in the vicinity of that target.

Table J-4. Representative SINKEX Weapons Firing Sequence

Time (Local)	Event Description
0900	Range Control Officer receives reports that the exercise area is clear of non-participant ship traffic, marine mammals, and sea turtles.
0909	Hellfire missile fired, hits target.
0915	2 HARM missiles fired, both hit target (5 minutes apart).
0930	1 Penguin missile fired, hits target.
0940	3 Maverick missiles fired, 2 hit target, 1 misses (5 minutes apart).
1145	1 SM-1 fired, hits target.
1147	1 SM-2 fired, hits target.
1205	5 Harpoon missiles fired, all hit target (1 minute apart).
1300-1335	7 live and 3 inert MK 82 bombs dropped – 7 hit target, 2 live and 1 inert miss target (4 minutes apart).
1355-1410	4 MK-83 bombs dropped – 3 hit target, 1 misses target (5 minutes apart).
1500	Surface gunfire commences – 400 5-inch rounds fired (one every 6 seconds), 380 hit target, 20 miss target.
1700	MK-48 torpedo fired, hits, and sinks target.

J.1.3 ENVIRONMENTAL PROVINCES

Propagation loss ultimately determines the extent of the Zone of Influence (ZOI) for a particular source activity. In turn, propagation loss as a function of range responds to a number of environmental parameters:

- Water depth,
- Sound speed variability throughout the water column,

- Bottom geo-acoustic properties, and
- Wind speed.

Due to the importance that propagation loss plays in ASW, the Navy has over the last four to five decades invested heavily in measuring and modeling these environmental parameters. The result of this effort is the following collection of global databases of these environmental parameters that are accepted as standards for all Navy modeling efforts:

- Water depth—Digital Bathymetry Data Base Variable Resolution (DBDBV),
- Sound speed—Generalized Dynamic Environmental Model (GDEM),
- Bottom loss—Low-Frequency Bottom Loss (LFBL), Sediment Thickness Database, and High-Frequency Bottom Loss (HFBL), and
- Wind speed—U.S. Navy Marine Climatic Atlas of the World.

This section provides some quantitative examples of the relative impact of these various environmental parameters. These examples then are used as guidance for determining environmental provinces (that is, regions in which the environmental parameters are relatively homogenous and can be represented by a single set of environmental parameters) within the HRC Operating Area (OPAREA).

J.1.3.1 Impact of Environmental Parameters

Within a typical operating area, the environmental parameter that tends to vary the most is bathymetry. It is not unusual for water depths to vary by an order of magnitude or more with the resulting impact on ZOI calculations being significant. Bottom loss can also vary considerably over typical operating areas but its impact upon ZOI calculations tends to be limited to waters on the continental shelf and the upper portion of the slope. Generally, the primary propagation paths in deep water from the source to most of the ZOI volume do not involve any interaction with the bottom. In shallow water, particularly if the sound velocity profile directs all propagation paths to interact with the bottom, bottom loss variability can play a large role.

The spatial variability of the sound speed field is generally small over operating areas of typical size. The presence of a strong oceanographic front is a noteworthy exception to this rule. To a lesser extent variability in the depth and strength of a surface duct can be of some importance. In the mid latitudes, seasonal variation often provides the most significant variation in the sound speed field. For this reason, both summer and winter profiles are modeled for each selected environment.

J.1.3.2 Environmental Provincing Methodology

The underwater acoustic environment can be quite variable over ranges in excess of 10 kilometers (km). For ASW applications, ranges of interest are often sufficiently large as to warrant the modeling of the spatial variability of the environment (e.g., in HRC the nominal range considered for an AN/SQS 53 sonar is approximately 65 nautical miles). In the propagation loss calculations, each of the environmental parameters is allowed to vary (either continuously or discretely) along the path from acoustic source to receiver. In such applications, each propagation loss calculation is conditioned upon the particular locations of the source and receiver. On the other hand, the range of interest for marine animal harassment for some criteria (TTS and PTS criteria) is more limited. This reduces the importance of the exact location of source and marine animal and makes the modeling required more manageable in scope.

In lieu of trying to model every environmental profile that can be encountered in an operating area, this effort utilizes a limited set of representative environments. Each environment is characterized by a fixed water depth, sound velocity profile, and bottom loss type. The operating area is then partitioned into homogeneous regions (or provinces), and the most appropriately representative environment is assigned to each. This process is aided by some initial provincing of the individual environmental parameters. The Navy-standard high-frequency bottom loss database in its native form is globally partitioned into nine classes. (Low-frequency bottom loss is likewise provinced in its native form although it is not considered in this selection of environmental provinces. The sources for which low-frequency bottom loss would be of interest have limited impact ranges thus rendering bottom loss of little consequence in this analysis.) The Navy-standard sound velocity profiles database is also available as a provinced subset. Only the Navy-standard bathymetry database varies continuously over the World's oceans. However, even this environmental parameter is easily provinced by selecting a finite set of water depth intervals. "Octave-spaced" intervals (10, 20, 50, 100, 200, 500, 1,000, 2,000, and 5,000 m) provide an adequate sampling of water depth dependence.

ZOI volumes are then computed using propagation loss estimates derived for the representative environments. Finally, a weighted average of the ZOI volumes is taken over all representative environments; the weighting factor is proportional to the geographic area spanned by the environmental province.

The selection of representative environments is subjective. However, the uncertainty introduced by this subjectivity can be mitigated by selecting more environments and by selecting the environments that occur most frequently over the operating area of interest.

As discussed in the previous subsection, ZOI estimates are most sensitive to water depth. Unless otherwise warranted, at least one representative environment is selected in each bathymetry province. Within a bathymetry province, additional representative environments are selected as needed to meet the following requirements.

- In water less than 1,000 m, bottom interactions occur at shorter ranges and more frequently; thus, significant variations in bottom loss need to be represented.
- Surface ducts provide an efficient propagation channel that can greatly influence ZOI estimates. Variations in the mixed layer depth need to be accounted for if the water is deep enough to support the full extent of the surface duct.

Depending on the size and complexity of the operating area, the number of environmental provinces tends to range from 5 to 20.

J.1.3.3 Description of Environmental Provinces Used in Acoustic Modeling

The HRC OPAREA consists of a number of warning areas, specialized ranges, and long-used training locations in and around the Hawaiian Islands. The HRC OPAREA is approximately bounded north and south by latitudes 25° N and 17° N and east and west by meridians 162° W and 154° W. Within these overall boundaries, a series of representative areas (Sonar Modeling Areas [SMAs]) have been defined for modeling purposes. The boundaries for these areas were drawn based on their encompassing the majority of the environmental variability in the OPAREA and having been the locations for the majority of previous Major Exercise training events, other training events, and research, development, test, and evaluation (RDT&E) events.

The various Navy units involved in Major Exercise training events, other training events, or RDT&E operate without consideration for their location within these SMAs or the boundaries as defined in this EIS/OEIS; the SMAs were only created for analytical purposes to support modeling. Stated in another manner, the boundaries created for analysis in this EIS/OEIS are artificial constructs that have no bearing on the conduct of activities being analyzed, do not restrict the movement of individual units, and are not boundaries to the conduct of training events or RDT&E within the HRC OPAREA. Details regarding the SMAs as representative environmental provinces for the HRC OPAREA are presented in the following paragraphs of this section.

For all of these provinces, the average wind speed (winter and summer) is 13 knots. The subsequent subsections describe the representative environmental provinces for the individual SMAs and specialized ranges.

The HRC OPAREA contains a total of 32 distinct environmental provinces. These represent the various combinations of nine bathymetry provinces, three Sound Velocity Profile (SVP) provinces, and six HFBL classes. However, as discussed in the following paragraphs, 12 of the provinces are similar enough to be considered the same, or occur so infrequently, that differentiating them is inconsequential, and, therefore, the modeling is based on 20 environmental provinces.

The bathymetry provinces represent depths ranging from shallowest of waters (10 m) to typical deep-water depths (slightly more than 5,000 m). However, the various ranges are concentrated in the deepest bathymetry province with nearly 90% of the entire range complex represented by environmental provinces with depths in the 5,000-m province. The distribution of the bathymetry provinces over the entire HRC OPAREA is provided in Table J-5.

Table J-5. Distribution of Bathymetry Provinces in the HRC OPAREA

Province Depth (m)	Frequency of Occurrence
10	Lima Landing & Puuloa only
20	0.01%
50	0.02%
100	0.05%
200	0.22%
500	0.75%
1,000	2.15%
2,000	7.87%
5,000	88.93%

The distribution of the three sound speed provinces is presented in Table J-6.

Table J-6. Distribution of Sound Speed Provinces in the HRC OPAREA

SVP Province	Frequency of Occurrence
81	66.07%
88	33.41%
98	0.52%

The variation in sound speed profiles among the three provinces is quite minimal; indeed due to the tropical location, even the seasonal variability is quite small. This is illustrated in Figure J-1 that displays the upper 1,000 m of the winter and summer profiles.

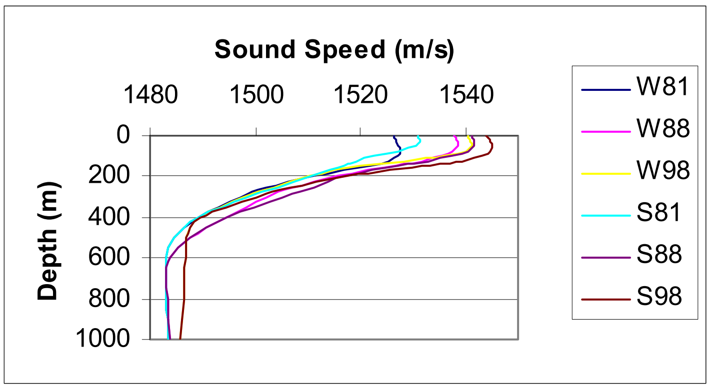


Figure J-1. Summer and Winter SVPs in the HRC OPAREA

The feature of the sound speed field that typically provides the most significant impact upon the size of the ZOI is the mixed layer or surface duct. Propagation loss from a source in a surface duct to points within the surface duct can be as much as 10 dB less than loss to points below the duct. The portion of the water column that enjoys this preferential propagation path (and hence longer impact ranges) is determined by the mixed layer depth. Among these profiles, the mixed layer depth (see Table J-7) is typically 50 m in both seasons.

Table J-7. Mixed Layer Depths in the HRC OPAREA

SVP Province	Summer Mixed Layer Depth (m)	Winter Mixed Layer Depth (m)
81	75	30
88	50	30
98	50	50

The HFBL classes represented in the HRC OPAREA vary from low-loss bottoms (class 2, typically in shallow water) to high-loss bottoms (class 8). Unlike the other two types of environmental parameters, the distribution of the five HFBL classes is provided in Table J-8.

Table J-8. Distribution of High-Frequency Bottom Loss Classes in the HRC OPAREA

HFBL Class	Frequency of Occurrence
2	0.57%
3	22.68%
4	23.22%
5	14.53%
7	11.47%
8	27.53%

Given the limited variability in the sound speed field, the logic for consolidating the environmental provinces focuses upon water depth and the HFBL class. The first consideration was to ensure that all nine bathymetry provinces are represented. The four shallowest bathymetry provinces do not occur frequently in the HRC OPAREA but, nonetheless, need to be represented by at least one environmental province. Within each of these depth regimes, the predominant environmental province is selected as the representative.

Nearly 90% of the HRC OPAREA is in the deepest bathymetry province; such a large area warrants the greatest partitioning. Among the 10 potential 5,000-m environmental provinces, the six most prevalent provinces are selected as representative. These span all five HFBL classes that occur at this water depth and two of the three SVP provinces (missing only SVP province 98 which is virtually indistinguishable from SVP province 88). The remaining bathymetry provinces (200, 500, 1,000, and 2,000 m) are then assigned to two or three of the most prevalent environmental provinces, ensuring that no environmental province that occurs in at least 10% of bathymetry regime is omitted. The resulting 20 environmental provinces used in the HRC OPAREA acoustic modeling are described in Table J-9.

J.1.3.3.1 Environmental Provinces in Sonar Modeling Area 1 (SMA 1)

SMA 1 is a range located north and west of Kauai and encompasses the Pacific Missile Range Facility (PMRF) Barking Sands Underwater Range Expansion (BSURE), the Barking Sands Tactical Underwater Range (BARSTUR), and most of the PMRF Shallow Water Training Range (SWTR) as shown on Figure J-2.

Although SMA 1 is primarily in deep water, it does include areas that are shallower than 200 m. The distribution of bathymetry provinces in SMA 1 is described in Table J-10.

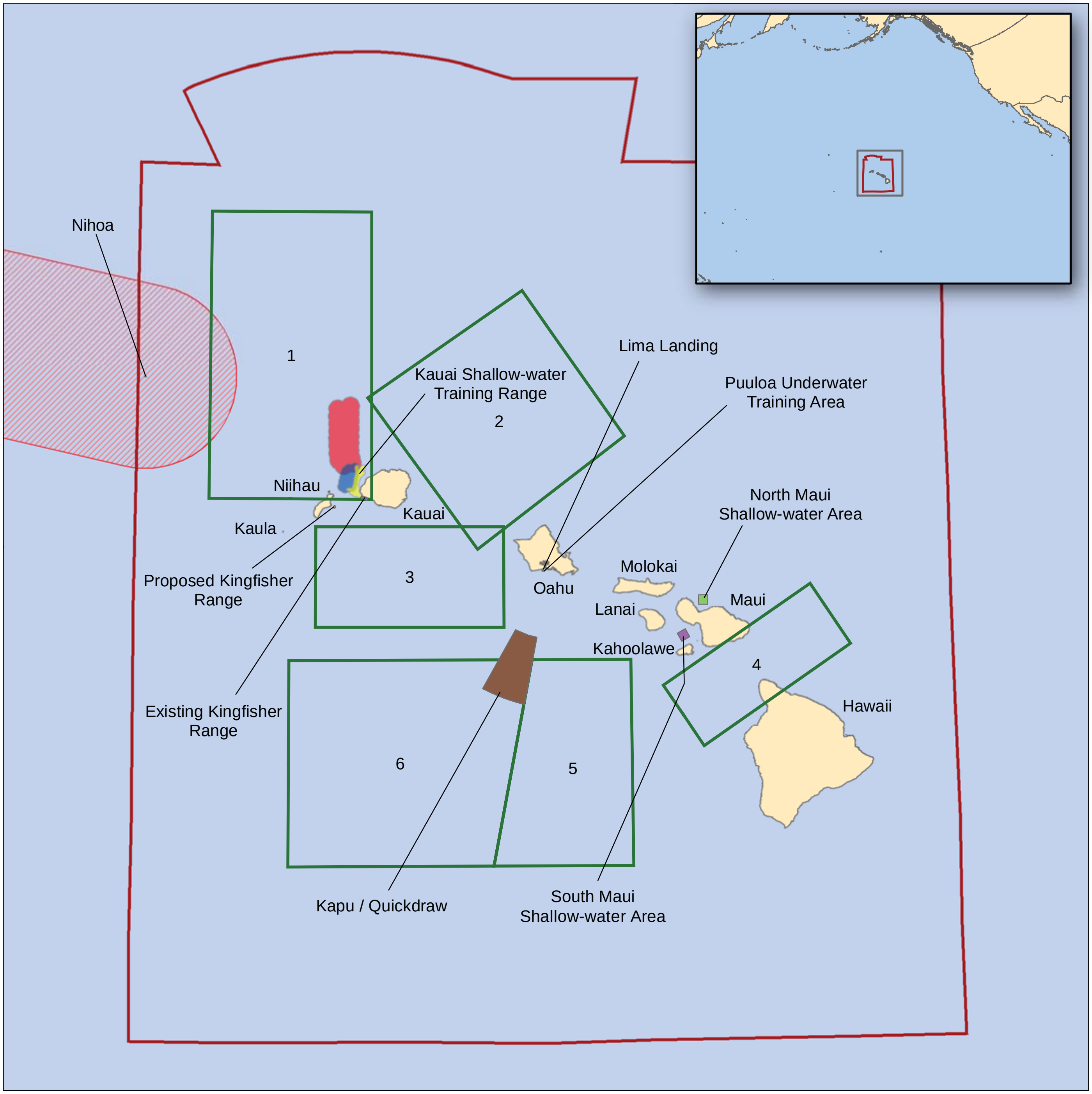
Table J-9. Distribution of Environmental Provinces in the HRC OPAREA

Environmental Province	Water Depth	SVP Province	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
1	20 m	81	8	– 98*	0.2 sec	0.01%
2	50 m	81	8	– 98*	0.2 sec	0.02%
3	100 m	81	8	– 98*	0.2 sec	0.42%
4	200 m	81	2	52	0.2 sec	0.08%
5	200 m	81	8	– 98*	0.23 sec	0.14%
6	500 m	88	8	0	0.11 sec	0.11%
7	500 m	81	8	– 98*	0.23 sec	0.56%
8	1,000 m	81	8	52	0.22 sec	1.52%
9	1,000 m	88	8	52	0.11 sec	0.62%
10	2,000 m	81	8	52	0.18 sec	6.45%
11	2,000 m	88	8	52	0.08 sec	1.43%
12	5,000 m	81	5	13	0.22 sec	10.01%
13	5,000 m	81	7	13	0.09 sec	10.34%
14	5,000 m	81	4	13	0.17 sec	24.20%
15	5,000 m	88	3	13	0.23 sec	26.21%
16	5,000 m	81	8	13	0.13 sec	12.65%
17	5,000 m	88	8	13	0.09 sec	5.47%
18	500 m	88	2	– 98*	0.2 sec	0.08%
19	100 m	81	2	52	0.2 sec	0.01%
20	10 m	81	2	52	0.2 sec	Lima Landing / Puuloa only

* Negative province numbers indicate shallow water provinces

Table J-10. Distribution of Bathymetry Provinces in SMA 1

Bathymetry	Frequency of Occurrence
200	0.05%
500	0.75%
1,000	2.39%
2,000	5.10%
5,000	91.71%



EXPLANATION

- Sonar Modeling Area
- Hawaii Range Complex
- Northwestern Hawaiian Islands Marine National Monument
- Barking Sands Tactical Underwater Range (BARSTUR) Hydrophones
- Barking Sands Underwater Range Expansion (BSURE) Hydrophones
- North Maui Shallow-water Area
- South Maui Shallow-water Area
- Kapu / Quickdraw Area
- Kauai Shallow-water Training Range
- Land

NORTH

0 50 100 200 Nautical Miles

Hawaii Range Complex Modeling Areas

Hawaiian Islands

Figure J-2

SMA 1 is almost exclusively in SVP province 88 as indicated in the distribution given in Table J-11.

Table J-11. Distribution of Sound Speed Provinces in SMA 1

Sound Speed Province	Frequency of Occurrence
81	0.17%
88	99.83%

Almost all of the HFBL classes present in the HRC OPAREA are represented in SMA 1; however, more than half of SMA 1 is a class 3 (low-loss) bottom as indicated in Table J-12.

Table J-12. Distribution of High-Frequency Bottom Loss Classes in SMA 1

High-Frequency Bottom Loss Class	Frequency of Occurrence
2	0.37%
3	54.28%
4	5.92%
5	13.32%
8	26.10%

For acoustic modeling purposes, the environmental variability of SMA 1 is captured by the 10 provinces listed in Table J-13. Note that the vast majority of SMA 1 is represented by two 5,000-m provinces—one with a low-loss bottom (15) and the other by with a high-loss bottom (17).

Table J-13. Distribution of Environmental Provinces in SMA 1

Environmental Province	Water Depth	SVP Province	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
4	200 m	81	2	52	0.2 sec	0.01%
5	200 m	81	8	– 98*	0.23 sec	0.04%
6	500 m	88	8	0	0.11 sec	0.37%
7	500 m	81	8	– 98*	0.23 sec	0.06%
8	1,000 m	81	8	52	0.22 sec	0.07%
9	1,000 m	88	8	52	0.11 sec	2.32%
11	2,000 m	88	8	52	0.08 sec	5.10%
15	5,000 m	88	3	13	0.23 sec	73.53%
17	5,000 m	88	8	13	0.09 sec	18.19%
18	500 m	88	2	– 98*	0.2 sec	0.31%

* Negative province numbers indicate shallow water provinces

J.1.3.3.2 Sonar Modeling Area 2 (SMA 2)

SMA 2 is located between and north of Kauai and Oahu and includes none of the smaller, specialized ranges. Although roughly equivalent in size to SMA 1, SMA 2 does not include coastal waters and thus has less environmental diversity. The bathymetry distribution is limited to depths of a kilometer or more as described in Table J-14.

Table J-14. Distribution of Bathymetry Provinces in SMA 2

Bathymetry	Frequency of Occurrence
1,000	1.84%
2,000	13.47%
5,000	84.68%

As with SMA 1, there are two SVP provinces covering SMA 2. As indicated in Table J-15, SMA 2 is nearly evenly divided between these two SVP provinces.

Table J-15. Distribution of Sound Speed Provinces in SMA 2

Sound Speed Province	Frequency of Occurrence
81	53.06%
88	46.94%

The limited environmental diversity is further demonstrated by the distribution of HFBL classes described in Table J-16.

Table J-16. Distribution of High-Frequency Bottom Loss Classes in SMA 2

High-Frequency Bottom Loss Class	Frequency of Occurrence
3	60.10 %
5	6.52 %
8	33.38 %

The environmental variability SMA 2 is reflected in the seven provinces listed in Table J-17.

Table J-17. Distribution of Environmental Provinces in SMA 2

Environmental Province	Water Depth	SVP Province	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
8	1,000 m	81	8	52	0.22 sec	1.84%
10	2,000 m	81	8	52	0.18 sec	13.20%
11	2,000 m	88	8	52	0.08 sec	0.28%
14	5,000 m	81	4	13	0.17 sec	20.04%
15	5,000 m	88	3	13	0.23 sec	46.57%
16	5,000 m	81	8	13	0.13 sec	17.97%
17	5,000 m	88	8	13	0.09 sec	0.31%

J.1.3.3.3 Sonar Modeling Area 3 (SMA 3)

SMA 3 is located south of Kauai and west of Oahu. It includes none of the smaller, specialized ranges. The bathymetry distribution is limited to depths of a kilometer or more as described in Table J-18.

Table J-18. Distribution of Bathymetry Provinces in SMA 3

Bathymetry	Frequency of Occurrence
1,000	0.95%
2,000	11.95%
5,000	87.10%

SMA 3 is described in its entirety by the sound speed province 81. The bottom loss classes in SMA 3 are limited to a medium-loss class (4) and a high-loss class (8) with distributions indicated in Table J-19.

Table J-19. Distribution of High-Frequency Bottom Loss Classes in SMA 3

High-Frequency Bottom Loss Class	Frequency of Occurrence
4	28.17%
8	71.83%

Table J-20 describes the four environmental provinces selected for SMA 3. The distribution of these provinces reflects the deep-water nature of this operating area.

Table J-20. Distribution of Environmental Provinces in SMA 3

Environmental Province	Water Depth	SVP Province	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
8	1,000 m	81	8	52	0.22 sec	0.95%
10	2,000 m	81	8	52	0.18 sec	11.95%
14	5,000 m	81	4	13	0.17 sec	28.17%
16	5,000 m	81	8	13	0.13 sec	58.93%

J.1.3.3.4 Sonar Modeling Area 4 (SMA 4)

SMA 4 is situated between Oahu and the island of Hawaii. It includes none of the smaller, specialized ranges but does include some shallow-water regions. The bathymetry distribution includes all eight bathymetry provinces but emphasizes deep-water with nearly 90% of the operating area in water depths of a kilometer or more as indicated in Table J-21.

Table J-21. Distribution of Bathymetry Provinces in SMA 4

Bathymetry	Frequency of Occurrence
20	0.12%
50	0.25%
100	0.62%
200	2.23%
500	7.64%
1,000	16.84%
2,000	40.13%
5,000	32.17%

SMA 4 is described in its entirety by the sound speed province 81. Bottom loss is likewise limited in variability with over 90% of the operating area characterized by a high-loss bottom (see Table J-22).

Table J-22. Distribution of High-Frequency Bottom Loss Classes in SMA 4

High-Frequency Bottom Loss Class	Frequency of Occurrence
2	6.59%
5	1.00%
7	0.01%
8	92.41%

SMA 4 is partitioned into the 12 environmental provinces listed in Table J-23. The distribution of environmental provinces is dominated by provinces with high-loss bottoms in the 1,000-m, 2,000-m and 5,000-m water depth regimes.

Table J-23. Distribution of Environmental Provinces in SMA 4

Environmental Province	Water Depth	SVP Province	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
1	20 m	81	8	– 98*	0.2 sec	0.13%
2	50 m	81	8	– 98*	0.2 sec	0.25%
3	100 m	81	8	– 98*	0.2 sec	0.49%
4	200 m	81	2	52	0.2 sec	0.99%
5	200 m	81	8	– 98*	0.23 sec	1.24%
7	500 m	81	8	– 98*	0.23 sec	7.64%
8	1,000 m	81	8	52	0.22 sec	16.84%
10	2,000 m	81	8	52	0.18 sec	40.13%
12	5,000 m	81	5	13	0.22 sec	1.00%
13	5,000 m	81	7	13	0.09 sec	0.01%
16	5,000 m	81	8	13	0.13 sec	31.17%
19	100 m	81	2	52	0.2 sec	0.13%

J.1.3.3.5 Sonar Modeling Area 5 (SMA 5)

Located south of Oahu and west of the island of Hawaii, SMA 5 is predominantly a deep-water region. This operating area includes none of the smaller, specialized ranges. The bathymetry distribution provided in Table J-24 includes only two bathymetry provinces, with more than 95% of the area in the 5,000-m bathymetry province.

Table J-24. Distribution of Bathymetry Provinces in SMA 5

Bathymetry	Frequency of Occurrence
2,000	3.35%
5,000	96.65%

The distribution of sound speed provinces is similarly concentrated in a single province, 81, as presented in Table J-25.

Table J-25. Distribution of Sound Speed Provinces in SMA 5

Sound Speed Province	Frequency of Occurrence
81	96.33%
98	3.67%

The distribution of bottom-loss classes is a little less concentrated as indicated in Table J-26.

Table J-26. Distribution of High-Frequency Bottom Loss Classes in SMA 5

High-Frequency Bottom Loss Class	Frequency of Occurrence
4	29.15%
7	61.94%
8	8.91%

The resulting five provinces that describe SMA 5 are presented in Table J-27 and reflect a distribution whose environmental variability is driven mainly by bottom loss.

Table J-27. Distribution of Environmental Provinces in SMA 5

Environmental Province	Water Depth	SVP Province	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
10	2,000 m	81	8	52	0.18 sec	3.35%
13	5,000 m	81	7	13	0.09 sec	55.39%
14	5,000 m	81	4	13	0.17 sec	29.15%
16	5,000 m	81	8	13	0.13 sec	8.44%
17	5,000 m	88	8	13	0.09 sec	3.67%

J.1.3.3.6 Sonar Modeling Area 6 (SMA 6)

SMA 6 is a large deep-water region located south of Kauai and Oahu, and adjacent to SMA 5 on the east. Like SMA 5, this operating area is exclusively deep-water as demonstrated in Table J-28.

Table J-28. Distribution of Bathymetry Provinces in SMA 6

Bathymetry	Frequency of Occurrence
2,000	0.56%
5,000	99.44%

SMA 6 is described in its entirety by the sound speed province 81. The ocean bottom in this region is primarily medium loss, distributed as shown in Table J-29.

Table J-29. Distribution of High-Frequency Bottom Loss Classes in SMA 6

High-Frequency Bottom Loss Class	Frequency of Occurrence
4	53.25%
5	37.04%
7	9.71%

A total of four environmental provinces are used to characterize this operating area according to the distribution given in Table J-30.

Table J-30. Distribution of Environmental Provinces in SMA 6

Environmental Province	Water Depth	SVP Province	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
10	2,000 m	81	8	52	0.18 sec	0.56%
12	5,000 m	81	5	13	0.22 sec	37.04%
13	5,000 m	81	7	13	0.09 sec	9.15%
14	5,000 m	81	4	13	0.17 sec	53.25%

J.1.3.3.7 Underwater Ranges at PMRF

Instrumented underwater ranges called BARSTUR, BSURE, and the SWTR are located between and north of Niihau and Kauai. They are contained entirely within the southeast corner of SMA 1 with a bathymetry distribution as described in Table J-31.

Table J-31. Distribution of Bathymetry Provinces in PMRF Ranges

Bathymetry	Frequency of Occurrence
500	3.5 %
1,000	11.53 %
2,000	12.38 %
5,000	72.58 %

These underwater ranges at PMRF are described in their entirety by the sound speed province 88. The ranges are fairly evenly divided between low-loss bottoms and high-loss bottoms according to the distribution described in Table J-32.

Table J-32. Distribution of High-Frequency Bottom Loss Classes in PMRF Ranges

High-Frequency Bottom Loss Class	Frequency of Occurrence
2	2.72 %
3	38.03 %
8	59.25 %

The various combinations of environmental properties results in the six provinces defined in Table J-33.

Table J-33. Distribution of Environmental Provinces in PMRF Ranges

Environmental Province	Water Depth	SVP Province	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
6	500 m	88	8	0	0.11 sec	1.34%
9	1,000 m	88	8	52	0.11 sec	11.53%
11	2,000 m	88	8	52	0.08 sec	12.38%
15	5,000 m	88	3	13	0.23 sec	38.03%
17	5,000 m	88	8	13	0.09 sec	34.56%
18	500 m	88	2	– 98*	0.2 sec	2.16%

J.1.3.3.8 South Maui Shallow-water Area and Potential MK 48 Area (SMA 7 & 8)

The South Maui Shallow-water Area is located between Kahoolawe, Lanai, and Maui. In addition to the PMRF ranges, it is one of two other areas that are typically used by submarines for training with MK 48 torpedoes. The other area is also in “shallow water” and is situated just north of Kahalui, Maui. These areas are referred to as “shallow” (being less than 600 ft deep) by training event planners and participants given safety requirements for vertical separation between participants to preclude the possibility of collisions. Both areas are also small in comparison to the SMAs, and hence the environmental variability is less pronounced. The distribution of water depths is limited to two bathymetry provinces as shown in Table J-34.

Table J-34. Distribution of Bathymetry Provinces in South Maui Shallow-water Area and Potential MK-48 Ranges

Bathymetry	Frequency of Occurrence
100	24.44%
200	75.56%

The South Maui Shallow-water Area and the potential MK 48 area are described in its entirety by the sound speed province 81. Two bottom loss classes, distributed as indicated in Table J-35, are present in these areas.

Table J-35. Distribution of High-Frequency Bottom Loss Classes in South Maui Shallow-water Area and Potential MK-48 Ranges

High-Frequency Bottom Loss Class	Frequency of Occurrence
2	9.55%
8	90.45%

This environmental variability is represented by the four environmental provinces described in Table J-36.

Table J-36. Distribution of Environmental Provinces in South Maui Shallow-water Area and Potential MK-48 Ranges

Environmental Province	Water Depth	SVP Province	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
3	100 m	81	8	– 98*	0.2 sec	18.19%
4	200 m	81	2	52	0.2 sec	3.30%
5	200 m	81	8	– 98*	0.23 sec	72.76%
19	100 m	81	2	52	0.2 sec	6.25%

J.1.3.3.9 Kapu/Quickdraw

Kapu/Quickdraw is a gunnery range located south of Oahu. This range partially overlaps SMA 6 and thus shares some of the same environmental characteristics. The range is strictly deep-water (5,000-m bathymetry province) and described in its entirety by the sound speed province 81. The only material environmental variability is in bottom loss class, as demonstrated in Table J-37.

Table J-37. Distribution of High-Frequency Bottom Loss Classes in Kapu/ Quickdraw Range

High-Frequency Bottom Loss Class	Frequency of Occurrence
4	78.72%
8	21.28%

The bottom-loss distribution, in turn, directly dictates the distribution of environmental provinces as listed in Table J-38.

Table J-38. Distribution of Environmental Provinces in Kapu/Quickdraw Range

Environmental Province	Water Depth	SVP Province	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
14	5,000	81	4	13	0.17 sec	78.72%
16	5,000	81	8	52	0.13 sec	21.28%

J.1.3.3.10 Lima Landing

Lima Landing is a limited area well inside the mouth of Pearl Harbor and it serves as the location for an Explosive Ordnance Demolition (EOD) Range. The limited extent of this range permits the entire range to be characterized by the single environmental province listed in Table J-39.

Table J-39. Distribution of Environmental Provinces in Lima Landing

Environmental Province	Water Depth	SVP Province	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
20	10 m	81	2	52	0.2 sec	100%

J.1.3.3.11 Kingfisher (Old and Proposed)

Two areas in the HRC OPAREA are designated for Kingfisher mine avoidance training. The "old" range is located just south of Kauai, adjoining the Shallow Water Training Range to the west. The "proposed" area is nearby, just east of Niihau. Both areas are very small size scale in comparison to the resolution of the Navy-standard databases. As such, the only environmental parameter that is apt to vary significantly is water depth. Water depths in the old range are known to vary between 150 to 350 feet (46 to 107 m). Given that the dominant bottom loss class is 2, the best fit for the Kingfisher ranges is provided by environmental province 19, as described in Table J-40.

Table J-40. Distribution of Environmental Provinces in the Kingfisher Ranges

Environmental Province	Water Depth	SVP Province	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
19	100 m	81	2	52	0.2 sec	100%

J.1.3.3.12 Puuloa

Puuloa Underwater Training Area is a small area just south of Pearl Harbor. The limited extent of this range permits the entire range to be characterized by the single environmental province listed in Table J-41.

Table J-41. Distribution of Environmental Provinces in Puuloa Range

Environmental Province	Water Depth	SVP Province	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
20	10 m	81	2	52	0.2 sec	100 %

J.1.3.3.13 Shallow Water Training Range

The SWTR is located just to the west of Kauai, overlapping a portion of the PMRF Ranges and part of SMA 1. The bathymetry distribution emphasizes shallow water as indicated in Table J-42.

Table J-42. Distribution of Bathymetry Provinces in SWTR

Bathymetry	Frequency of Occurrence
50	9.85%
100	9.85%
200	1.79%
500	47.70%
1,000	30.81%

The distribution of sound speed provinces is provided in Table J-43.

Table J-43. Distribution of Sound Speed Provinces in SWTR

Sound Speed Province	Frequency of Occurrence
81	72.46%
88	27.54%

The distribution of bottom loss classes presented in Table J-44 indicates relatively equal portions of low-loss and high-loss bottoms in SWTR.

Table J-44. Distribution of High-Frequency Bottom Loss Classes in SWTR

High-Frequency Bottom Loss Class	Frequency of Occurrence
2	2.72%
3	38.03%
8	59.25%

Without the influence of large, deep-water provinces, the SWTR is more uniformly distributed over the 10 environmental provinces it contains as indicated in Table J-45.

Table J-45. Distribution of Environmental Provinces in SWTR

Environmental Province	Water Depth	SVP Province	HFBL Class	LFBL Province	Sediment Thickness	Frequency of Occurrence
2	50 m	81	8	– 98*	0.2 sec	9.85%
3	100 m	81	8	– 98*	0.2 sec	4.92%
4	200 m	81	2	52	0.2 sec	0.71%
5	200 m	81	8	– 98*	0.23 sec	1.08%
6	500 m	88	8	0	0.11 sec	14.60%
7	500 m	81	8	– 98*	0.23 sec	3.00%
8	1,000 m	81	8	52	0.22 sec	1.79%
9	1,000 m	88	8	52	0.11 sec	29.02%
18	500 m	88	2	– 98*	0.2 sec	30.10%
19	100 m	81	2	52	0.2 sec	4.92%

J.1.4 IMPACT VOLUMES AND IMPACT RANGES

Without range clearance procedures and standard protective measures serving as mitigation, many training activities would have the potential to injure or harass marine animals. For potential impacts from acoustic exposures, the number of animals exposed to potential harm in any such action is dictated by the number of marine mammals present per unit area, the propagation field, and the characteristics of the noise source.

The impact volume associated with a particular activity is defined as the volume of water in which some acoustic metric exceeds a specified threshold. The product of this impact volume with a volumetric animal density yields the expected value of the number of animals exposed to (or taken according to) that acoustic metric at a level that exceeds the threshold. The acoustic metric can either be an energy term (energy flux density, either in a limited frequency band or across the full band) or a pressure term (such as peak pressure or positive impulse). The thresholds associated with each of these metrics set levels at which a percentage of the animals exposed will experience harassment.

Regardless of the type of source, estimating the number of animals that may be exposed to an acoustic or pressure wave in a particular environment entails the following steps:

- Each source emission is modeled according to the particular operating mode of the sonar. The “effective” energy source level is computed by integrating over the bandwidth of the source, scaling by the pulse length, and adjusting for gains due to source directivity. The location of the source at the time of each emission must also be specified.
- For the relevant environmental acoustic parameters, transmission loss (TL) estimates are computed, sampling the water column over the appropriate depth and range intervals. TL data are sampled at the typical depth(s) of the source and at the nominal center frequency of the source. If the source is relatively broadband, an average over several frequency samples is required.

- The accumulated energy within the waters that the source is “operating” is sampled over a volumetric grid. At each grid point, the received energy from each source emission is modeled as the effective energy source level reduced by the appropriate propagation loss from the location of the source at the time of the emission to that grid point and summed. For the peak pressure or positive impulse, the appropriate metric is similarly modeled for each emission. The maximum value of that metric (over all emissions) is stored at each grid point.
- The impact volume for a given threshold is estimated by summing the incremental volumes represented by each grid point for which the appropriate metric exceeds that threshold.
- Finally, the number of exposures is estimated as the “product” (scalar or vector, depending upon whether an animal density depth profile is available) of the impact volume and the animal densities.

This section describes in detail the process of computing impact volumes (that is, the first four steps described above). This discussion is presented in two parts: active sonars and explosive sources. The relevant assumptions associated with this approach and the limitations that are implied are also presented. The final step, computing the number of exposures, is discussed in Section J.1.5.

J.1.4.1 Computing Impact Volumes for Active Sonars

This section provides a detailed description of the approach taken to compute impact volumes for active sonars. Included in this discussion are:

- Identification of the underwater propagation model used to compute transmission loss data, a listing of the source-related inputs to that model, and a description of the output parameters that are passed to the energy accumulation algorithm.
- Definitions of the parameters describing each sonar type.
- Description of the algorithms and sampling rates associated with the energy accumulation algorithm.

J.1.4.1.1 Transmission Loss Calculations

TL data are pre-computed for each of two seasons in the five environmental provinces described in the previous subsection using the GRAB propagation loss model (Keenan, 2000). The TL output consists of a parametric description of each significant eigenray (or propagation path) from source to animal. The description of each eigenray includes the departure angle from the source (used to model the source vertical directivity later in this process), the propagation time from the source to the animal (used to make corrections to absorption loss for minor differences in frequency and to incorporate a surface-image interference correction at low frequencies), and the transmission loss suffered along the eigenray path.

The eigenray data for a single GRAB model run are sampled at uniform increments in range out to a maximum range for a specific “animal” (or “target” in GRAB terminology) depth. Multiple GRAB runs are made to sample the animal depth dependence. The depth and range sampling parameters are summarized in Table J-46. Note that some of the low-power sources do not require TL data to large maximum ranges.

Table J-46. TL Depth and Range Sampling Parameters by Sonar Type

Sonar	Range Step	Maximum Range	Animal Depth
MK 48	10 meter (m)	10 kilometer (km)	0 – 1 km in 5-m steps 1 km – Bottom in 10-m steps
AN/SQS 53	10 m	200 km	0 – 1 km in 5-m steps 1 km – Bottom in 10-m steps
AN/SQS 56	10m	40 km	0 – 1 km in 5-m steps 1 km – Bottom in 10-m steps
BQQ 10	10m	150 km	0 – 1 km in 5-m steps 1 km – Bottom in 10-m steps
AN/AQS 22	10 m	10 km	0 – 1 km in 5-m steps 1 km – Bottom in 10-m steps
AN/ASQ 62	5 m	5 km	0 – 1 km in 5-m steps 1 km – Bottom in 10-m steps

In a few cases, most notably the AN/SQS 53 for thresholds below approximately 180 dB, TL data may be required by the energy summation algorithm at ranges greater than covered by the pre-computed GRAB data. In these cases, TL is extrapolated to the required range using a simple cylindrical spreading loss law in addition to the appropriate absorption loss. This extrapolation leads to a conservative (or under) estimate of transmission loss at the greater ranges.

Although GRAB provides the option of including the effect of source directivity in its eigenray output, this capability is not exercised. By preserving data at the eigenray level, this allows source directivity to be applied later in the process and results in fewer TL calculations.

The other important feature that storing eigenray data supports is the ability to model the effects of surface-image interference that persist over range. However, this is primarily important at frequencies lower than those associated with the sonars considered in this subsection. A detailed description of the modeling of surface-image interference is presented in the subsection on explosive sources.

J.1.4.1.2 Energy Summation

The summation of energy flux density over multiple pings in a range-independent environment is a trivial exercise for the most part. A volumetric grid that covers the waters in and around the area of sonar operation is initialized. The source then begins its set of pings. For the first ping, the TL from the source to each grid point is determined (summing the appropriate eigenrays after they have been modified by the vertical beam pattern), the “effective” energy source level is reduced by that TL, and the result is added to the accumulated energy flux density at that grid point. After each grid point has been updated, the accumulated energy at grid points in each depth layer are compared to the specified threshold. If the accumulated energy exceeds that threshold, then the incremental volume represented by that grid point is added to the impact volume for that depth layer.

The source is then moved along one of the axes in the horizontal plane by the specified ping separation distance, and the second ping is processed in a similar fashion. This procedure continues until the maximum number of pings specified has been reached.

Defining the volumetric grid over which energy is accumulated is the trickiest aspect of this procedure. The volume must be large enough to contain all volumetric cells for which the accumulated energy is likely to exceed the threshold but not so large as to make the energy accumulation computationally unmanageable.

Determining the size of the volumetric grid begins with an iterative process to determine the lateral extent to be considered. Unless otherwise noted, throughout this process the source is treated as omni-directional and the only animal depth that is considered is the TL target depth that is closest to the source depth (placing source and receiver at the same depth is generally an optimal TL geometry).

The first step is to determine the impact range (R_{MAX}) for a single ping. The impact range in this case is the maximum range at which the effective energy source level reduced by the transmission loss is less than the threshold. Next the source is moved along a straight-line track and energy flux density is accumulated at a point that has a CPA range of R_{MAX} at the mid-point of the source track. That total energy flux density is then compared to the prescribed threshold. If it is greater than the threshold (which, for the first R_{MAX}, it must be) then R_{MAX} is increased by 10%, the accumulation process is repeated, and the total energy is again compared to the threshold. This continues until R_{MAX} grows large enough to ensure that the accumulated energy flux density at that lateral range is less than the threshold. The lateral range dimension of the volumetric grid is then set at twice R_{MAX}, with the grid centered along the source track. In the direction of advance for the source, the volumetric grid extends of the interval from [$-R_{MAX}$, 3 R_{MAX}] with the first source position located at zero in this dimension. Note that the source motion in this direction is limited to the interval [0, 2 R_{MAX}]. Once the source reaches 2 R_{MAX} in this direction, the incremental volume contributions have approximately reached their asymptotic limit and further pings add the same essentially the same amount. This geometry is demonstrated in Figure J-3.

If the source is directive in the horizontal plane, then the lateral dimension of the grid may be reduced and the position of the source track adjusted accordingly. For example, if the main lobe of the horizontal source beam is limited to the starboard side of the source platform, then the port side of the track is reduced substantially as demonstrated in Figure J-4.

Once the extent of the grid is established, the grid sampling can be defined. In both dimensions of the horizontal plane the sampling rate is approximately $R_{MAX}/100$. The round-off error associated with this sampling rate is roughly equivalent to the error in a numerical integration to determine the area of a circle with a radius of R_{MAX} with a partitioning rate of $R_{MAX}/100$ (approximately 1%). The depth-sampling rate of the grid is comparable to the sampling rates in the horizontal plane but discretized to match an actual TL sampling depth. The depth-sampling rate is also limited to no more that 40 m in order to ensure that significant TL variability over depth is captured.

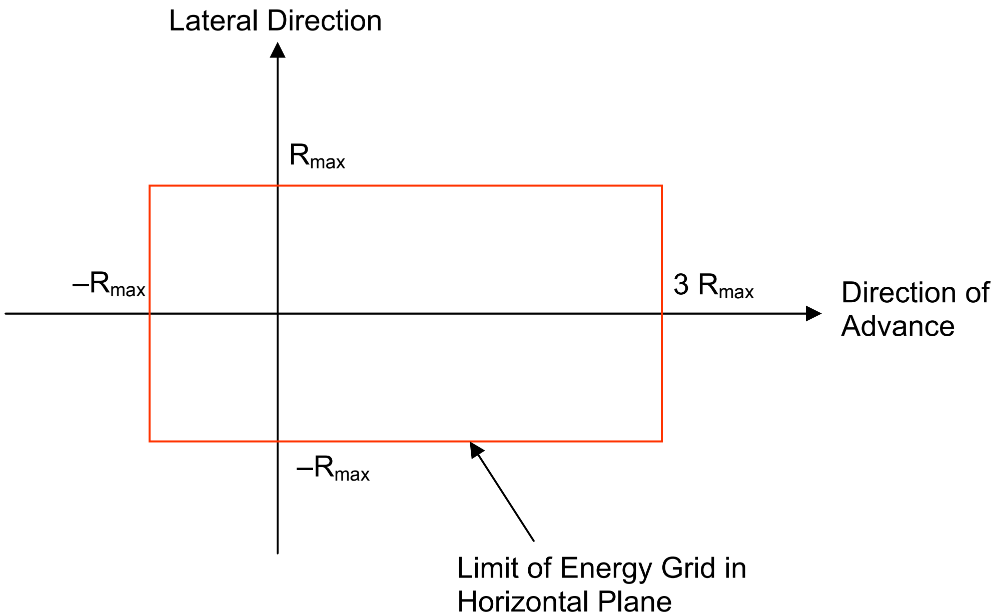


Figure J-3. Horizontal Plane of Volumetric Grid for Omni-Directional Source

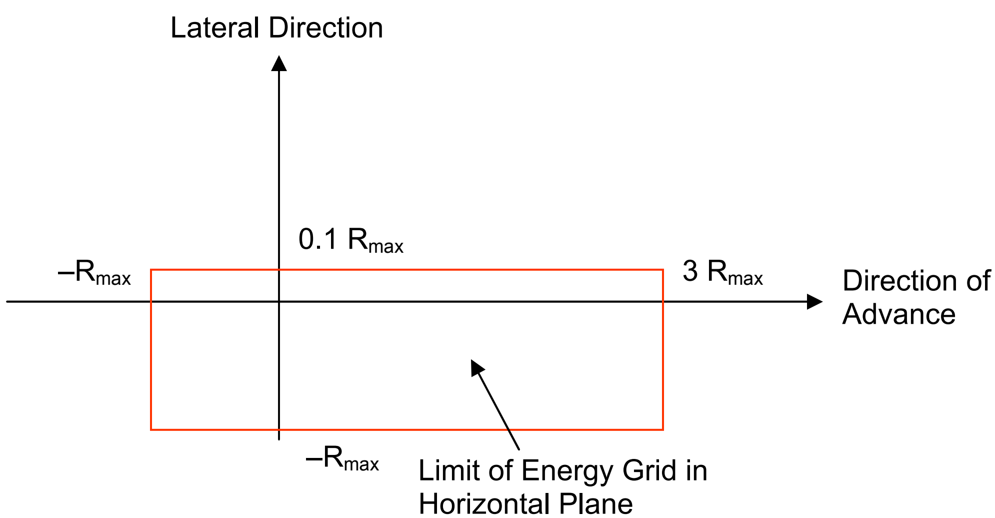


Figure J-4. Horizontal Plane of Volumetric Grid for Starboard Beam Source.

J.1.4.1.3 Impact Volume per Hour of Sonar Operation

The impact volume for a sonar moving relative to the animal population (density) increases with each additional ping at the start. The rate at which the impact volume increases varies with a number of parameters but eventually approaches some asymptotic limit. Beyond that point the increase in impact volume becomes essentially linear as depicted in Figure J-5.

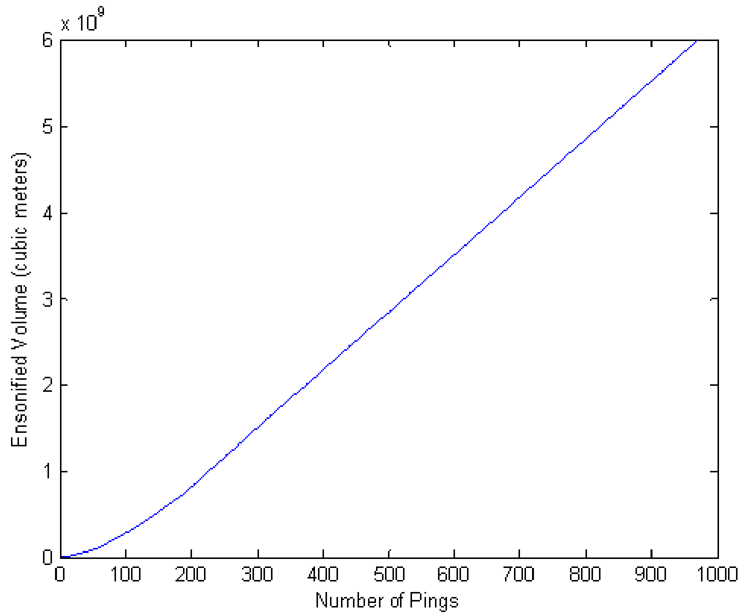


Figure J-5. AN/SQS 53 Impact Volume by Ping

The slope of the impact volume versus number of pings at a given depth is the impact volume added per ping. This number multiplied by the number of pings in an hour gives the hourly impact volume for the given depth increment. Completing this calculation for all depths in a province, for a given source, gives the hourly impact volume vector, v_n, which contains the hourly impact volumes by depth for province n. Figure J-6 provides an example of an hourly impact volume vector for a particular environment.

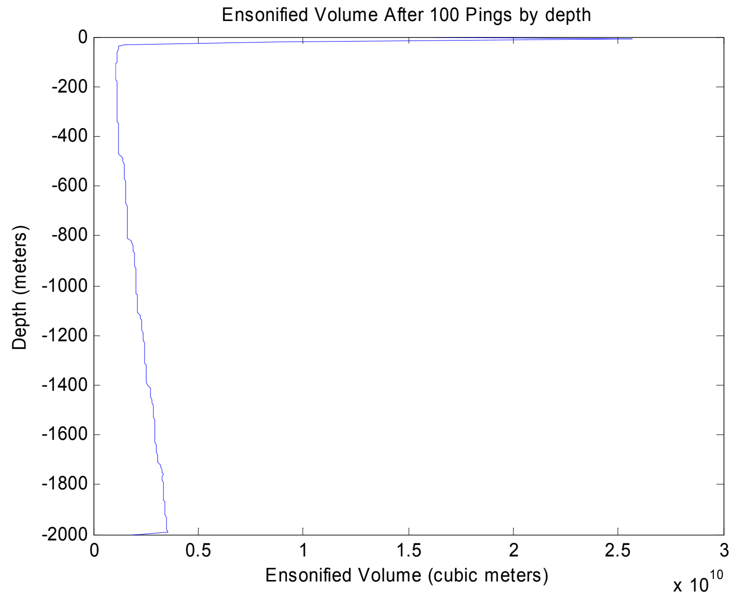


Figure J-6. Example of an Impact Volume Vector

J.1.4.2 Computing Impact Volumes for Explosive Sources

This section provides the details of the modeling of the explosive sources. This energy summation algorithm is similar to that used for sonars, only differing in details such as the sampling rates and source parameters. These differences are summarized in the following subsections. A more significant difference is that the explosive sources require the modeling of additional pressure metrics: (1) peak pressure, and (2) "modified" positive impulse. The modeling of each of these metrics is described in detail in the subsections of J.1.4.2.3.

J.1.4.2.1 Transmission Loss Calculations

Modeling impact volumes for explosive sources span requires the type of same TL data as needed for active sonars. However, unlike active sonars, explosive ordnances are very broadband, contributing significant energy from tens of hertz to tens of kilohertz. To accommodate the broadband nature of these sources, TL data are sampled at seven frequencies from 10 Hz to 40 kHz, spaced every two octaves.

An important propagation consideration at low frequencies is the effect of surface-image interference. As either source or target approach the surface, pairs of paths that differ in history by a single surface reflection set up an interference pattern that ultimately causes the two paths to perfectly cancel each other when the source or target is at the surface. A fully coherent summation of the eigenrays produces such a result but also introduces extreme fluctuations at all depths that would have to be highly sampled range and depth, and then smoothed to give meaningful results. An alternative approach is to implement what is sometimes called a semi-coherent summation. A semi-coherent sum attempts to capture significant effects of surface-image interference (namely the reduction of the field as the source or target approach the surface) without having to deal with the more rapid fluctuations associated with a fully coherent sum. The semi-coherent sum is formed by a random phase addition of paths that have already been multiplied by the expression:

$$\sin^2 [\, 4\pi\, f\, z_s\, z_a \,/\, (c^2\, t)\,]$$

where f is the frequency, z_s is the source depth, z_a is the animal depth, c is the sound speed and t is the travel time from source to animal along the propagation path. For small arguments of the sine function this expression varies directly as the frequency and the two depths. It is this relationship that causes the propagation field to go to zero as the depths approach the surface or the frequency approaches zero.

A final important consideration is the broadband nature of explosive sources. This is handled by sampling the TL field at a limited number of frequencies. But the image-interference correction given above varies substantially over that frequency spacing. To avoid possible under sampling, the correction is averaged over each frequency interval.

J.1.4.2.2 Source Parameters

Unlike the active sonars, the explosive sources are defined by only two parameters: (1) net explosive weight, and (2) source detonation depth. Values for these source parameters are defined in Section J.1.2.2.

The effective energy source level, which is treated as a de facto input for the other sonars, is instead modeled directly for EER and explosives. For both the energy source level is comparable to the model used for other explosives (Arons [1954], Weston [1960], McGrath [1971], Urick [1983], Christian and Gaspin [1974]). The energy source level over a one-third octave band with a center frequency of f for a source with a net explosive weight of w pounds is

$$10 \log_{10} (0.26\, f) + 10 \log_{10} (\, 2\, p_{max}^{\;2} \,/\, [1/\theta^2 + 4\, \pi\, f^2]\,) + 197 \text{ dB}$$

where the peak pressure for the shock wave at 1 m is defined as

$$p_{max} = 21600\, (w^{1/3} \,/\, 3.28\,)^{1.13} \text{ psi} \qquad \text{(A-1)}$$

and the time constant is defined as:

$$\theta = [(0.058)\, (w^{1/3})\, (3.28 \,/\, w^{1/3})^{\,0.22}\,] \,/\, 1{,}000 \text{ msec} \qquad \text{(A-2)}$$

J.1.4.2.3 Impact Volumes for Various Metrics

The impact of explosive sources on marine species is measured by four different metrics, each with its own threshold(s). The energy metric, peak one-third octave, is treated in similar fashion as the energy metric used for the active sonars, including the summation of energy if there are multiple source emissions. The other two, peak pressure and positive impulse, are not accumulated but rather the maximum levels are stored.

Peak One-Third Octave Energy Metric

The computation of impact volumes for the energy metric follows closely the approach taken to model the energy metric for the active sonars. The only significant difference is that energy flux density is sampled at several frequencies in one-third-octave bands and only the peak one-third-octave level is accumulated.

Peak Pressure Metric

The peak pressure metric is a simple, straightforward calculation. At each range/animal depth combination, transmission ratio modified by the source level in a one-octave band and beam pattern is averaged across frequency on an eigenray-by-eigenray basis. This averaged transmission ratio (normalized by the broadband source level) is then compared across all eigenrays with the maximum designated as the peak arrival. Peak pressure at that range/animal depth combination is then simply the product of:

- The square root of the averaged transmission ratio of the peak arrival,
- The peak pressure at a range of 1 m (given by equation A-1), and
- The similitude correction (given by $r^{-0.13}$, where r is the slant range along the eigenray estimated as tc with t the travel time along the dominant eigenray and c the nominal speed of sound.

If the peak pressure for a given grid point is greater than the specified threshold, then the incremental volume for the grid point is added to the impact volume for that depth layer.

"Modified" Positive Impulse Metric

The modeling of positive impulse follows the work of Goertner (Goertner, 1982). The Goertner model defines a "partial" impulse as

$$\int_0^{T_{min}} p(t)\, dt$$

where p(t) is the pressure wave from the explosive as a function of time t, defined so that p(t) = 0 for t < 0. This pressure wave is modeled as

$$p(t) = p_{max}\, e^{-t/\theta}$$

where p_{max} is the peak pressure at 1 m (see equation A-1), and θ is the time constant defined as

$$\theta = 0.058\, w^{1/3}\, (r/w^{1/3})^{0.22} \text{ seconds}$$

with w the net explosive weight (pounds), and r the slant range between source and animal.

The upper limit of the "partial" impulse integral is

$$T_{min} = \min \{T_{cut}, T_{osc}\}$$

where T_{cut} is the time to cutoff and T_{osc} is a function of the animal lung oscillation period. When the upper limit is T_{cut}, the integral is the definition of positive impulse. When the upper limit is defined by T_{osc}, the integral is smaller than the positive impulse and thus is just a "partial" impulse. Switching the integral limit from T_{cut} to T_{osc} accounts for the diminished impact of the positive impulse upon the animals lungs that compress with increasing depth and leads to what is sometimes call a "modified" positive impulse metric.

The time to cutoff is modeled as the difference in travel time between the direct path and the surface-reflected path in an isospeed environment. At a range of r, the time to cutoff for a source depth z_s and an animal depth z_a is

$$T_{cut} = 1/c \{ [r^2 + (z_a + z_s)^2]^{1/2} - [r^2 + (z_a - z_s)^2]^{1/2} \}$$

where c is the speed of sound.

The animal lung oscillation period is a function of animal mass M and depth z_a and is modeled as

$$T_{osc} = 1.17\, M^{1/3} (1 + z_a/33)^{-5/6}$$

where M is the animal mass (in kg) and z_a is the animal depth (in feet).

The modified positive impulse threshold is unique among the various injury and harassment metrics in that it is a function of depth and the animal weight. So instead of the user specifying the threshold, it is computed as $K (M/42)^{1/3} (1 + z_a / 33)^{1/2}$. The coefficient K depends upon the level of exposure. For the onset of slight lung injury, K is 19.7; for the onset of extensive lung hemorrhaging (1% mortality), K is 47.

Although the thresholds are a function of depth and animal weight, sometimes they are summarized as their value at the sea surface for a typical calf dolphin (with an average mass of 12.2 kg). For the onset of slight lung injury, the threshold at the surface is approximately 13 psi-msec; for the onset of extensive lung hemorrhaging (1% mortality), the threshold at the surface is approximately 31 psi-ms.

As with peak pressure, the "modified" positive impulse at each grid point is compared to the derived threshold. If the impulse is greater than that threshold, then the incremental volume for the grid point is added to the impact volume for that depth layer.

J.1.4.2.4 Impact Volume per Explosive Detonation

The detonations of explosive sources are generally widely spaced in time and/or space. This implies that the impact volume for multiple firings can easily be derived by scaling the impact volume for a single detonation. Thus the typical impact volume vector for an explosive source is presented on a per detonation basis.

The one exception to this rule is SINKEX. Impact volume vectors for the representative SINKEX are provided on a per-event basis (that is, representing the cumulative impact of all weapons fired during the event).

J.1.4.3 Impact Volume by Operating Area

The HRC OPAREA is comprised of 20 environmental provinces. The hourly impact volume vector for training events involving any particular source is a linear combination of the 20 volume impact vectors, $\{v_1, v_2, ..., v_{20}\}$, with the weighting determined by the distribution of those 20 environmental provinces within the source's operation area. Unique hourly impact volume vectors for winter and summer are calculated for each type of source and each metric/threshold combination.

J.1.5 EXPOSURES

This section defines the animal densities and their depth distributions for the HRC. This is followed by a series of tables providing exposure estimates per unit of operation for each source type (active sonars and explosives) and for a SINKEX.

J.1.5.1 Animal densities

Densities are usually reported by marine biologists as animals per square kilometer, which is an area metric. This gives an estimate of the number of animals below the surface in a certain area, but does not provide any information about their distribution in depth. The impact volume vector (see Subsection J.1.4.1.3) specifies the volume of water ensonified above the specified threshold in each depth interval. A corresponding animal density for each of those depth intervals is required to compute the expected value of the number of exposures. The two-dimensional area densities do not contain this information, so three-dimensional densities must be constructed by using animal depth distributions to extrapolate the density at each depth. The required depth distributions are presented in next subsection.

Barlow presents density results based on an in-depth analysis of line-transect data collected during vessel surveys conducted within the U.S. Exclusive Economic Zone (EEZ) near the Hawaiian Island Archipelago from August-November 2002 (Barlow, 2006). Results from these surveys were initially published in a NMFS Administrative Report (Barlow, 2003), which is cited for density/abundance values in the RIMPAC report (Gilcrest et al., 2006). However, the Barlow (2006) paper (Barlow, 2006) is a peer-reviewed journal article and represents the "best available information" for this region. The study area and densities provided in Barlow (2006) also overlap entirely with older aerial survey data presented by Mobley (Mobley, et al., 2000); therefore, the "Inshore" densities included in the RIMPAC document are also not necessary nor is their use advised.

Barlow (Barlow, 2006; Table 4) provided abundance for two stratum, the Main Island stratum which covered from the main islands to approximately 75 nautical miles (nm) (140 km) offshore, and the Outer EEZ (OEEZ) stratum which covered the rest of the EEZ (200 nm, 370 km) around the entire Hawaiian island chain (including all 1,500 miles of the chain to the Northwest Hawaiian Islands ending at Kure Atoll). Density and CV were pooled for combined strata only.

Based on the abundance numbers per stratum in Barlow (Barlow, 2006), it would be tempting to apply the pooled densities to only the OEEZ stratum (for those species with 100% occurrence) or divide based on percentage abundance in each strata (e.g., bottlenose dolphins had 14% abundance in Main Island and 86% abundance in OEEZ). However, this is likely not a good idea. Other researchers (Baird et al., 2006; Baird et al., 2005a,b; Baird, 2005) have carried out long-term studies near the Main Hawaiian Islands, and have observed many species, not seen by Barlow (Barlow, 2006) in the Main Island stratum, within 75 nm of the main islands. While these other studies do not provide densities, they do indicate that other species occur close to the islands. Therefore, it is most appropriate to apply densities to the overall area (both strata) exactly as provided in Barlow (Barlow, 2006). The only exceptions to this would be Fraser's dolphin, Longman's beaked whale and Bryde's whale; these three species were seen by Barlow (Barlow, 2006) only in the OEEZ stratum and have not been sighted within 75 nm of the main islands by other researchers either. The densities calculated for these three species by Barlow (Barlow, 2006) can be applied to the OEEZ stratum only (greater than 75 nm from the Main Hawaiian Islands; see Figure 1 in Barlow [Barlow, 2006]).

Barlow (2006) reports on densities for the summer/fall time period. Most of the species for which densities were calculated are resident to the archipelago (i.e., not migratory). Therefore, the densities are applicable year-round. Marine mammals that were not seen by Barlow (2006) occur too rarely to be of concern (right, blue, fin, sei, minke), with two notable exceptions. Humpback whales are seasonal migrants, occurring in the Hawaiian Islands generally from December through April (and therefore were not present during the summer 2002 surveys). The most recent NMFS Alaska Stock Assessment Report (Angliss and Outlaw, 2005) provides an abundance estimate of 4005 for wintering humpback whales in Hawaii, but no density. Mobley et al. (2001) conducted aerial surveys from 1993-2000 over shallow near-shore waters as well as deep pelagic regions (survey lines extended approximately 25 nm offshore). Densities were corrected for availability bias, and the corrected density estimate for 2000 was 0.2186 (CV=0.153), with an abundance of 4,491. This number applies only to winter/spring months and only to areas within 25 nm (46 km) of the Main Hawaiian Islands.

Hawaiian monk seals, an endangered species, are resident throughout the Hawaiian Islands. They are more numerous in the Northwestern Hawaiian Islands where most pupping and foraging occurs (Johanos and Baker, 2005). The most recent population estimate is 1,252 (Carretta et al., 2006), which is applicable to the entire archipelago. However, approximately 77 monk seals are present in and around the Main Hawaiian Islands and spend approximately one-third of the time onshore (hauled-out) according to the Monk Seal Recovery Plan (National Marine Fisheries Service, 2007).

The SMA areas are divided into the percentage of area within 25 nm of Land and beyond 25 nm of Land, based on the offshore surveys by Mobley (Mobley, et al, 2000) and the preliminary analysis by Barlow (Barlow, 2003). Those divisions are not applicable for the densities used here, with the exception of humpback whales.

Each SMA should be assessed in the following manner:

1. Humpback whales—occurrence is limited to offshore areas within 25 nm of land as the only areas to which density/abundance is applied.

2. Monk seals—occurrence is limited to offshore areas only. As noted, monk seals spend approximately one-third of the time hauled-out on shore, and so the potential time for impact on monk seals is reduced by 33%. Monk seals forage in waters generally less than 100 m and occasionally dive to over 500 m (National Marine Fisheries Service 2007). The areas between the shore and 500 m depth, where monk seals are assumed to be concentrated, will be applied for modeling impacts on monk seals.

3. Fraser's dolphin, Bryde's whale, Longman's beaked whale—occurrence appears to be in offshore areas only. Therefore, the percentage of each SMAs that are beyond 75 nm of the Main Hawaiian Islands (see Figure 1 in Barlow [Barlow, 2006]) are the only areas to which density/abundance should be applied.

4. All marine mammal species not specifically noted in #1 and 2 above—occurrence is throughout the Hawaiian Islands including Leeward Islands. Therefore, the percentage of SMAs from 200 nm (370 km) of land (likely 100% for each SMA) are the areas to which density/abundance should be applied.

The animal area densities for the HRC are given in Table J-47.

Table J-47. Hawaiian Islands Animal Densities

Species Name	Scientific Name	Abundance	Area for population (km^2)*	Density ($\#/km^2$)	CV	Area	Season	Reference
Bryde's whale	*B. edeni*	469	N/A	0.0002	0.45	75-200 nm offshore	Year-round	Barlow 2006
Humpback whale	*Megaptera novaeangliae*	4,491	N/A	0.2186	0.15	0-25 nm offshore	Dec-Mar	Mobley et al. 2001
Sperm whale	*Physeter catodon*	6,919	N/A	0.0028	0.81	0-200 nm offshore	Year-round	Barlow 2006
Dwarf sperm whale	*Kogia sima*	17,519	N/A	0.0071	0.74	0-200 nm offshore	Year-round	Barlow 2006
Pygmy sperm whale	*Kogia breviceps*	7,138	N/A	0.0029	1.12	0-200 nm offshore	Year-round	Barlow 2006
Cuvier's beaked whale	*Ziphius cavirostris*	15,242	N/A	0.0062	1.43	0-200 nm offshore	Year-round	Barlow 2006
Longman's beaked whale	*Indopacetus pacificus*	1,007	N/A	0.0004	1.26	75-200 nm offshore	Year-round	Barlow 2006
Blainville's beaked whale	*Mesoplodon densirostris*	2,872	N/A	0.0012	1.25	0-200 nm offshore	Year-round	Barlow 2006
Unidentified beaked whale	*Family Ziphiidae*	371	N/A	0.0002	1.17	0-200 nm offshore	Year-round	Barlow 2006
Bottlenose dolphin	*Tursiops truncatus*	3,215	N/A	0.0013	0.59	0-200 nm offshore	Year-round	Barlow 2006
False killer whale	*Pseudorca crassidens*	236	N/A	0.0001	1.13	0-200 nm offshore	Year-round	Barlow 2006
Killer whale	*Orcinus orca*	349	N/A	0.0001	0.98	0-200 nm offshore	Year-round	Barlow 2006
Pygmy killer whale	*Feresa attenuata*	956	N/A	0.0004	0.83	0-200 nm offshore	Year-round	Barlow 2006
Short-finned pilot whale	*Globicephala macrorhychus*	8,870	N/A	0.0036	0.38	0-200 nm offshore	Year-round	Barlow 2006
Risso's dolphin	*Grampus griseus*	2,372	N/A	0.0010	0.65	0-200 nm offshore	Year-round	Barlow 2006
Melon-headed whale	*Peponocephala electra*	2,950	N/A	0.0012	1.17	0-200 nm offshore	Year-round	Barlow 2006
Rough-toothed dolphin	*Steno bredanensis*	8,709	N/A	0.0036	0.45	0-200 nm offshore	Year-round	Barlow 2006
Fraser's dolphin	*Lagenodelphis hosei*	10,226	N/A	0.0042	1.16	75-200 nm offshore	Year-round	Barlow 2006
Offshore pantropical spotted dolphin	*Stenella attenuata*	8,978	N/A	0.0037	0.48	0-200 nm offshore	Year-round	Barlow 2006
Spinner dolphin	*Stenella longirostris*	3,351	N/A	0.0014	0.74	0-200 nm offshore	Year-round	Barlow 2006
Striped dolphin	*Stenella coeruleoalba*	13,143	N/A	0.0054	0.46	0-200 nm offshore	Year-round	Barlow 2006
Hawaiian monk seal	*Monachus schauinslandi*	1,252	360,000	0.0035	N/A	Offshore Hawaiian Island Archipelago	Year-round	Caretta et al. 2006

* Area was derived via ArcMap (obtaining individual areas for all Main Hawaiian Islands then subtracting those from the overall area of the Hawaiian Island archipelago).

Density for monk seals derived via dividing the abundance from Caretta et al (2006) with the area obtained via ArcMap.

N/A = Not Available

J.1.5.2 Hawaii Range Complex Marine Mammal Depth Distribution Summary

There is very limited depth distribution data for most marine mammals. This is especially true for cetaceans, as they must be tagged at-sea and using a tag that either must be implanted in the skin/blubber in some manner or that adheres to the skin. There is slightly more data for some pinnipeds, as they can be tagged while on shore during breeding or molting seasons and the tags can be glued to the pelage rather than implanted. There are a few different methodologies/techniques that can be used to determine depth distribution percentages, but by far the most widely used technique at this time is the time-depth recorder. These instruments are designed to be attached to the animal for a fairly short period of time (several hours to a few days) via a suction cup, and are retrieved immediately after detachment. Depth information can also be collected via satellite tags, sonic tags, digital tags, and, for sperm whales, via acoustic tracking of sounds produced by the animal itself.

Barlow (Barlow, 2006) provides density values for 20 species (Table 4). There were several species/species groups seen during the 2002 survey for which no abundance/density was calculated; these species are not included in the depth distribution analysis. Monk seals are present year-round and humpbacks are seasonally present in shallow waters of the Hawaiian Islands, bringing the total number of species requiring depth distribution data to 22. Of these 22, there are somewhat suitable depth distribution data for 10. Sample sizes are extremely small for these 10 species, usually fewer than 10 animals total and often only one or two animals. Depth distribution information often must be interpreted from other dive and or preferred prey characteristics, so confidence in any of these depth distributions is not high. However, these depth distribution data represent the “best available” at this time. Depth distributions for the remaining 12 cetaceans in the Hawaiian Islands area have been extrapolated from similar species to provide the “best available” depth distribution information.

Monk seals forage most frequently in less than 100-m depth but have been recorded foraging to 500-m depth.

J.1.5.2.1 Depth Distributions for Mysticetes

Bryde’s whale (*B. edeni*)––There are no depth distribution data for this species. They feed on small schooling fish and krill. They are quite a bit smaller than fin whales (13 feet versus 21 feet) but still closer in size to fins than to blue whales. Therefore, in light of the total lack of data for this species, fin whale (*Balaenoptera physalus*) depth distribution data will be extrapolated to Bryde’s whales. Fin whale data from Ligurian Sea are the most complete (Panigada et al., 2003), and showed differences between day and night diving; daytime dives were shallower (within 100 m) and night dives were deeper (>400 m), likely taking advantage of nocturnal prey migrations into shallower depths; this data may be atypical of fin whales elsewhere in areas where they do not feed on vertically-migrating prey. Goldbogen (Goldbogen, et al. 2006) studied fins in southern CA and found that 60% of total time was spent diving, with the other 40% near surface (<50 m); dives were to >225 m and were characterized by rapid gliding ascent, foraging lunges near the bottom of dive, and rapid ascent with flukes. Dives are somewhat V-shaped, although the bottom of the V is wide. Therefore, percent of time at depth levels for fin whales could be estimated as 40% at <50 m, 20% at 50 to 225 m (covering the ascent and descent times) and 40% at >225 m.

Humpback whales (*Megaptera novaeangliae*)—In a feeding area (Greenland), 37% of time was spent at <4 m, 25% of time 4-20 m, 7% of time 20-35 m, 4% of time 35-50 m, 6% of time 50-100 m, 7% of time 100-150 m, 8% of time 150-200 m, 6% of time 200-300 m, <1% at >300 m (Dietz et al., 2002). In a non-feeding area (HI), humpbacks spent 40% of time in 0-10 m, 27% in 11-20 m, 12% in 21-30 m, 4% in 31-40 m, 3% in 41-50 m, 2% in 51-60 m, 2% in 61-70 m, 2% in 71-80 m, 2% in 81-90 m, 2% in 91-100 m, 1% in 101-110 m, 1% in 111-120 m, 1% in 121-130 m, 1% in 131-140 m, and <1% in <140 m depth (Baird et al., 2000, Table 3).

J.1.5.2.2 Depth Distributions for Odontocetes

<u>Sperm whale</u> (*Physeter catodon,* aka *Physeter macrocephalus*)—Unlike other cetaceans, there is a preponderance of dive information for this species, most likely because it is the deepest diver of all species and so generates a lot of interest (and funding). Sperm whales feed on large and medium-sized squid, octopus, rays and sharks, on or near the ocean floor. Some evidence suggests that they do not always dive to the bottom of the sea floor (likely if food is elsewhere in the water column), but that they do generally feed at the bottom of the dive. The most consistent dive type recorded is U-shaped, whereby the whale makes a rapid descent to the bottom of the dive, forages at various velocities while at depth (likely while chasing prey) and then ascends rapidly to the surface. Perhaps the best source for depth distribution data comes from Amano and Yoshioka (2003), who attached a tag to a female sperm whale near Japan in an area where water depth was 1,000-1,500 m. Based on values in Table 1 for dives with active bottom periods, the total dive sequence was 45.9 min (mean surface time plus dive duration). Mean surface time divided by total time (8.5/45.9) yields a percent of time at the surface (0-2 m) of 19%. Mean bottom time divided by total time (17.5/45.9) yields a percent of time at the bottom of the dive (in this case >800 m as the mean maximum depth was 840 m) of 38%. Total time in the water column descending or ascending equals duration of dive minus bottom time (37.4-17.5) or ~20 minutes. Assuming a fairly equal descent and ascent rate (as shown in the table) and a fairly consistent descent/ascent rate over depth, we assume 10 minutes each for descent and ascent and equal amounts of time in each depth gradient in either direction. Therefore, 0-200 m = 2.5 minutes one direction (which correlates well with the descent/ascent rates provided) and therefore 5 minutes for both directions. Same for 201-400 m, 401-600 m and 601-800 m. Therefore, the depth distribution for sperm whales based on information in the Amano paper is: 19% in 0-2 m, 10% in 2-200 m, 11% in 201-400 m, 11% in 401-600 m, 11% in 601-800 m and 38% in >800 m. The percentages derived above from data in Amano and Yoshioka (2003) are in fairly close agreement with those derived from Table 1 in Watwood et al. (2006) for sperm whales in the Ligurian Sea, Atlantic Ocean, and Gulf of Mexico.

<u>Dwarf sperm whale</u> (*Kogia sima)*—There are no depth distribution data for this species. Prey preference appears to be cephalopods, crustaceans and fish, and there is some evidence that they feed at the bottom. In lieu of any other information, Blainville's beaked whale depth distribution data will be extrapolated to dwarf sperm whales as the two species appear to have similar prey preferences and Kogia sp. are closer in size to Blainville's than to sperm or Cuvier's beaked whales.

<u>Pygmy sperm whale</u> (*Kogia breviceps*)—There are no depth distribution data for this species. An attempt to record dive information on a rehabilitated pygmy sperm whale failed when the TDR package was never recovered (Scott et al., 2001). Prey preference appears to be cephalopods, crustaceans and fish, and there is some evidence that they feed at the bottom. In lieu of any other information, Blainville's beaked whale depth distribution data will be extrapolated to pygmy sperm whales as the two species appear to have similar prey preferences and Kogia sp. are closer in size to Blainville's than to sperm or Cuvier's beaked whales.

Cuvier's beaked whale (*Ziphius cavirostris*)—Studies in Hawaii (Baird et al., 2005a; Baird et al., 2006) found that this species undertook three or four different types of dives, including intermediate (to depths of 292-568 m), deep (>1,000 m) and short-interventilation (within 2-3 m of surface). Studies in the Canary Islands indicated that Cuvier's beaked whales dived to >1,000 m and usually started "clicking" (actively searching for prey) around 475 m (Johnson et al., 2004; Soto et al, 2006). Clicking continued at depths and ceased once ascent to the surface began, indicating active foraging at depth. In both locations, Cuvier's spent more time in deeper water than did Blainville's, although maximum dive depths were similar. There was no significant difference between day and night diving indicating that preferred prey likely do not undergo vertical migrations. To determine depth distribution data for this species, the graph representing daytime dives in Figure 5 in Baird et al. (2005a) was used. It would appear that ~15% of total time is spent in 0-100 m depth, ~13% from 101-200 m depth, ~22% from 201-300 m depth, ~13% from 301-600 m depth, ~6% from 601-800 m depth, ~11% from 801-1,000 m depth, and 20% at >1000 m. These data are representative of only one animal so, like all the other depth distribution data, are very limited in scope.

Longman's beaked whale (aka Tropical bottlenose whale) (*Indopacetus pacificus*)—There are no depth distribution data for this species, and preferred prey species are also unknown. There has been one study on northern bottlenose whales, *Hyperoodon ampullatus*, which provides some guidance as to depth distribution (Hooker and Baird, 1999). Most (62-70%, average = 66%) of the time was spent diving (>40 m), and most dives were somewhat V-shaped. Both shallow dives (<400 m) and deep dives (>800 m) were recorded, and whales spent 24-30% (therefore, average of 27%) of dives at 85% maximum depth indicating they feed near the bottom. Using these data points, we estimate 34% of time at 0-40 m, 39% at 41-800 m, 27% at >800 m for *H. ampullatus* and extrapolate this to *I. pacificus*.

Blainville's beaked whale (*Mesoplodon densirostris)*—Studies in Hawaii (Baird et al., 2004; 2005a; 2006) found that this species undertook several different types of dives, including shallow (0-50 m with most time at 0-20 m), deep (mean maximum of 890 and 1,408 m) and short-interventilation (within 2-4 m of surface). Studies in the Canary Islands indicated that Blainville's beaked whales dived to >655 m and usually started "clicking" (actively searching for prey) around 200-570 m (Johnson et al., 2004). Clicking continued at depths and ceased once ascent to the surface began, indicating active foraging at depth. To determine depth distribution data for this species, the top two left-side graphs in Figure 6 in Baird et al. (2005a) were used. It would appear that ~48% of total time is spent in 0-50 m depth, ~11% from 51-100 m depth, ~11% from 101-200 m depth, ~9% from 201-500 m depth, ~5% from 501-800 m depth, ~5% from 801-1,000 m depth, and 11% at >1,000 m. This data is representative of only two animals, so like all the other depth distribution data is very limited in scope.

Unidentified beaked whale (Family Ziphiidae)—This encompasses all beaked whales and several genera that might be found offshore Hawaii. Based on the total lack of additional information about what this species may have been, suggest using the limited dive information available for Cuvier's beaked whale.

Bottlenose dolphin (*Tursiops truncatus)*—There have been a few studies on bottlenose dolphin depth distributions. Corkeron and Martin (2004) reported that two dolphins spent 66% of time in top 5 m of water surface; maximum dive depth was greater than 150 m, and there was no apparent diurnal pattern. Based on this study plus information from Hastie et al. (2006), the following depth distribution has been estimated for bottlenose dolphins: 66% of time at 0-10 m, 12% at 11-20 m, 12% at 21-30 m, 5% at 31-40 m, 4% at 41-50 m, and 1% at >50 m.

False killer whale (*Pseudorca crassidens*)—The only study conducted on false killer whales diving in Hawaii has not been published in any detail (Ligon and Baird, 2001), but an abstract provides limited information. False killer whales did not dive deep and instead recorded maximum dives of 22, 52, and 53 m in near-shore Hawaii waters. Based on the nearly total lack of data for this species, suggest using the limited dive information available for killer whales.

Killer whale (*Orcinus orca*)—Diving studies on killer whales have been undertaken mainly on "resident" (fish-eating) killer whales in the Puget Sound and are likely not applicable across all populations of killer whales. Diving is usually related to foraging, and mammal-eating killer whales may display different dive patterns. Killer whales in one study (Baird et al., 2005b) dove as deep as 264 m, and males dove more frequently and more often to depths >100 m than females, with fewer deep dives at night. Using best available data from Baird et al. (2003a), it would appear that killer whales spend ~4% of time at depths >30 m and 96% of time at depths <30 m. Dives to deeper depths were often characterized by velocity bursts which may be associated with foraging or social activities.

Pygmy killer whale (*Feresa attenuata*)—There are no depth distribution data for this species, and there is little information on prey preference. In lieu of any other information, killer whale depth distribution data will be extrapolated to pygmy killer whales.

Short-finned pilot whale (*Globicephala macrorhychus*)—The only study conducted on short-finned pilot whales in Hawaii has not been published in any detail (Baird et al., 2003b), but an abstract did indicate that there are significant differences between day and night diving; dives of >100m were far more frequent at night, likely to take advantage of vertically-migrating prey; night dives regularly went to 300-500 m. Deepest dives were during the day, however, perhaps because prey was deeper. A closely-related species, the long-finned pilot whale, also shows marked differences in daytime and nighttime diving in studies in the Ligurian Sea (Baird et al., 2002), but there is no information on percent of time at various depth categories. A study following two rehabilitated and released long-finned pilot whales provides a breakdown of percent of time at depth distribution for two whales (Nawojchik et al., 2003). Averaging the values for the two whales results in the following depth distribution breakdown: 64% at <15 m, 19% at 16-50 m, 7% at 51-100m, 4% at 101-150 m, 5% at 151-200 m, 1% at 201-250 m and <1% at >250 m. As the same type of detailed dive depth distribution is not available for SF pilot whales, these numbers will have to suffice.

Risso's dolphin (*Grampus griseus*)—There are no depth distribution data for this species. They are primarily squid eaters and feeding is presumed to take place at night. In lieu of any other information, short-finned pilot whale depth distribution data will be extrapolated to Risso's dolphins.

Melon-headed whale (*Peponocephala electra*)—There are no depth distribution data for this species. They are primarily squid and pelagic fish eaters and at least some feeding is presumed to take place at fairly deep depth. In lieu of any other information, short-finned pilot whale depth distribution data will be extrapolated to melon-headed whales.

Rough-toothed dolphin (*Steno bredanensis*)—There are no depth distribution data for this species. They are believed to be deep divers and feeders. In lieu of any other information, spinner dolphin depth distribution data will be extrapolated for rough-toothed dolphins.

Fraser's dolphin (*Lagenodelphis hosei*—Studies on diving by this species have not been undertaken, but studies of stomach contents in the eastern tropical Pacific and Sulu Sea indicate that they eat myctophid fish as well as cephalopods and crustaceans (Dolar et al., 2003). Based on prey species, this species apparently regularly feeds in deeper waters than spinner dolphins as several of its major prey items are regularly found between 600 and 1,000 m. It is believed that Fraser's dolphins also feed mainly at night. Based on this very limited information, the following are very rough order estimates of time at depth: daytime: 100% at 0-50 m; nighttime: 100% at 0-700 m.

Offshore pantropical spotted dolphin (*Stenella attenuata)*—One study on this species in Hawaii contains dive information (Baird et al., 2001). The biggest differences recorded were in the increase in dive activity at night. During the day, 89% of time was spent within 0-10 m, most of the rest of the time was 10-50 m, and the deepest dive was to 122 m. At night, only 59% of time was spent from 0-10 m and the deepest dive was to 213 m; dives were especially pronounced at dusk. For activities conducted during daytime-only, the depth distribution would be 89% at 0-10 m and 11% at 11-50 m, with <1% at 51-122 m. For activities conducted over a 24-hour period, the depth distribution needs to be modified to reflect less time at surface and deeper depth dives; 80% at 0-10 m, 8% at 11-20 m, 2% at 21-30 m, 2% at 31-40 m, 2% at 41-50 m, and 6% at 51-213 m.

Spinner dolphin (*Stenella longirostris*)—Studies on spinner dolphins in Hawaii have been carried out using active acoustics (fish-finders) (Benoit-Bird and Au, 2003). These studies show an extremely close association between spinner dolphins and their prey (small, mesopelagic fishes). Mean depth of spinner dolphins was always within 10 m of the depth of the highest prey density. These studies have been carried out exclusively at night, as stomach content analysis indicates that spinners feed almost exclusively at night when the deep scattering layer moves toward the surface bringing potential prey into relatively shallower (0-400 m) waters. Prey distribution during the day is estimated at 400-700 m. Based on these data, the following are very rough order estimates of time at depth: daytime: 100% at 0-50 m; nighttime: 100% at 0-400 m.

Striped dolphin (*Stenella coeruleoalba*)—Studies are rare on this species. In lieu of any other information, pantropical spotted dolphin depth distribution data will be extrapolated to striped dolphins.

J.1.5.2.3 Depth Distributions of Pinnipeds

Hawaiian monk seal (*Monachus schauinslandi*)—There have been several recent studies on foraging patterns by monk seals near rookeries in the Northwestern Hawaiian Islands. Dive depths appear to differ slightly between rookeries as well as between age and sex classes. At Pearl and Hermes Reef, most dives were from 8-40 m with a second much smaller node at 100-120 m (Stewart, 2004). At Kure Atoll, most dives were shallower than 40 m, with males tending to dive deeper than females (Stewart and Yochem, 2004a). At Laysan Island, a similar dive pattern was recorded with most dives shallower than 40 m, but at that location females tended to dive deeper than males (250-350 m) (Stewart and Yochem, 2004b). Parrish et al (2002) noted a tendency towards night diving at French Frigate Shoals, with dives to ~80-90 m. The recent monk seal recovery plan update summarizing this data indicates that monk seals generally forage at depths less than 100 m but occasionally dive to over 500 m (National Marine Fisheries Service 2007). Based on these data, the following are rough order estimates of time at depth: 90% at 0-40 m; 9% at 40-120 m; 1% at >120 m.

J.1.5.3 Exposure Estimates

The following sperm whale example demonstrates the methodology used to create a three-dimensional density by merging the area densities with the depth distributions. The sperm whale surface density is 0.0028 whales per square kilometer. From the depth distribution report, "depth distribution for sperm whales based on information in the Amano paper is: 19% in 0-2 m, 10% in 2-200 m, 11% in 201-400 m, 11% in 401-600 m, 11% in 601-800 m and 38% in >800 m." So the sperm whale density at 0 to 2 m is (0.0028*0.19/0.002 =) 0.266 per cubic km, at 2-200 m is (0.0028*0.10/0.198 =) 0.001414 per cubic km, and so forth.

In general, the impact volume vector samples depth in finer detail than given by the depth distribution data. When this is the case, the densities are apportioned uniformly over the appropriate intervals. For example, suppose the impact volume vector provides volumes for the intervals 0 to 2 m, 2 to 10 m, and 10 to 50 m. Then for the depth-distributed densities discussed in the preceding paragraph:

- 0.266 whales per cubic km is used for 0 to 2 m,
- 0.001414 whales per cubic km is used for the 2 to 10 m, and
- 0.001414 whales per square km is used for the 10 to 50 m.

Once depth-varying, three-dimensional densities are specified for each species type, with the same depth intervals and the ensonified volume vector, the density calculations are finished. The expected number of ensonified animals within each depth interval is the ensonified volume at that interval multiplied by the volume density at that interval, and this can be obtained as the dot product of the ensonified volume and animal density vectors.

Since the ensonified volume vector is the ensonified volume per unit operation (i.e., per hour, per sonobuoy, etc), the final exposure count for each animal is the unit operation exposure count multiplied by the number of units (hours, sonobuoys, etc). The tables below are organized by alternative and threshold level; each table represents the total yearly exposures modeled at different threshold levels for each alternative. For sonar sources, exposures are reported at the appropriate risk function level, TTS, and PTS.

The number of total exposures at different threshold levels for each alternative are presented in Section 4.1.2 in Volume 2 of the HRC EIS/OEIS.

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J.2 RISK FUNCTION MODELING

J.2.1 RISK FUNCTION: THEORETICAL AND PRACTICAL IMPLEMENTATION

This section discusses the recent addition of a risk function "threshold" to acoustic effects analysis procedure. This approach includes two parts, a new metric, and a function to map exposure level under the new metric to probability of harassment. What these two parts mean, how they affect exposure calculations, and how they are implemented are the objects of discussion.

J.2.1.1 Thresholds and Metrics

The term "thresholds" is broadly used to refer to both thresholds and metrics. The difference, and the distinct roles of each in effects analyses, will be the foundation for understanding the risk function approach, putting it in perspective, and showing that, conceptually, it is similar to past approaches.

Sound is a pressure wave, so at a certain point in space, sound is simply rapidly changing pressure. Pressure at a point is a function of time. Define p(t) as pressure (in micropascals) at a given point at time t (in seconds); this function is called a “time series.” Figure J-7 gives the time series of the first “hallelujah” in Handel's Hallelujah Chorus.

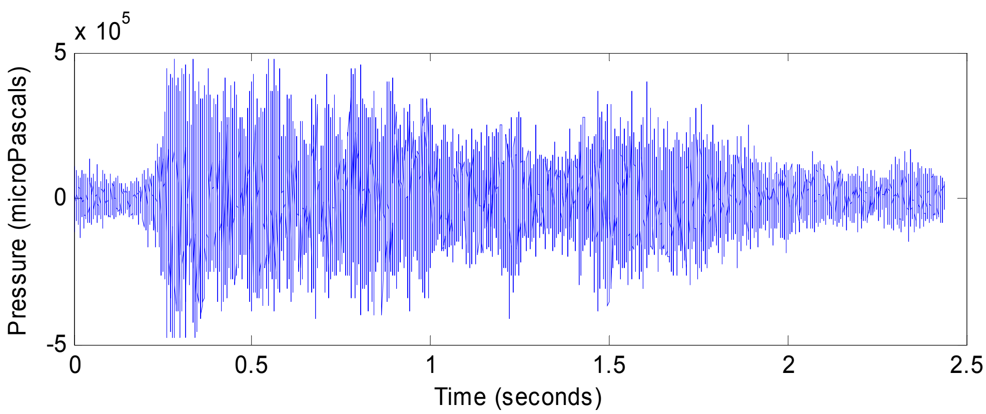

Figure J-7. Time Series

The time-series of a source can be different at different places. Therefore, sound, or pressure, is not only a function of time, but also of location. Let the function p(t), then be expanded to p(t;x,y,z) and denote the time series at point (x,y,z) in space. Thus, the series in Figure J-7 p(t) is for a given point (x,y,z). At a different point in space, it would be different.

Assume that the location of the source is (0,0,0) and this series is recorded at (0,10,-4). The time series above would be p(t;0,10,-4) for 0<t<2.5.

As in Figure J-7, pressure can be positive or negative, but usually the function is squared so it is always positive; this makes integration meaningful. Figure J-8 is $p^2(t;0,10,-4)$.

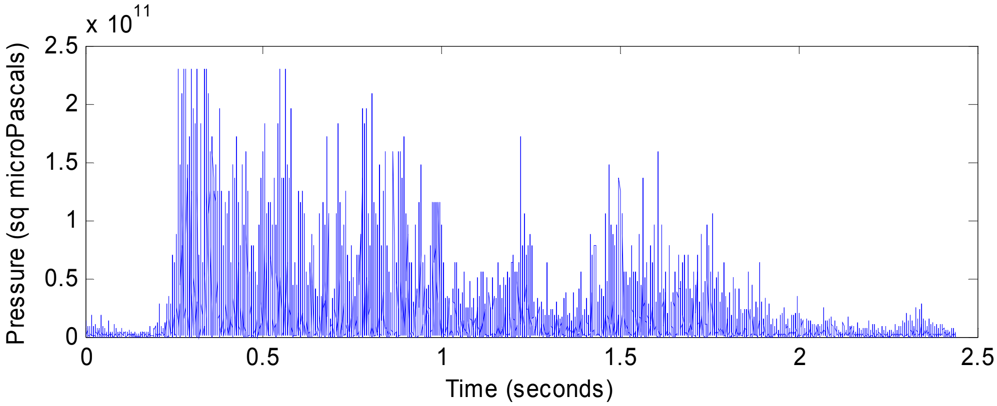

Figure J-8. Time Series Squared

The metric chosen to evaluate the sound field at the end of this first "hallelujah" determines how the time series is summarized from thousands of points, as in Figure J-7, to a single value for each point (x,y,z) in the space. The metric essentially "boils down" the four dimensional p(t,x,y,z) into a three dimensional function m(x,y,z) by dealing with time. There is more than one way to summarize the time component, so there is more than one metric.

Max SPL

One way to summarize $p^2(t;x,y,z)$ to one number over the 2.5 seconds is to only report the maximum value of the function over time or,

$$SPL_{\max} = \max\{p^2(t,x,y,z)\} \text{ for } 0<t<2.5$$

The $SPL_{\max}$ for this snippet of the Hallelujah Chorus is $2.3 \times 10^{11}\ \mu Pa^2$ and occurs at 0.2825 seconds, as shown in Figure J-9.

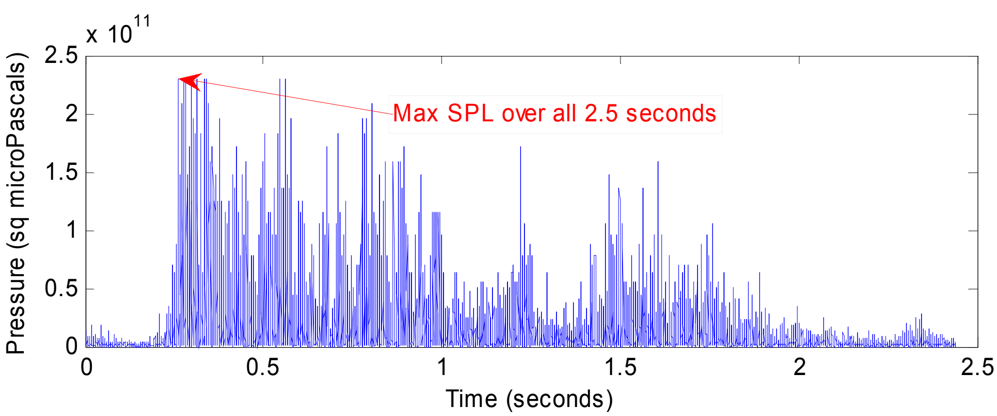

Figure J-9. Max SPL of Time Series Squared

Integration

$SPL_{\max}$ is not necessarily influenced by the duration of the sound (2.5 seconds in this case). Integrating the function over time does take this duration into account. A simple integration of $p^2(t;x,y,z)$ over t is common and usually called "energy."

$Energy = \int_0^T p^2(t,x,y,z)dt$ where T is the maximum time of interest, in this case 2.5

The energy for this snippet of the Hallelujah Chorus is $1.24 \times 10^{11}\ \mu Pa \cdot s$.

Energy is sometimes called "equal energy" because if p(t) is a constant function and the duration is doubled, the effect is the same as doubling the signal amplitude (y value). Thus, the duration and the signal have an "equal" influence on the energy metric.

Mathematically,

$$\int_0^{2T} p(t)^2\,dt = 2\int_0^T p(t)^2\,dt = \int_0^T 2p(t)^2\,dt$$

or a doubling in duration equals a doubling in energy equals a doubling in signal.

Sometimes, the integration metrics are referred to as having a "3 dB exchange rate" because if the duration is doubled, this integral increases by a factor of two, or 10log10(2)=3.01 dB. Thus, equal energy has "a 3 dB exchange rate."

After p(t) is determined (i.e., when the stimulus is over), propagation models can be used to determine p(t;x,y,z) for every point in the vicinity and for a given metric. Define

$m_a(x,y,z,T) =$ value of metric "a" at point (x,y,z) after time T

So,

$$m_{energy}(x,y,z;T) = \int_0^T p(t)^2\,dt$$

$$m_{\max SPL}(x,y,z;T) = \max(p(t))\ over\ [0,T]$$

Since modeling is concerned with the effects of an entire event, T is usually implicitly defined: a number that captures the duration of the event. This means that $m_a(x,y,z)$ is assumed to be measured over the duration of the received signal.

Three Dimensions vs Two Dimensions

To further reduce the calculation burden, it is possible to reduce the domain of $m_a(x,y,z)$ to two dimensions by defining $m_a(x,y) = \max\{m_a(x,y,z)\}$ over all z.

This reduction is not used for this analysis, which is exclusively three-dimensional.

Threshold

For a given metric, a threshold is a function that gives the probability of exposure at every value of m_a. This threshold function will be defined as

$$D(m_a(x,y,z)) = \Pr(effect\ at\ m_a(x,y,z))$$

The domain of D is the range of $m_a(x,y,z)$, and its range is the number of thresholds.

An example of threshold functions is the Heavyside (or unit step) function, currently used to determine permanent and temporary threshold shift (PTS and TTS) in cetaceans. For PTS, the metric is $m_{energy}(x,y,z)$, defined above, and the threshold function is a Heavyside function with a discontinuity at 215 dB, shown in Figure J-10.

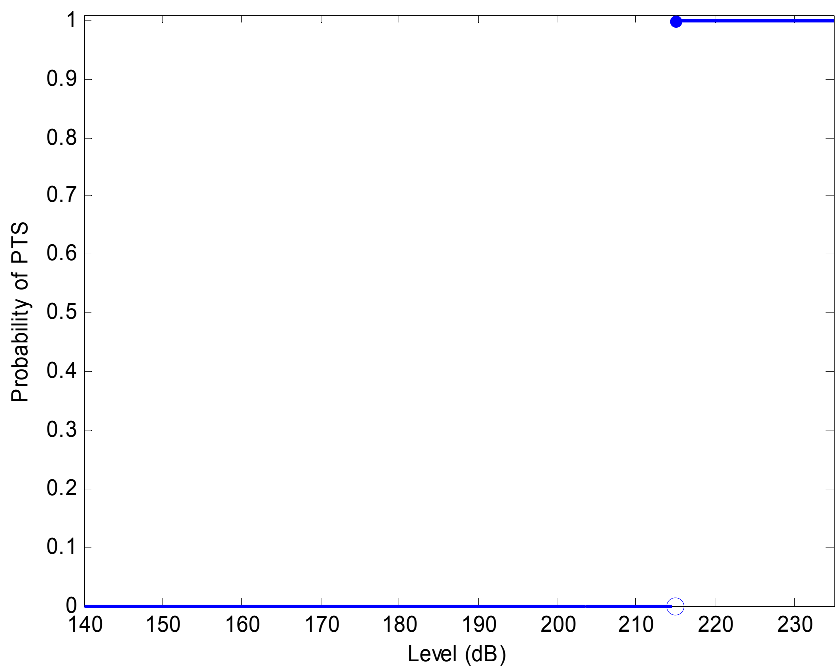

Figure J-10. PTS Heavyside Threshold Function

Mathematically, this D is defined as:

$$D(m_{energy}) = \begin{cases} 0 \ for\ m_{energy} < 215 \\ 1 \ for\ m_{energy} \geq 215 \end{cases}$$

Any function can be used for D, as long as its range is in [0,1]. The risk function as described in U.S. Department of the Navy (2001), uses the mathematical function below as adapted from a solution in Feller (1968).

$$R = \frac{1-\left(\frac{L-B}{K}\right)^{-A}}{1-\left(\frac{L-B}{K}\right)^{-2A}}$$

Where: R = risk (0 – 1.0);
L = Received Level (RL) in dB;
B = basement RL in dB; (120 dB);
K = the RL increment above basement in dB at which there is 50 percent risk;
A = risk transition sharpness parameter (10) (explained in 3.1.5.3).

Multiple Metrics and Thresholds

It is possible to have more than one metric, and more than one threshold in a given metric. For example, in this document, humpback whales have two metrics (energy and max SPL), and three thresholds (two for energy, one for max SPL). The energy thresholds are heavyside functions, as described above, with discontinuities at 215 and 195 for PTS and TTS respectively.

J.2.1.2 Calculation of Expected Exposures

Determining the number of expected exposures for disturbance is the object of this analysis.

Expected exposures in volume V= $\int_V \rho(V)D(m_a(V))dV$

For this analysis, $m_a = m_{\max SPL}$, so

$$\int_V \rho(V)D(m_a(V))dV = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\rho(x,y,z)D(m_{\max SPL}(x,y,z))dxdydz$$

In this analysis, the densities are constant over the x/y plane, and the z dimension is always negative, so this reduces to

$$\int_{-\infty}^{0}\rho(z)\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}D(m_{\max SPL}(x,y,z))dxdydz$$

Numeric Implementation

Numeric integration of $\int_{-\infty}^{\infty}\rho(z)\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}D(m_{\max SPL}(x,y,z))dxdydz$ can be involved because, although the bounds are infinite, D is non-negative out to 120 dB, which, depending on the environmental specifics, can drive propagation loss calculations and their numerical integration out to more approximately 120 km (65 nautical miles) from an AN/SQS 53 sonar having a source level of 235 dB.

The first step in the solution is to separate out the x/y-plane portion of the integral:

Define f(z)= $\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z))dxdy$.

Calculation of this integral is the most involved and time consuming part of the calculation. Once it is complete,

$$\int_{-\infty}^{0}\rho(z)\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z))dxdydz = \int_{-\infty}^{0}\rho(z)f(z)dz,$$

which, when numerically integrated, is a simple dot product of two vectors.

Thus, the calculation of f(z) requires the majority of the computation resources for the numerical integration. The rest of this section presents a brief outline of the steps to calculate f(z) and preserve the results efficiently.

The concept of numerical integration is, instead of integrating over continuous functions, to sample the functions at small intervals and sum the samples to approximate the integral. The smaller the size of the intervals, the closer the approximation, but the longer the calculation, so a balance between accuracy and time is determined in the decision of step size. For this analysis, z is sampled in 5-m steps to 1,000 m in depth and 10-m steps to 2,000 m, which is the limit of animal depth in this analysis. The step size for x is 5 m, and y is sampled with an interval that increases as the distance from the source increases. Mathematically,

$$z \in Z = \{0,5,...1000,1010,...,2000\}$$
$$x \in X = \{0,\pm5,...,\pm5k\}$$
$$y \in Y = \{0,\pm5(1.005)^0, 5\pm(1.005)^1, \pm5(1.005)^2,...,5(1.005)^j\}$$

for integers k,j, which depend on the propagation distance for the source. For this analysis, k=20,000 and j=600.

With these steps, $f(z_0) = \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z_0))dxdy$ is approximated as

$$\sum_{i\in Y}\sum_{j\in X} D(m_{\max SPL}(x,y,z_0))\left[\left(x_{j+\frac{j}{|j|}} - x_j\right)\left(y_{i+\frac{i}{|i|}} - y_i\right)\right]$$

where X,Y are defined as above.

This calculation must be repeated for each $z_0 \in Z$, to build the discrete function f(z).

With the calculation of f(z) complete, the integral of its product with $\rho(z)$ must be calculated to complete evaluation of

$$\int_{-\infty}^{\infty}\rho(z)\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} D(m_{\max SPL}(x,y,z))dxdydz = \int_{-\infty}^{0}\rho(z)f(z)dz$$

Since f(z) is discrete, and $\rho(z)$ can be readily made discrete,

$\int_{-\infty}^{0} \rho(z) f(z) dz$ is approximated numerically as $\sum_{z \in Z} \rho(z) f(z)$, a dot product.

Preserving Calculations for Future Use
Calculating f(z) is the most time-consuming part of the numerical integration, but the most time-consuming portion of the entire process is calculating $m_{\max SPL}(x, y, z)$ over the area range required for the minimum basement value (120 dB). The calculations usually require propagation estimates out to over 100 km, and those estimates, with the beam pattern, are used to construct a sound field that extends 200 km x 200 km—40,000 sq km, with a calculation at the steps for every value of X and Y, defined above. This is repeated for each depth, to a maximum of 2,000 m.

Saving the entire $m_{\max SPL}(x, y, z)$ for each z is unrealistic, requiring great amounts of time and disk space. Instead, the different levels in the range of $m_{\max SPL}(x, y, z)$ are sorted into 0.5 dB wide bins; the volume of water at each bin level is taken from $m_{\max SPL}(x, y, z)$, and associated with its bin. Saving this, just the amount of water ensonified at each level, at 0.5 dB resolution, preserves the ensonification information without using the space and time required to save $m_{\max SPL}(x, y, z)$ itself. Practically, this is a histogram of occurrence of level at each depth, with 0.5 dB bins. Mathematically, this is simply defining the discrete function V(L,z), where L=.5a for every $a \in R_1$. These functions, or histograms, are saved for future work. The information lost by saving only the histograms is *where* in space the different levels occur, although *how often* they occur is saved. But the thresholds (risk function curves) are purely a function of level, not location, so this information is sufficient to calculate f(z).

Applying the risk function to the histograms is a dot product:

$$\sum_{L \in R_1} D(L) V(L, z_0) \approx \int_{-\infty}^{\infty} \rho(z) \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} D(m_{\max SPL}(x, y, z)) dx dy dz$$

So, once the histograms are saved, neither $m_{\max SPL}(x, y, z)$ nor f(z) must be recalculated to generate $\int_{-\infty}^{\infty} \rho(z) \int_{-\infty}^{\infty} \int_{-\infty}^{\infty} D(m_{\max SPL}(x, y, z)) dx dy dz$ for a new threshold function.

For the interested reader, the following section includes an in-depth discussion of the method, software, and other details of the f(z) calculation.

J.2.1.3 Software Detail

The risk function metric uses the cumulative normal probability distribution to determine the probability that an animal is affected by a given sound pressure level. The probability distribution is defined by the risk function presented above. The acoustic quantity of interest is the maximum sound pressure level experienced over multiple pings in a range-independent environment. The procedure for calculating the impact volume at a given depth is relatively simple.

In brief, given the sound pressure level of the source and the transmission loss (TL) curve, the sound pressure level is calculated on a volumetric grid. For a given depth, volume associated with a sound pressure level interval is calculated. Then, this volume is multiplied by the probability that an animal will be affected by that sound pressure level. This gives the impact volume for that depth, that can be multiplied by the animal densities at that depth, to obtain the number of animals affected at that depth. The process repeats for each depth to construct the impact volume as a function of depth.

The case of a single emission of sonar energy, one ping, illustrates the computational process in more detail. First, the sound pressure levels are segregated into a sequence of bins that cover the range encountered in the area. The sound pressure levels are used to define a volumetric grid of the local sound field. The impact volume for each depth is calculated as follows: for each depth in the volumetric grid, the sound pressure level at each x/y plane grid point is calculated using the sound pressure level of the source, the TL curve, the horizontal beam pattern of the source, and the vertical beam patterns of the source. The sound pressure levels in this grid become the bins in the volume histogram. Figure J-11 shows a volume histogram for a low power sonar. Level bins are 0.5 dB in width and the depth is 50 m in an environment with water depth of 100 m. The oscillatory structure at very low levels is due the flattening of the TL curve at long distances from the source, which magnifies the fluctuations of the TL as a function of range. The “expected” impact volume for a given level at a given depth is calculated by multiplying the volume in each level bin by the risk function probability function at that level. Total expected impact volume for a given depth is the sum of these “expected” volumes. Figure J-12 is an example of the impact volume as a function of depth at a water depth of 100 m.

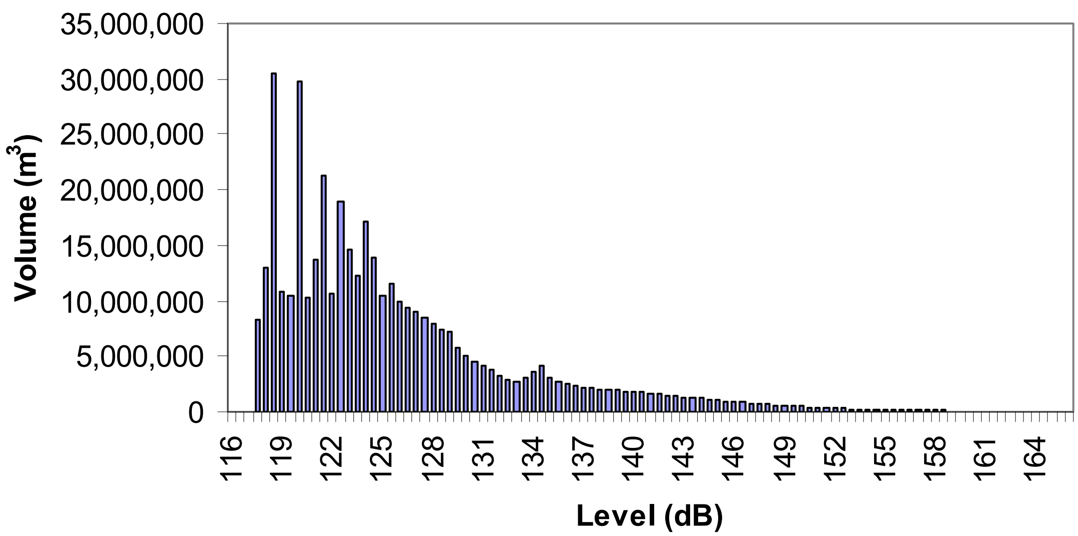

Figure J-11. Example of a Volume Histogram

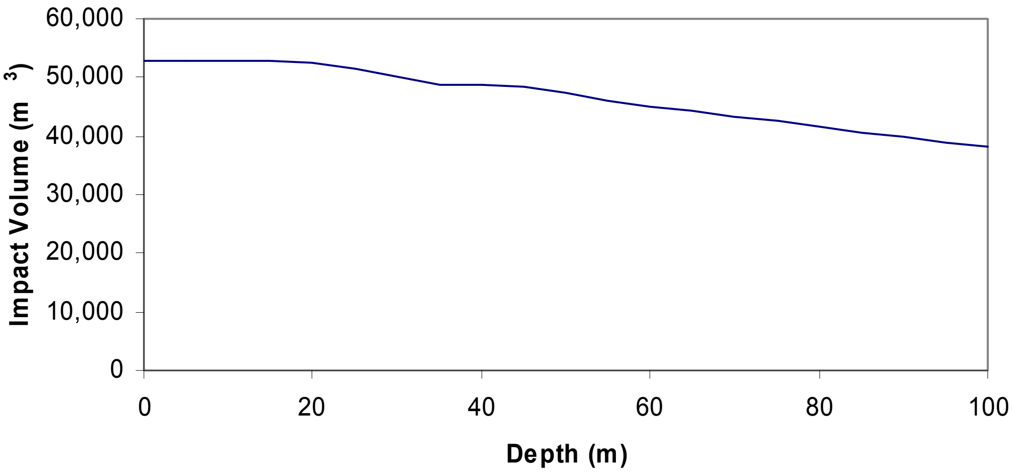

Figure J-12. Example of the Dependence of Impact Volume on Depth

The volumetric grid covers the waters in and around the area of sonar operation. The grid for this analysis has a uniform spacing of 5 m in the x-coordinate and a slowly expanding spacing in the y-coordinate that starts with 5 m spacing at the origin. The growth of the grid size along the y-axis is a geometric series. Each successive grid size is obtained from the previous by multiplying it by 1+Ry, where Ry is the y-axis growth factor. This forms a geometric series. The n^{th} grid size is related to the first grid size by multiplying by $(1+Ry)^{(n-1)}$. For an initial grid size of 5 m and a growth factor of 0.005, the 100^{th} grid increment is 8.19 m. The constant spacing in the x-coordinate allows greater accuracy as the source moves along the x-axis. The slowly increasing spacing in y reduces computation time, while maintaining accuracy, by taking advantage of the fact that TL changes more slowly at longer distances from the source. The x- and y-coordinates extend from –Rmax to +Rmax, where Rmax is the maximum range used in the TL calculations. The z direction uses a uniform spacing of 5 m down to 1,000 m and 10 m from 1,000 to 2,000 m. This is the same depth mesh used for the effective energy metric as described above. The depth mesh does not extend below 2,000 m, on the assumption that animals of interest are not found below this depth.

The next three figures indicate how the accuracy of the calculation of impact volume depends on the parameters used to generate the mesh in the horizontal plane. Figure J-13 shows the relative change of impact volume for one ping as a function of the grid size used for the x-axis. The y-axis grid size is fixed at 5 m and the y-axis growth factor is 0, i.e., uniform spacing. The impact volume for a 5 m grid size is the reference. For grid sizes between 2.5 and 7.5 m, the change is less than 0.1%. A grid size of 5 m for the x-axis is used in the calculations. Figure J-14 shows the relative change of impact volume for one ping as a function of the grid size used for the y-axis. The x-axis grid size is fixed at 5 m and the y-axis growth factor is 0. The impact volume for a 5 m grid size is the reference. This figure is very similar to that for the x-axis grid size. For grid sizes between 2.5 and 7.5 m, the change is less than 0.1%. A grid size of 5 m is used for the y-axis in our calculations. Figure J-15 shows the relative change of impact volume for one ping as a function of the y-axis growth factor. The x-axis grid size is fixed at 5 m and the initial y-axis grid size is 5 m. The impact volume for a growth factor of 0 is the reference. For growth factors from 0 to 0.01, the change is less than 0.1%. A growth factor of 0.005 is used in the calculations.

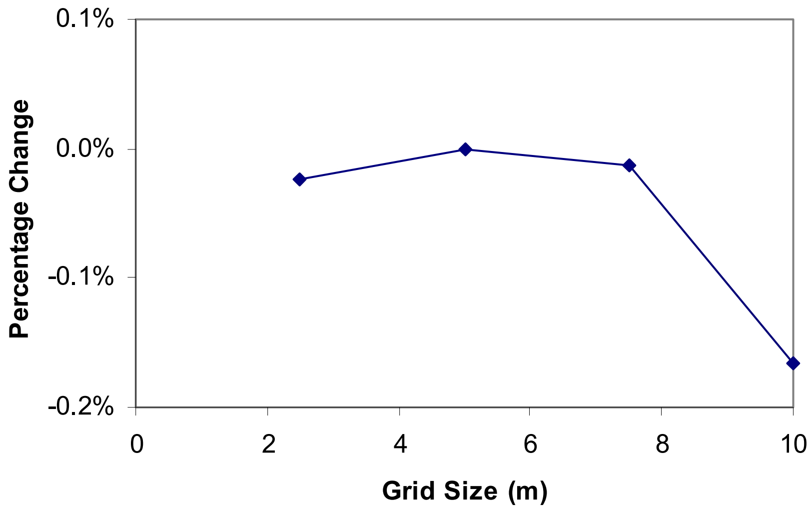

Figure J-13. Change of Impact Volume as a Function of X-axis Grid Size

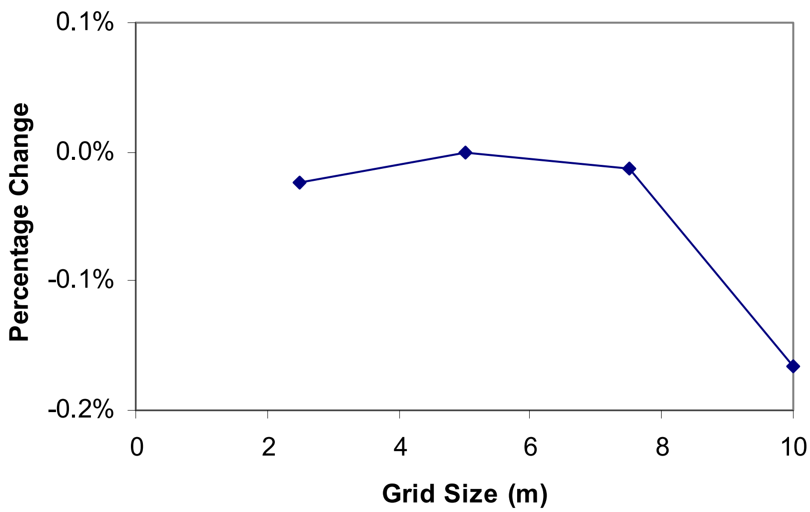

Figure J-14. Change of Impact Volume as a Function of Y-axis Grid Size

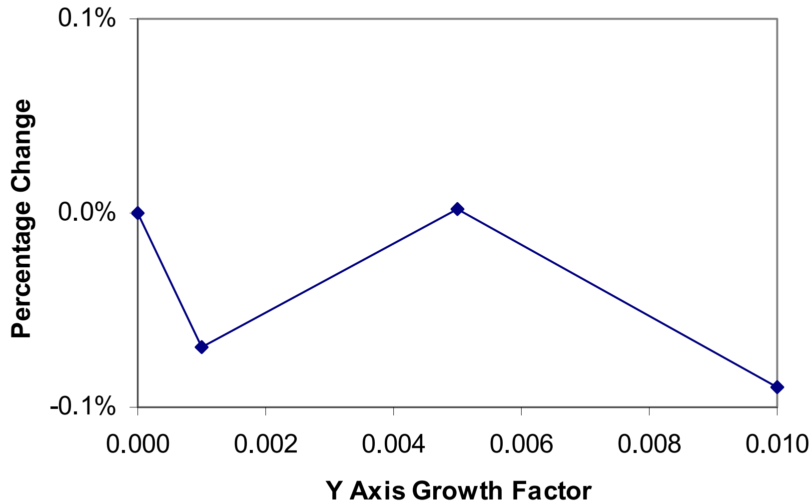

Figure J-15. Change of Impact Volume as a Function of Y-axis Growth Factor

Another factor influencing the accuracy of the calculation of impact volumes is the size of the bins used for sound pressure level. The sound pressure level bins extend from 100 dB (far lower than required) up to 300 dB (much higher than that expected for any sonar system). Figure J-16 shows the relative change of impact volume for one ping as a function of the bin width. The x-axis grid size is fixed at 5 m the initial y-axis grid size is 5 m, and the y-axis growth factor is 0.005. The impact volume for a bin size of 0.5 dB is the reference. For bin widths from 0.25 dB to 1.00 dB, the change is about 0.1%. A bin width of 0.5 is used in our calculations.

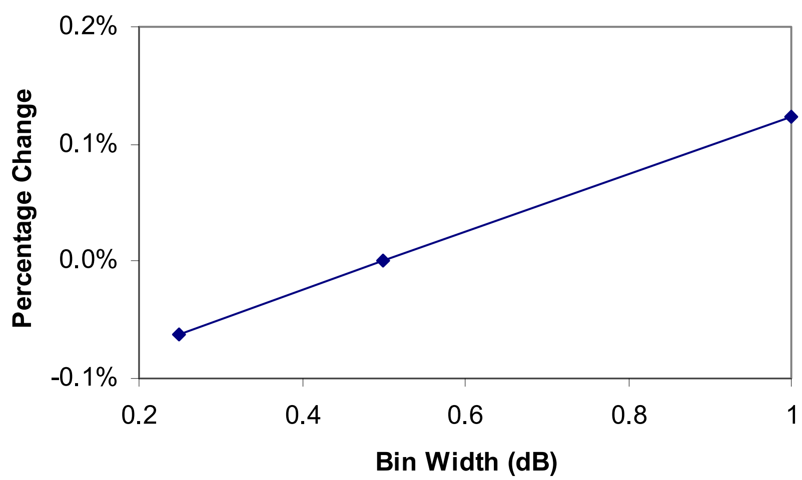

Figure J-16. Change of Impact Volume as a Function of Bin Width

Two other issues for discussion are the maximum range (Rmax) and the spacing in range and depth used for calculating TL. The TL generated for the energy accumulation metric is used for risk function analysis. The same sampling in range and depth is adequate for this metric because it requires a less demanding computation (i.e., maximum value instead of accumulated energy). Using the same value of Rmax needs some discussion since it is not clear that the same value can be used for both metrics. Rmax was set so that the TL at Rmax is more than needed to reach the energy accumulation threshold of 173 dB for 1000 pings. Since energy is accumulated, the same TL can be used for one ping with the source level increased by 30 dB ($10 \log_{10}(1000)$). Reducing the source level by 53 dB, to get back to its original value, permits the handling of a sound pressure level threshold down to 120 dB, established by National Marine Fisheries Service as the minimum required. Hence, the TL calculated to support energy accumulation for 1,000 pings will also support calculation of impact volumes for the risk function metric.

The process of obtaining the maximum sound pressure level at each grid point in the volumetric grid is straightforward. The active sonar starts at the origin and moves at constant speed along the positive x-axis emitting a burst of energy, a ping, at regularly spaced intervals. For each ping, the distance and horizontal angle connecting the sonar to each grid point is computed. Calculating the TL from the source to a grid point has several steps. The TL is made up of the sum of many eigenrays connecting the source to the grid point. The beam pattern of the source is applied to the eigenrays based on the angle at which they leave the source. After summing the vertically beamformed eigenrays on the range mesh used for the TL calculation, the vertically beamformed TL for the distance from the sonar to the grid point is derived by interpolation. Next, the horizontal beam pattern of the source is applied using the horizontal angle connecting the sonar to the grid point. To avoid problems in extrapolating TL, only use grid points with distances less than R_{max} are used. To obtain the sound pressure level at a grid point, the sound pressure level of the source is reduced by that TL. For the first ping, the volumetric grid is populated by the calculated sound pressure level at each grid point. For the second ping and subsequent pings, the source location increments along the x-axis by the spacing between pings and the sound pressure level for each grid point is again calculated for the new source location. Since the risk function metric uses the maximum of the sound pressure levels at each grid point, the newly calculated sound pressure level at each grid point is compared to the sound pressure level stored in the grid. If the new level is larger than the stored level, the value at that grid point is replaced by the new sound pressure level.

For each bin, a volume is determined by summing the ensonified volumes with a maximum SPL in the bin's interval. This forms the volume histogram shown in J-11. Multiplying by the risk function probability function for the level at the center of a bin gives the impact volume for that bin. The result can be seen in Figure J-12, which is an example of the impact volume as a function of depth.

The impact volume for a sonar moving relative to the animal population increases with each additional ping. The rate at which the impact volume increases for the risk function metric is essentially linear with the number of pings. Figure J-17 shows the dependence of impact volume on the number of pings. The function is linear; the slope of the line at a given depth is the impact volume added per ping. This number multiplied by the number of pings in an hour gives the hourly impact volume for the given depth increment. Completing this calculation for all depths in a province, for a given source, gives the hourly impact volume vector which contains the hourly impact volumes by depth for a province. Figure J-18 provides an example of an hourly impact volume vector for a particular environment. Given the speed of the sonar, the hourly impact volume vector could be displayed as the impact volume vector per kilometer of track.

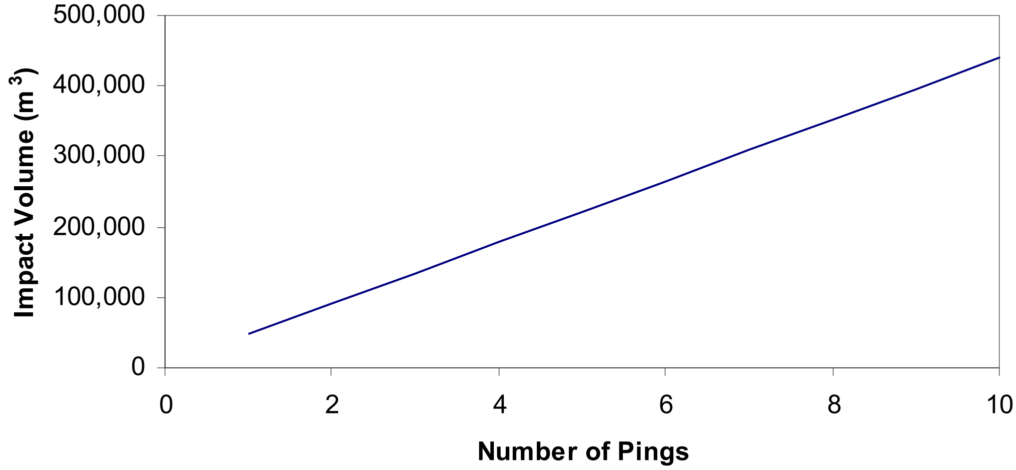

Figure J-17. Dependence of Impact Volume on the Number of Pings

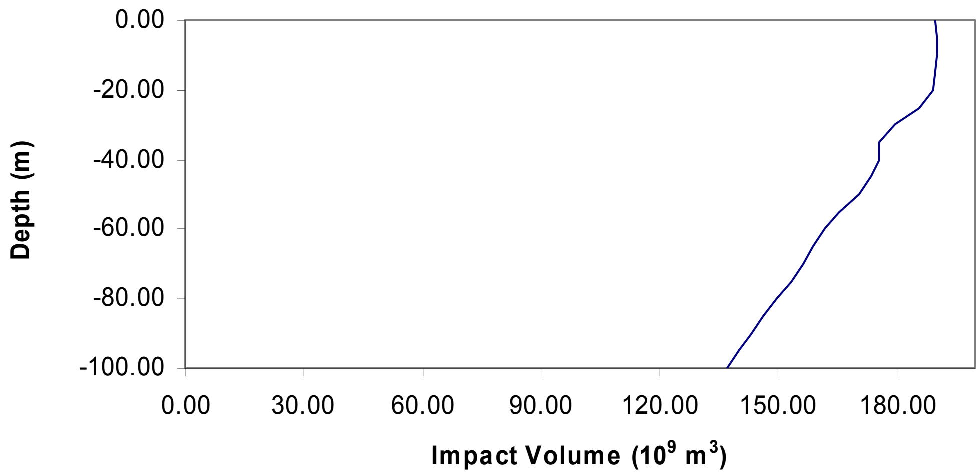

Figure J-18. Example of an Hourly Impact Volume Vector

J.3 DEFINITIONS AND METRICS FOR SOUND AND PROBABILITY/STATISTICS

J.3.1 SOME FUNDAMENTAL DEFINITIONS OF ACOUSTICS

Static Pressure (Acoustics)

At a point in a fluid (gas or liquid), the *static pressure* is the pressure that would exist if there were no sound waves present (paraphrase from Beranek, 1986).

Because *pressure* is a force applied to a unit area, it does not necessarily generate energy. Pressure is a scalar quantity—there is no direction associated with pressure (although a pressure wave may have a direction of propagation). *Pressure* has units of force/area. The SI derived unit of pressure is the pascal (Pa) defined as one N/m^2. Alternative units are many (lbs/ft^2, bars, inches of mercury, etc); some are listed at the end of this section.

Acoustic Pressure

Without limiting the discussion to small amplitude or linear waves, define *acoustic pressure* as the residual pressure over the "average" static pressure caused by a disturbance. As such, the "average" *acoustic pressure* is zero. Here the "average" is usually taken over time (after Beranek, 1986).

Mean-Square Pressure is usually defined as the **short-term** time average of the squared pressure:

$$\frac{1}{T}\int_{\tau}^{\tau+T} p^2(t)dt ,$$

where p is pressure and T is on the order of several periods of the lowest frequency component of the time series starting at time τ. T can be greater, but should be specified as part of the metric.

RMS Pressure is the square root of the mean-square pressure.

Impedance

In general *impedance* measures the ratio of force amplitude to velocity amplitude. For acoustic plane waves, the ratio is ρc, where ρ is the fluid density and c the sound speed.

Equivalent Plane Wave Intensity

As noted by Bartberger (1965) and others, it is general practice to measure (and model) pressure (p) or rms pressure (p_{rms}), and then infer an intensity from the formula for plane waves in the direction of propagation:

Intensity = $(p_{rms})^2/\rho c$.

Such an inferred intensity should properly be labeled as the *equivalent plane-wave intensity in* the *propagation direction*.

Energy Flux Density (EFD)

EFD is the time integral of instantaneous intensity. For plane waves,

$$EFD = \frac{1}{\rho c}\int_0^T p^2(t)\,dt,$$

where ρc is the impedance. Units are J/m^2.

J.3.2 DEFINITIONS RELATED TO SOUND SOURCES, SIGNALS, AND EFFECTS

Source Intensity

Define *source intensity*, I(θ,ϕ), as the intensity of the projected signal referred to a point at unit distance from the source in the direction (θ,ϕ). (θ,ϕ) is usually unstated; in that case, it is assumed that propagation is in the direction of the axis of the main lobe of the projector's beam pattern.

Source Power

For an omni-directional source, the power radiated by the projector at range r is $I_r(4\pi r^2)$ where I_r is the radiated intensity at range r (in the far field). If intensity has SI units of W/m^2, then the power has units of W. The result can be extrapolated to a unit reference distance if either I_1 is known or $I_r=I_1/r^2$. Then the *source power* at unit distance is $4\pi I_1$, where I_1 is the intensity (any direction) at unit distance in units of power/area.

Pure Tone Signal or Wave (Also, Continuous Wave, CW, Monochromatic Wave, Unmodulated Signal)

Each term means a single-frequency wave or signal. The actual bandwidth of the signal will depend on context, but could be interpreted as "single-frequency as far as can be determined."

Narrowband Signal

Narrowband is a non-precise term. It is used to indicate that the signal can be treated as a single-frequency carrier signal, which is made to vary (is modulated) by a second signal whose bandwidth is smaller than the carrier frequency. In dealing with sonars, a bandwidth less than about 30% of center frequency is often spoken of as narrowband.

Hearing Threshold

"The *threshold of hearing* is defined as the sound pressure at which one, listening with both ears in a free field to a signal of waning level, can still just hear the sound, or if the signal is being increased from a level below the threshold, can just sense it." (Magrab, p.29, 1975)

"A threshold of audibility for a specified signal is the minimum effective sound pressure of that signal that is capable of evoking an auditory sensation (in the absence of noise) in a specified fraction of trials." (Beranek, p. 394, 1986)

Temporary (Hearing) Threshold Shift (TTS)

"The diminution, following exposure to noise, of the ability to detect weak auditory signals is termed *temporary threshold shift* (TTS), if the decrease in sensitivity eventually disappears…" (Magrab, p.35, 1975)

Permanent (Hearing) Threshold Shift (PTS)

"The diminution, following exposure to noise, of the ability to detect weak auditory signals is termed temporary threshold shift (TTS), if the decrease in sensitivity eventually disappears, and noise-induced permanent threshold shift (NIPTS) if it does not." (Magrab, p.35, 1975)

J.3.3 DECIBELS AND SOUND LEVELS

Decibel (dB)—Because practical applications of acoustic power and energy involve wide dynamic ranges (e.g., from 1 to 1,000,000,000,000), it is common practice to use the logarithm of such quantities. For a given quantity Q, define the decibel as:

$$10 \log (Q/Q_0) \text{ dB re } Q_0$$

where Q_0 is a reference quantity and log is the base-10 logarithm.

The word "level" usually indicates decibel quantity (e.g., *sound pressure level* or *spectrum level*). Some specific examples for this document follow.

Sound Pressure Level

For pressure p, the *sound pressure level* (SPL) is defined as follows:

$$SPL = 10 \log (p^2/p_0^2) \text{ dB re } 1\ p_0^2,$$

where p_0 is the reference pressure (usually 1 μPa for underwater acoustics and 20 μPa for in-air acoustics). The convention is to state the reference as p_0 (with the square implicit).

For a pressure of 100 μPa, the SPL would be

$$10 \log [(100\ \mu Pa)^2/ (1\ \mu Pa)^2] \text{ dB re } 1\ \mu Pa$$

$$= 40 \text{ dB re } 1\ \mu Pa$$

This is about the lowest level that a dolphin can hear in water.

Source Level

Refer to source intensity above. Define *source level* as $SL(\theta,\phi) = 10 \log[I(\theta,\phi)/I_0]$, where I_o is the reference intensity (usually that of a plane wave of rms pressure 1 μPa). The reference pressure and reference distance must be specified. When SL does not depend on direction, then the source is said to be *omni-directional;* otherwise it is *directive.*

Intensity Level

It is nearly universal practice to use SPL in place of intensity level. This makes sense as long as impedance is constant. In that case, intensity is proportional to short-term-average, squared pressure, with proportionality constant equal to the reciprocal of the impedance.

When the impedance differs significantly in space or time (as in noise propagation from air into water), the intensity level must specify the medium change and/or the changes in impedance.

Energy (Flux Density) Level (EFDL) Referred to Pressure^2 Time

Note that the abbreviation "EFDL" is not in general usage, but is used here for convenience.

Just as the usual reference for intensity level is pressure (and not intensity itself), the reference often (but not always) used for EFDL is *pressure^2 time*. This makes sense when the impedance is constant. Some examples of conversions follow:

Suppose the integral of the plane-wave pressure-squared time is 1 μPa^2 s. Since impedance for water is 1.5 10^{12} μPa(s/m), the EFD is then

$$(1\ \mu Pa^2 s)/(1.5\ 10^{12}\ \mu Pa(s/m)) = 6.66\ 10^{-13}\ \mu Pa\text{-}m = 6.66\ 10^{-19}\ J/m^2$$

Thus an EFDL of 0 dB (re 1 μPa^2 s) corresponds to an EFD of 6.66 10^{-19} J/m^2 (in water).

It follows that thresholds of interest for impacts on marine life have values in water as follows:

190 dB (re 1 μPa^2 s) = 10^{19} x 6.66 10^{-19} J/m^2 = 6.7 J/m^2

200 dB (re 1 μPa^2 s) = 66.7 J/m^2

215 dB (re 1 μPa^2 s) = 2106.1 J/m^2

Given that 1 J = 1 Ws, notice that these energies are small. Applied to an area the size of a person, 215 dB would yield about 2000 J, or about 2 kWs or about 0.0006 kW-hr.

J.3.4 SOME CONSTANTS AND CONVERSION FORMULAS

Length
1 nm = 1.85325 km
1 m = 3.2808 ft

Speed
1 knot = 0.514791 m/s = 1.85325 km/hr
1 mph= 0.447 m/s= 1.6093 km/hr
1 m/s = 1.94254 knots

Pressure
1 Pa = 1 N/m^2 = 1 J/m^3 = 1 kg/m s^2
1 Pa = 10^6 μ Pa = 10 dyn/cm^2 = 10 μbar
1 μPa = 10^{-5} dyn/cm^2 = 1.4504·10^{-10} psi
1 atm = 1.014 bar = 14.7097 psi
1 kPa = 1000 Pa = 10^9 μPa = 0.145 psi = 20.88 psf

Power
1 W = 1 J/s = 1 Nm/s = 1 kg m^2/s^2
1 W = 10^7 erg/s

Energy (Work)
1 J = 1 N m = 1 kg m^2/s^2
1 J= 10^7 g cm^2/s^2 = 1 W s
1 erg = 1 g cm^2/s^2 = 10^{-7} J
1 kW hr = (3.6) 10^6 J

Acoustic Intensity
1 W/m^2= 1 Pa (m/s) = 10^6 μPa (m/s)
1 W/m^2= 1 J/(s m^2) = 1 N/m s
1 psi in/s = 175 W/m^2 = 1.75 10^8 μPa (m/s)
1 lb/ft s = 14.596 J/m^{2}s = 14.596 W/m^2
1 W/m^2 = 10^7 erg/m^{2}s = 10^3 erg/cm^{2}s

Acoustic Energy Flux Density
1 J/m^2 = 1 N/m = 1 Pa m = 10^6 μPa m = 1 W s/m^2
1 J/m^2 = 5.7 10^{-3} psi in = 6.8 10^{-2} psf ft
1 J/cm^2 = 10^4 J/m^2 = 10^7 erg/cm^2
1 psi in = 175 J/m^2 = 1.75 10^8 μPa m

J.3.5 ADDITIONAL DEFINITIONS FOR METRICS USED IN AIR

Weighted Sound Levels

For sound pressure measurements in air related to hearing, it is common practice to weight the spectrum to reduce the influence of the high and low frequencies so that the response is similar that of the human ear to noise. *A-weighting* is the most common filter, with the weight resembling the ear's responses. Other popular weightings are B and C. The table below gives a sampling of the filter values for selected frequencies.

Frequency (Hz)	A-Weighting (dB)	B-Weighting (dB)	C-Weighting (dB)
10	-70	-38	-14
20	-50	-24	-6
40	-35	-14	-2
80	-23	-7	-1
160	-13	-3	0
320	-7	-1	0
640	-2	0	0
2,000	+1	0	0
5,000	+1	-1	-1
10,000	-3	-4	-4
12,000	-4	-6	-6
20,000	-9	-11	-11

Decibel levels based on these weighted are usually labeled: dBA or dB(A) for A weighting, etc.

Sound Exposure Level (SEL)

For a time-varying sound pressure p(t), *sound exposure level* is computed as

$$\mathrm{SEL} = 10 \log \left[\frac{1}{t_0} \int_0^T p^2(t)\,dt \Big/ p_0^2 \right],$$

where t_0 is 1 second, T is the total duration of the signal (in the same units as those of t_0, namely seconds) and p_0 is the reference pressure (usually 20 μPa).

SEL is thus a function of p(t), T, and the reference pressure. When the impedance of the medium of interest is approximately constant, then SEL can be viewed as the total energy level for the time interval from 0 to T. It has explicit reference units of p_0 for pressure with implicit units of seconds for time.

SEL is almost never used in underwater sound, primarily because it does not account for changes in impedance (as, for example, in sound propagation through sediments). Instead, energy flux density level is the standard.

When p(t) is A-weighted, then the measure is called the *A-weighted SEL* or *ASEL*. Likewise for other weightings.

Equivalent Sound Level (L_{eq})

The *equivalent sound level (L_{eq})* is defined as the A-weighted sound pressure level (SPL) averaged over a specified time period T. It is useful for noise that fluctuates in level with time. L_{eq} is also sometimes called the *average sound level (L_{AT}),* so that $L_{eq} = L_{AT}$ (see, e.g., Crocker, 1997).

If $p_A(t)$ is the instantaneous A-weighted sound pressure and p_{ref} the reference pressure (usually 20 μPa), then

$$L_{eq} = 10 \log \left\{ \left(\frac{1}{T} \int_0^T {p_A}^2(t)\,dt \right) \Big/ p_{ref}^2 \right\}.$$

It is thus equivalent to an average A-weighted intensity or power level.

Note that since the averaging time can be specified to be anything from seconds to hours, L_{eq} has become popular as a measure of environmental noise. For community noise, T may be assigned a value as high as 24 hours or more.

L_{dn} (or DNL)

Following Magrab (1975), L_{dn} was introduced by USEPA in 1974 to provide a single-number measure of community noise exposure over a specified period. It was designed to improve L_{eq} by adding a correction of 10 dB for nighttime levels to account for increased annoyance to the population.

L_{dn} is calculated as the level resulting from a weighted averaging of intensities:

$$10^{L_{dn}/10} = (0.625)10^{L_d/10} + (0.375)10^{(L_n+10)/10}$$

It is thus a long-term-average, weighted function of SPL.

J.3.6 DEFINITIONS FOR PROBABILITY AND STATISTICS (FROM VARIOUS PUBLIC INTERNET SOURCES)

Random Variables

The outcome of an experiment need not be a number, for example, the outcome when a coin is tossed can be “heads” or “tails.” However, we often want to represent outcomes as numbers. A random variable is a function that associates a unique numerical value with every outcome of an experiment. The value of the random variable will vary from trial to trial as the experiment is repeated.

A random variable has either an associated probability distribution (discrete random variable) or probability density function (continuous random variable).

Examples:

1. A coin is tossed 10 times. The random variable X is the number of tails that are noted. X can only take the values 0, 1, ..., 10, so X is a discrete random variable.

2. A light bulb is burned until it burns out. The random variable Y is its lifetime in hours. Y can take any positive real value, so Y is a continuous random variable.

Expected Value (Mean Value)

The expected value (or population mean) of a random variable indicates its average or central value. It is a useful summary value (a number) of the variable’s distribution.

Stating the expected value gives a general impression of the behaviour of some random variable without giving full details of its probability distribution (if it is discrete) or its probability density function (if it is continuous).

Two random variables with the same expected value can have very different distributions. There are other useful descriptive measures which affect the shape of the distribution, for example variance.

The expected value of a random variable X is symbolized by E(X) or μ.

If X is a discrete random variable with possible values x1, x2, x3, ..., xn, and p(xi) denotes P(X = xi), then the expected value of X is defined by:

sum of xi.p(xi)

where the elements are summed over all values of the random variable X.

If X is a continuous random variable with probability density function f(x), then the expected value of X is defined by:

integral of xf(x)dx

Example:

Discrete case: When a die is thrown, each of the possible faces 1, 2, 3, 4, 5, 6 (the xi's) has a probability of 1/6 (the p(xi)'s) of showing. The expected value of the face showing is therefore:

μ = E(X) = (1 x 1/6) + (2 x 1/6) + (3 x 1/6) + (4 x 1/6) + (5 x 1/6) + (6 x 1/6) = 3.5

Notice that, in this case, E(X) is 3.5, which is not a possible value of X.

Variance (Square of the Standard Deviation)

The (population) variance of a random variable is a non-negative number which gives an idea of how widely spread the values of the random variable are likely to be; the larger the variance, the more scattered the observations on average.

Stating the variance gives an impression of how closely concentrated round the expected value the distribution is; it is a measure of the 'spread' of a distribution about its average value.

Variance is symbolized by V(X) or Var(X) or sigma^2

The variance of the random variable X is defined to be:

V(X)=E(X^2)-E(X)^2

where E(X) is the expected value of the random variable X.

Notes

1. the larger the variance, the further that individual values of the random variable (observations) tend to be from the mean, on average;

2. the smaller the variance, the closer that individual values of the random variable (observations) tend to be to the mean, on average;

3. taking the square root of the variance gives the standard deviation, i.e.:

   sqrt(V(X))=sigma

4. the variance and standard deviation of a random variable are always non-negative.

Probability Distribution

The probability distribution of a discrete random variable is a list of probabilities associated with each of its possible values. It is also sometimes called the probability function or the probability mass function.

More formally, the probability distribution of a discrete random variable X is a function which gives the probability p(xi) that the random variable equals xi, for each value xi:

p(xi) = P(X=xi)

It satisfies the following conditions:

1. 0 <= p(xi) <= 1

2. sum of all p(xi) is 1

Cumulative Distribution Function

All random variables (discrete and continuous) have a cumulative distribution function. It is a function giving the probability that the random variable X is less than or equal to x, for every value x.

Formally, the cumulative distribution function F(x) is defined to be:

F(x) = P(X<=x)

for

-infinity < x < infinity

For a discrete random variable, the cumulative distribution function is found by summing up the probabilities as in the example below.

For a continuous random variable, the cumulative distribution function is the integral of its probability density function.

Probability Density Function

The probability density function of a continuous random variable is a function which can be integrated to obtain the probability that the random variable takes a value in a given interval.

More formally, the probability density function, f(x), of a continuous random variable X is the derivative of the cumulative distribution function F(x):

f(x) = d/dx F(x)

Since F(x) = P(X<=x) it follows that:

integral of f(x)dx = F(b)-F(a) = P(a<X<b)

If f(x) is a probability density function then it must obey two conditions:

1. that the total probability for all possible values of the continuous random variable X is 1:

   integral of f(x)dx = 1

2. that the probability density function can never be negative: f(x) > 0 for all x.

Normal (Gaussian) Density Function

The normal distribution (the “bell-shaped curve” which is symmetrical about the mean) is a theoretical function commonly used in inferential statistics as an approximation to sampling distributions (see also Elementary Concepts). In general, the normal distribution provides a good model for a random variable, when:

1. There is a strong tendency for the variable to take a central value;
2. Positive and negative deviations from this central value are equally likely;
3. The frequency of deviations falls off rapidly as the deviations become larger.

As an underlying mechanism that produces the normal distribution, one may think of an infinite number of independent random (binomial) events that bring about the values of a particular variable. For example, there are probably a nearly infinite number of factors that determine a person’s height (thousands of genes, nutrition, diseases, etc.). Thus, height can be expected to be normally distributed in the population.

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J.4 POST ACOUSTIC MODELING ANALYSIS

The acoustic modeling results include additional analysis to account for land mass, multiple ships, and number of animals that could be exposed. Specifically, post modeling analysis is designed to consider:

- Acoustic footprints for sonar sources must account for land masses.
- Acoustic footprints for sonar sources should not be added independently, which would result in overlap with other sonar systems used during the same active sonar activity. As a consequence, the area of the total acoustic footprint would be larger than the actual acoustic footprint when multiple ships are operating together.
- Acoustic modeling should account for the maximum number of individuals of a species that could potentially be exposed to sonar within the course of 1 day or a discreet continuous sonar event if less than 24 hours.

When modeling the effect of sound projectors in the water, the ideal task presents modelers with complete *a priori* knowledge of the location of the source(s) and transmission patterns during the times of interest. In these cases, calculation inputs include the details of ship path, proximity of shoreline, high-resolution density estimates, and other details of the scenario. However, in the HRC, there are sound-producing events for which the source locations, number of projectors, and transmission patterns are unknown, but still require analysis to predict effects. For these cases, a more general modeling approach is required: “We will be operating somewhere in this large area for X hours. What are the potential effects on average?”

Modeling these general scenarios requires a statistical approach to incorporate the scenario nuances into harassment calculations. For example, one may ask: “If an animal receives 130 decibel (dB) sound pressure level (SPL) when the ship passes at closest point of approach (CPA) on Tuesday morning, how do we know it doesn't receive a higher level on Tuesday evening?” This question cannot be answered without knowing the path of the ship (and several other facts). Because the path of the ship is unknown, the number of an individual’s re-exposures cannot be calculated directly. But it can, on average, be accounted for by making appropriate assumptions.

Table J-48 lists unknowns created by uncertainty about the specifics of a future proposed action, the portion of the calculation to which they are relevant, and the assumption that allows the effect to be computed without the detailed information.

Table J-48. Unknowns and Assumptions

Unknowns	Relevance	Assumption
Path of ship (esp. with respect to animals)	Ambiguity of multiple exposures, Local population: upper bound of harassments	Most conservative case: ships are everywhere within SOA
Ship(s) locations	Ambiguity of multiple exposures, land shadow	Equal distribution of action in each modeling area
Direction of sonar transmission	Land shadow	Equal probability of pointing any direction
Number of ships	Effect of multiple ships	Average number of ships per training event
Distance between ships	Effect of multiple ships	Average distance between ships

The following sections discuss three topics that require action details, and describes how the modeling calculations used the general knowledge and assumptions to overcome the future-action uncertainty considering re-exposure of animals, land shadow, and the effect of multiple-ship training events.

Multiple Exposures in General Modeling Scenario

Consider the following hypothetical scenario. A box shaped area is designated on the surface of a well-studied ocean environment with well-known sound propagation characteristics. A sonar-equipped ship and 44,000 whales are inserted into that box and a curtain is drawn. What will happen? This is the general scenario. The details of what will happen behind the curtain are unknown, but the existing knowledge, and general assumptions, can allow for a general calculation of average effects.

For the first period of time, the ship is traveling in a straight line and pinging at a given rate. In this time, it is known how many animals, on average, receive their max SPLs from each ping. As long as the ship travels in a straight line, this calculation is valid. However, after an undetermined amount of time, the ship will change course to a new and unknown heading.

If the ship changes direction 180 degrees and travels back through the same swath of ocean, all the animals the ship passes at closest point of approach (CPA) before the next course change have already been exposed to what will be their maximum SPL, so the population is not “fresh.” If the direction does not change, only new animals will receive what will be their maximum SPL from that ship (though most have received sound from it), so the population is completely “fresh.” Most ship headings lead to a population of a mixed “freshness,” varying by course direction. Since the route and position of the ship over time are unknown, the freshness of the population at CPA with the ship is unknown. This ambiguity continues through the remainder of the training event.

What is known? The source and, in general, the animals remain in the Sonar Operating Area (SOA). Thus, if the farthest range to a possible effect from the ship is X kilometers (km), no animals farther than X km outside of the SOA can be harassed. The intersection of this area with a given animal's habitat multiplied by the density of that animal in its habitat represents the maximum number of animals that can be harassed by activity in that SOA, which shall be defined as “the local population.” Two details: first, this maximum should be adjusted down if a risk function is being used, because not 100 percent of animals within X km of the SOA border will be harassed. Second, it should be adjusted up to account for animal motion in and out of the area.

The ambiguity of population freshness throughout the training event means that multiple exposures cannot be calculated for any individual animal. It must be dealt with generally at the local population level.

Solution to the Ambiguity of Multiple Exposures in the General Modeling Scenario

At any given time, each member of the population has received a maximum SPL (possibly zero) that indicates the probability of harassment during the training event. This probability indicates the contribution of that individual to the expected value of the number of harassments. For example, if an animal receives a level that indicates 50 percent probability of harassment, it contributes 0.5 to the sum of the expected number of harassments. If it is passed later with a higher level that indicates a 70 percent chance of harassment, its contribution increases to 0.7. If two animals receive a level that indicates 50 percent probability of harassment, they together contribute 1 to the sum of the expected number of harassments. That is, we statistically expect exactly one of them to be harassed. Let the expected value of harassments at a given time be defined as “the harassed population” and the difference between the local population (as defined above) and the harassed population be defined as “the unharassed population.” As the training event progresses, the harassed population will never decrease and the unharassed population will never increase.

The unharassed population represents the number of animals statistically “available” for harassment. Since we do not know where the ship is, or where these animals are, we assume an average (uniform) distribution of the unharassed population over the area of interest. The densities of unharassed animals are lower than the total population density because some animals in the local population are in the harassed population.

Density relates linearly to expected harassments. If action A, in an area with a density of 2 animals per square kilometer (km^2) produces 100 expected harassments, then action A in an area with 1 animal per km^2 would produce 50 expected harassments. The modeling produces the number of expected harassments per ping starting with 100 percent of the population unharassed. The next ping will produce slightly fewer harassments because the pool of unharassed animals is slightly less.

For example, consider the case where 1 animal is harassed per ping when the local population is 100, 100 percent of which are initially unharassed. After the first ping, 99 animals are unharassed, so the number of animals harassed during the second ping are

$$10\left(\frac{99}{100}\right) = 1(.99) = 0.99 \text{ animals}$$

and so on for the subsequent pings.

Mathematics

A closed form function for this process can be derived as follows.

Define $P_n =$ unharassed population after ping n

Define $H =$ number of animals harassed in a ping with 100 percent unharassed population

$$P_0 = \text{local population}$$
$$P_1 = P_0 - H$$
$$P_2 = P_1 - H\left(\frac{P_1}{P_0}\right)$$
...
$$P_n = P_{n-1} - H\left(\frac{P_{n-1}}{P_0}\right)$$

Therefore,

$$P_n = P_{n-1}\left(1-\left(\frac{H}{P_0}\right)\right) = P_{n-2}\left(1-\left(\frac{H}{P_0}\right)\right)^2 = \ldots = P_0\left(1-\left(\frac{H}{P_0}\right)\right)^n$$

Thus, the total number of harassments depends on the per-ping harassment rate in an unharassed population, the local population size, and the length of time the sonar operates

Local Population: Upper Bound on Harassments

As discussed above, Navy planners have confined period of sonar use to modeling areas. The size of the harassed population of animals for an action depends on animal re-exposure, so uncertainty about the precise ship path creates variability in the “harassable” population. Confinement of sonar use to a SOA allows modelers to compute an upper bound, or worst case, for the number of harassments with respect to location uncertainty. This is done by assuming that there is a sonar transmitting from each point in the confined area throughout the action length.

NMFS has defined a 24-hour “refresh rate” to account for the maximum number of individuals of a species that could potentially be exposed to sonar within the course of 1 day. The Navy has determined that, in a 24-hour period, all sonar training events in the HRC transmit for a subset of that time, as Table J-49 shows:

Table J-49. Duration of Sonar Use During 24-hour Period

Action	Duration of Sonar Use in 24-hour Period
Other HRC ASW Training	13.5 hours
USWEX	16 hours
RIMPAC	12 hours
Multiple Strike Group	12 hours

Creating the most conservative ship position by assuming that a sonar transmits from each point in the SOA simultaneously can produce an upper bound on harassments for a single ping, but animal motion over the period in the Table J-49 can bring animals into range that otherwise would be out of the harassable population.

Animal Motion Expansion

Though animals often change course to swim in different directions, straight-line animal motion would bring more animals into the harassment area than a “random walk” motion model. Since precise and accurate animal motion models exist more as speculation than documented fact and because the modeling requires an undisputable upper bound, calculation of the upper bound for HRC modeling areas uses a straight-line animal motion assumption. This is a conservative assumption. The consideration of animal motion is to identify the area to be modeled and is not a part of the actual exposure model.

For a circular area, the straight-line motion with initial random direction assumption produces an identical result to the initial fixed direction. Since the HRC SOAs are non-circular polygons, choosing the initial fixed direction as perpendicular to the longest diagonal produces greater results than the initial random direction. Thus, the product of the longest diagonal and the distance the animals move in the period of interest gives the maximum potential expansion in HRC modeling areas due to animal motion. The HRC expansions use this for the animal-motion expansion.

Figure J-19 is an example that illustrates the maximum potential expansion, which occurs during the second arrow.

Risk Function Expansion

The expanded area contains the number of animals that will enter the SOA over the period of interest. However, an upper bound on harassments must also include animals outside the area that would be affected by a ship transmitting from the area’s edge. A gross overestimation could simply include all area with levels greater than the risk function cutoff. In the case of HRC, this would include all area within approximately 120 km from the edge of the adjusted box. This basic method would give a crude and inaccurately high upper bound, since only a fraction of the population is affected in much of that area. A more refined upper bound on harassments can be found by maintaining the assumption that a sonar is transmitting from each point in the adjusted box and calculating the expected ensonified area.

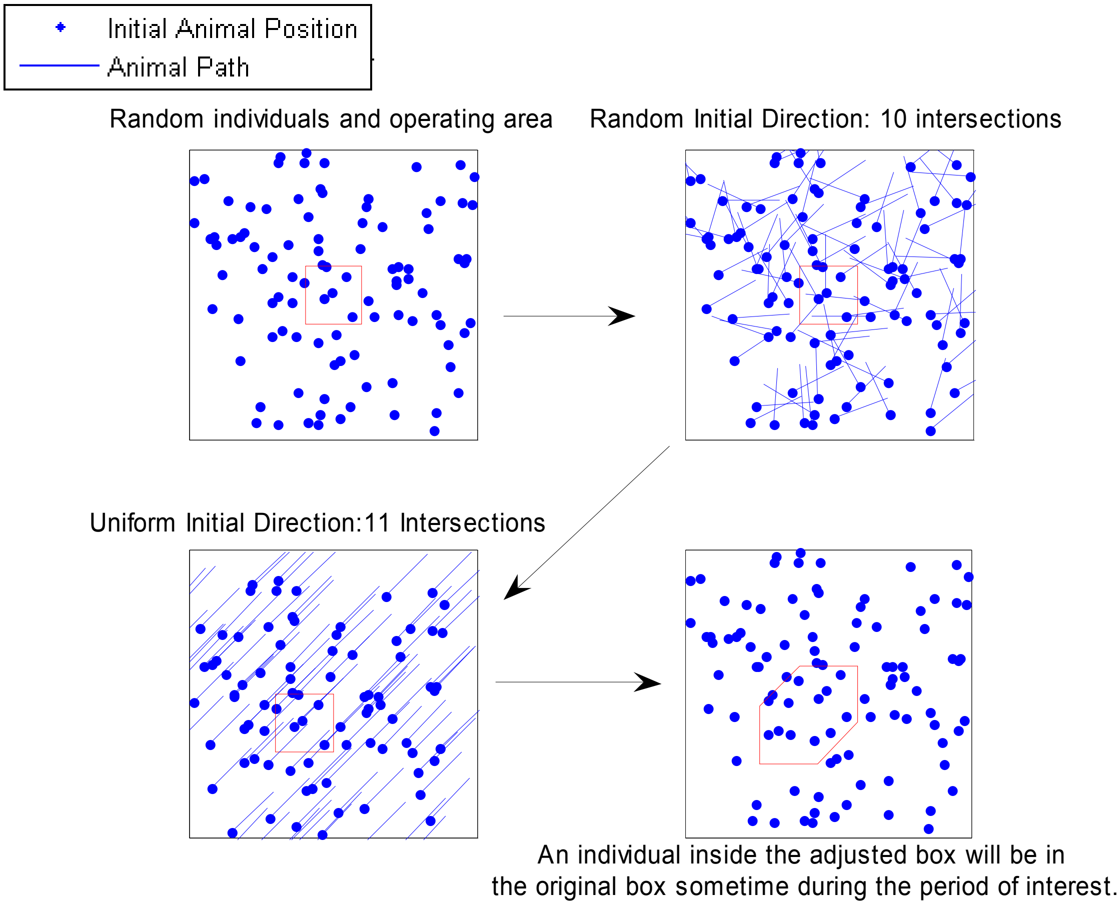

Figure J-19. Process of Determining Maximum Potential Individuals Present in Area at Any Time

The expected lateral range from the edge of a polygon to the cutoff range can be expressed as,

$$\int_{0}^{L^{-1}(120dB)} D(L(r))dr \, ,$$

where D is the risk function with domain in level and range in probability, L is the SPL function with domain in range and range in level, and r is the range from the SOA.

At the corners of the polygon, additional area can be expressed as

$$\frac{[\pi - \theta] \int_{0}^{L^{-1}(120dB)} D(L(r))rdr}{2\pi}$$

with D, L, and r as above, and θ the inner angle of the polygon corner, in radians.

For the risk function and transmission loss of HRC, this method adds an area equivalent to expanding the boundaries of the adjusted box by 4 km. The resulting shape, the adjusted box with a boundary expansion of 4 km, does not possess special meaning for the problem. But the number of individuals contained by that shape, as demonstrated above, is the maximum potential number of harassments that would occur if sonars transmitted continuously from each point in the SOA over the training event length, an upper bound on harassments for that training event.

The plots in Figure J-20 illustrate the growth of area for the sample case above. The shapes of the boxes are unimportant. The area after the final expansion, though, gives an upper bound on the “harassable,” or unharassed population.

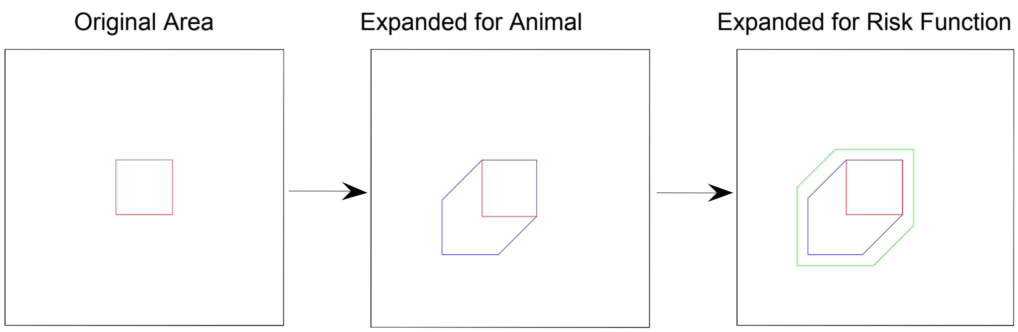

Figure J-20. Process of Expanding Area to Create Upper Bound of Harassments

Example Case

Consider a sample case from the HRC: the rate of exposure for bottlenose dolphins in SOA 2 during the summer, in a Multiple Strike Group Exercise with three active AN/SQS-53 sonars is 0.0234 harassments per ping. The Multiple Strike Group Exercise will transmit sonar pings for 12 hours in a 24-hour period, as given in the action table (Table J-49), with 120 pings per hour, a total of 12*120=1440 pings in a 24-hour period.

SOA 3 has an area of approximately 19,467 km^2 and a diagonal of 217 km. Adjusting this with straight-line (upper bound) animal motion of 5.5 km per hour for 12 hours, animal motion adds 217*5.5*12= 14,322 km^2 to the area. Using risk function to calculate the expected range outside the SOA adds another 1,040 km, bringing the total affected area to 34,458 km^2.

According to Barlow 2006, bottlenose dolphins have a density of 0.0013 animals per km^2 in the Hawaii area, so the upper bound number of bottlenose dolphins that can be affected by sonar activity in SOA 3 in a 12-hour period is 34,458 *0.0013 = 45 dolphins.

In the first ping, 0.0234 bottlenose dolphins will be harassed. With the second ping,

$0.0234\left(\frac{45-0.0234}{45}\right)=0.02338$ bottlenose dolphins will be harassed. Using the formula derived above, after 12 hours of continuous operation, the remaining unharassed population is

$$P_{1440}=P_0\left(1-\left(\frac{h}{P_0}\right)\right)^{1440}=45\left(1-\left(\frac{0.0234}{45}\right)\right)^{1440}\approx 21$$

So the harassed population will be 24 animals.

Contrast this with linear accumulation of harassments without consideration of the local population and the dilution of the unharassed population:

Harassments = 0.234*1440= 34

Figure J-21 illustrates the difference between the two approaches.

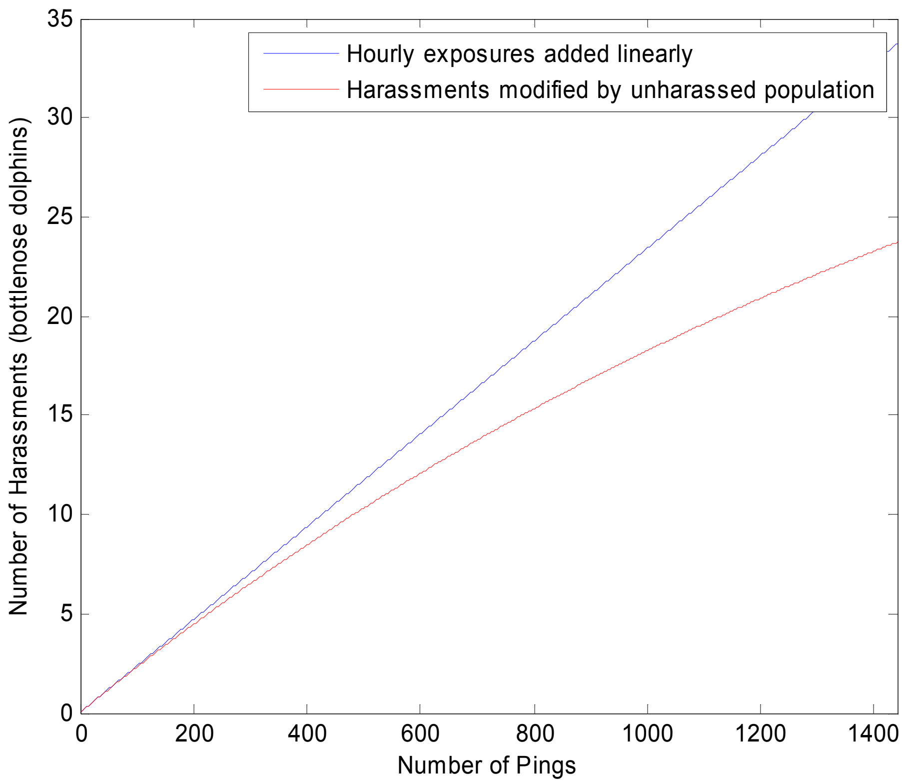

Figure J-21. Comparison of Harassments from Unlimited and Limited Populations

Land Shadow

The risk function considers harassment possible if an animal receives 120 dB sound pressure level, or above. In the HRC, this occurs about 120 km away from an AN/SQS-53-transmitting ship so over a large “effect" area, sonar sound could, but does not necessarily, harass an animal. The harassment calculations for a general modeling case must assume that this effect area covers only water fully populated with animals, but in some portions of the HRC SOAs, land partially encroaches on the area, obstructing sound propagation.

As discussed in the introduction of "Additional Modeling Considerations..." Navy planners do not know the exact location and transmission direction of the sonars at any time. These factors however, completely determine the interference of the land with the sound, or "land shadow," so a general modeling approach does not have enough information to compute the land shadow effects directly. However, modelers can predict the reduction in harassments at any point due to land shadow for different pointing directions and use expected probability distribution of activity to calculate the average land shadow for training events in each SOA.

For HRC, the land shadow is computed over a dense grid in each SOA An example of the grid, for SOA 4, is shown in Figure J-22:

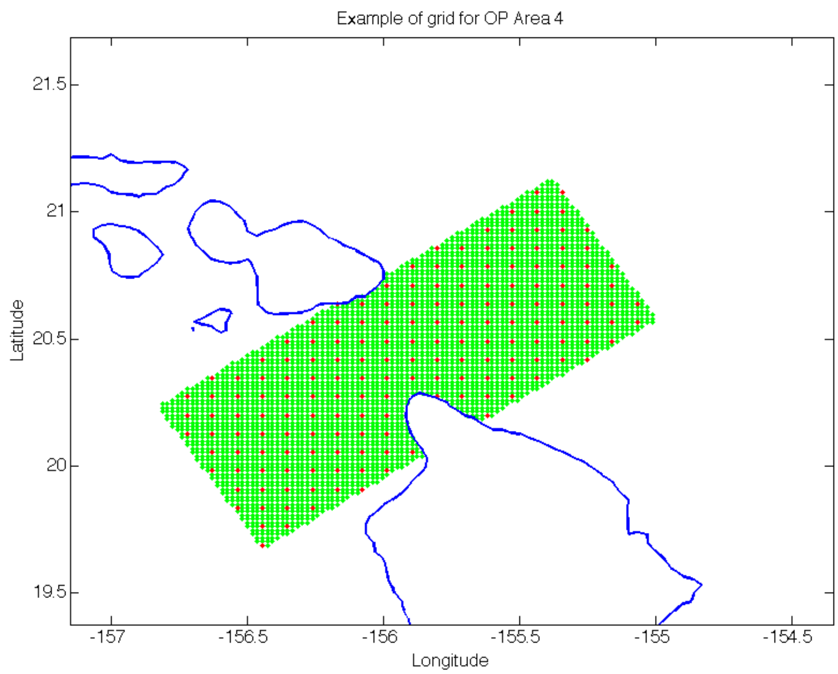

Figure J-22. Grid example, SOA 4. The dense grid is shown by the near continuous green dots. For illustrative purposes, every 25th point is shown as a red dot.

For each grid point, the land shadow is computed by combining the distance to land and the azimuth coverage. The process finds all of the points within 120 km of the gridpoint, as shown in Figure J-23:

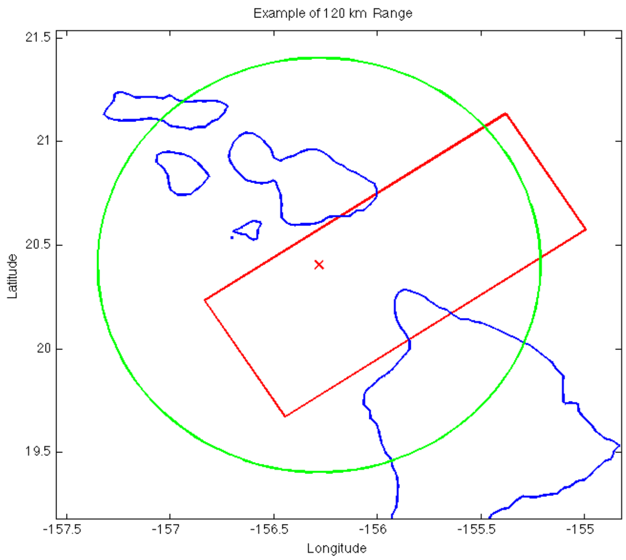

Figure J-23. The red box is the SOA. The red X is one grid point, with the green circle corresponding to a radius of 120 km from the grid point.

For each of the coastal points that are within 120 km of the grid, the azimuth and distance is computed. In the computation, only the minimum range at each azimuth is computed. The minimum range compared with azimuth for the sample point is shown in Figure J-24:

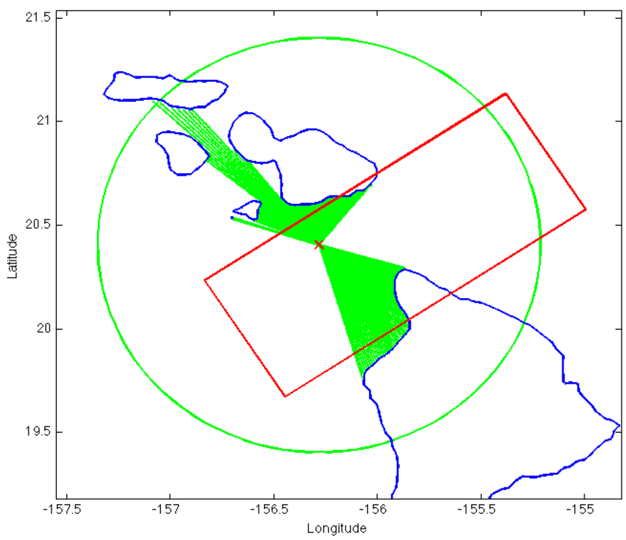

Figure J-24. The nearest point at each azimuth (with 1° spacing) to a sample grid point (red X) is shown by the green lines

Now, the average of the distances to shore, along with the angular profile of land is computed (by summing the unique azimuths that intersect the coast) for each grid point. The values are then used to compute the land shadow for the grid points. The land shadow effect at the example point is .9997, or there is a 0.03 percent reduction in effect due to land shadow.

Computing the Land Shadow Effect at Each Grid Point

The effect of land shadow is computed by determining the levels, and thus the distances from the sources. Table J-50 shows the distances at which harassments occur from for the risk function (SPL) and TTS/PTS (EFD) impact criteria. Figure J-25 displays the percentage of behavioral harassments resulting from the risk function for every 5 dB (bin) of received level.

Table J-50. Harassments at each received level bin

Received Level	Distance at which Levels Occur in HRC	Percent of Harassments Occurring at Given Levels
Below 140 dB SPL	36 km–125 km	<1%
140>Level>150 dB SPL	15 km–36 km	2%
150>Level>160 dB SPL	5 km–15 km	20%
160>Level>170 dB SPL	2 km–5 km	40%
170>Level>180 dB SPL	0.6–2 km	24%
180>Level>190 dB SPL	180–560 meters	9%
Above 190 dB SPL	0–180 meters	2%
TTS (195 dB EFDL)	0-110 meters	2%
PTS (215 dB EFDL)	0-10	<1%

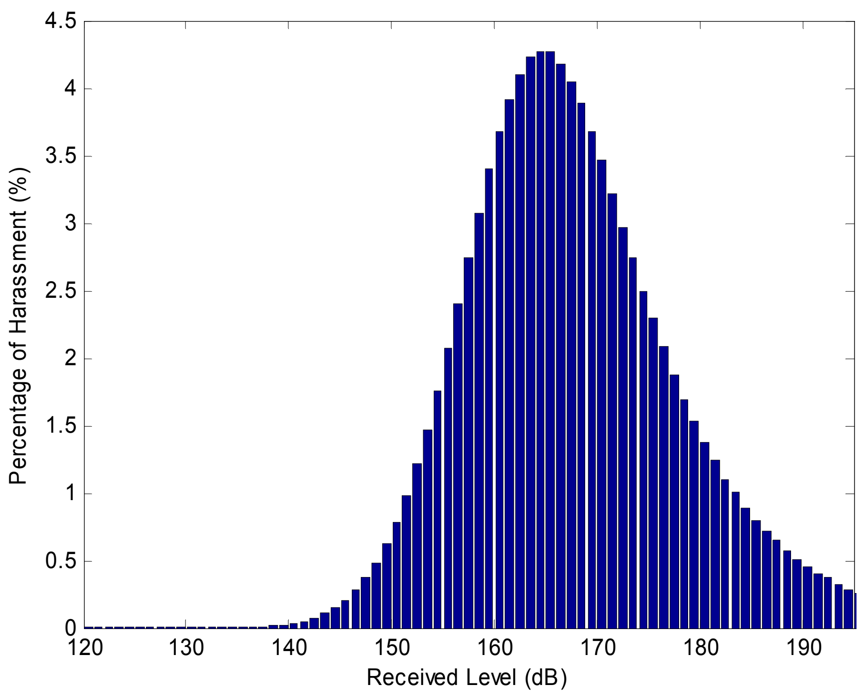

Figure J-25. The percentage of behavioral harassments resulting from the risk function for every 5 dB of received level

The information about the levels at which harassments occur allows for an estimation of the correction required if land obstructs the path of sound before it reaches 120 dB (Figure J-26).

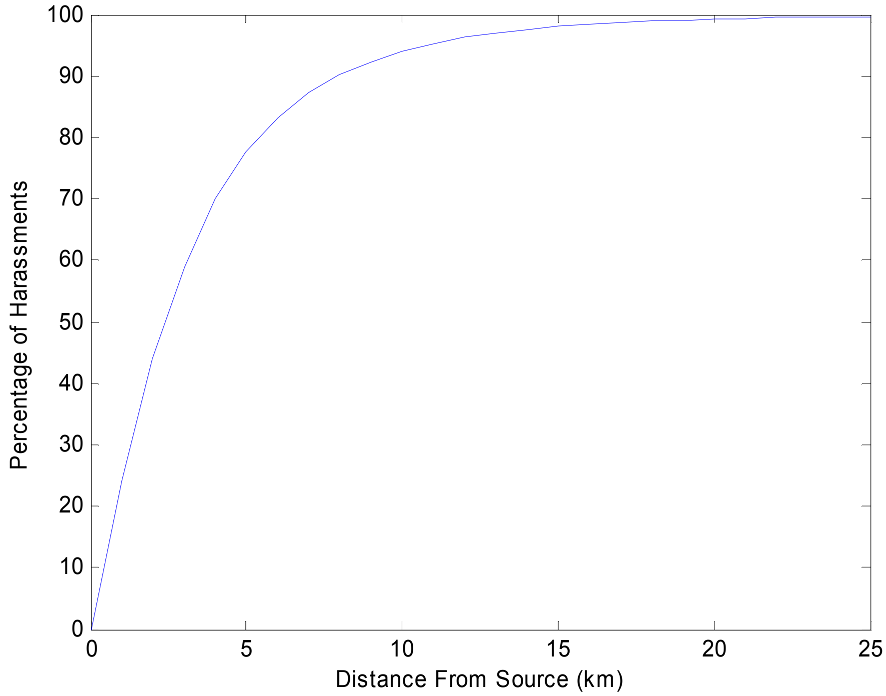

Figure J-26. Percentage of Harassments Occurring Within a Given Distance

With the data used to produce this figure, the effect reduction for a sound path blocked by land can be calculated. For example, since approximately 94 percent of harassments occur within 10 km of the source, a sound path blocked by land at 10 km will cause 94 percent the effect of an unblocked path.

As described above, the mapping process determines the angular profile of and distance to the coastline(s) from each grid point. The distance, then, determines the reduction due to land shadow when the sonar is pointed in that direction. The angular profile, then, determines the probability that the sonar is pointed at the coast.

Define θ_n = angular profile of coastline at point n in radians

Define r_n = mean distance to shoreline

Define A(r) = average effect adjustment factor for sound blocked at distance r

The land shadow at point n can be approximated by $A(r_n)\theta_n/(2\pi)$. The following plots (Figures J-27 through J-33) give the land shadow reduction factor at each point in each SOA. The white portions of the plot indicate the areas more than 120 km from land. The land shadow effects for most points are white (not within 120 km), or burgundy (within 120 km, but negligible effect).

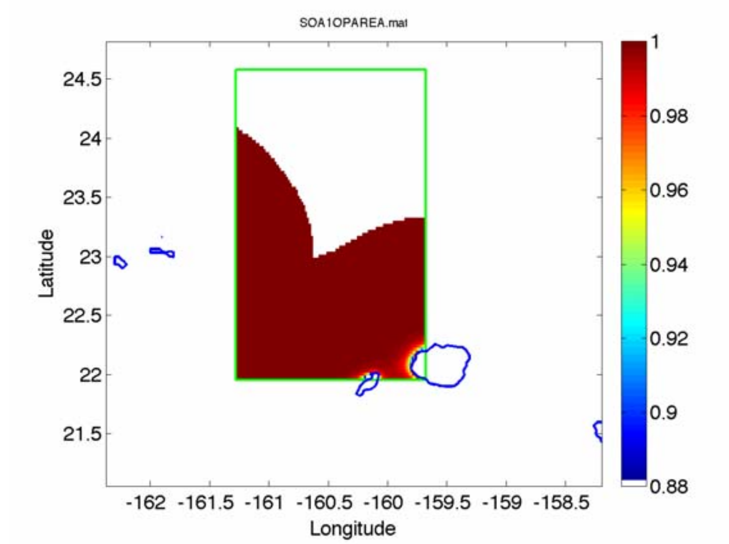

Figure J-27. Land Shadow Factor for SOA 1

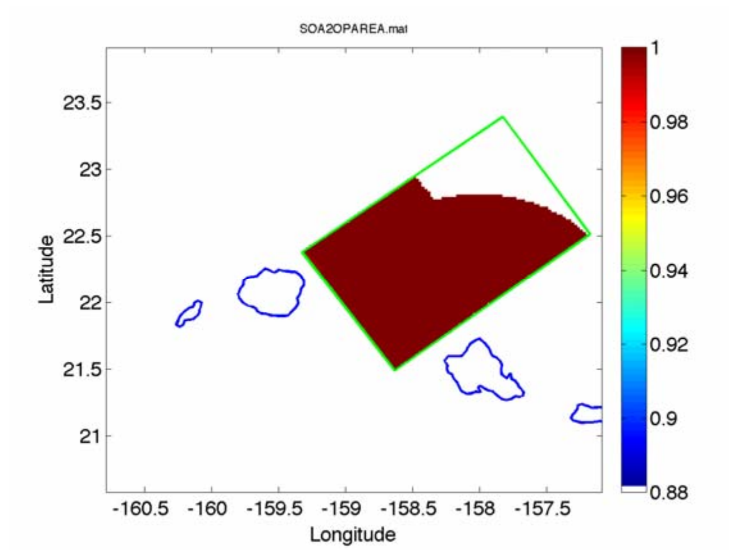

Figure J-28. Land Shadow Factor for SOA 2

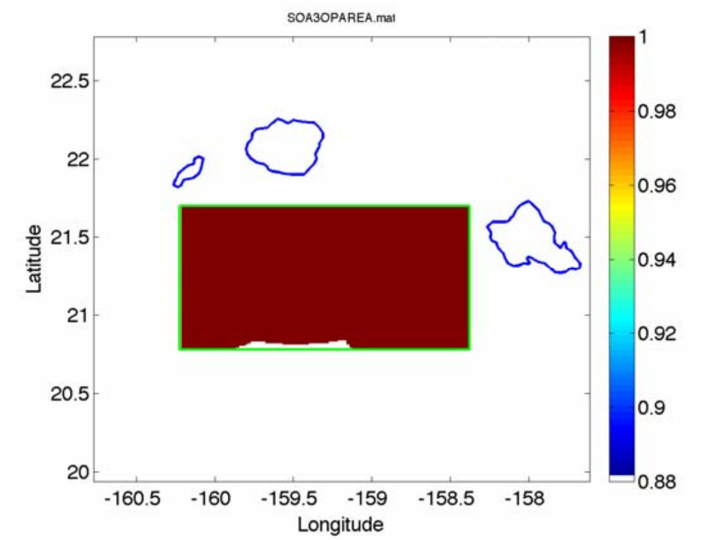

Figure J-29. Land Shadow Factor for SOA 3

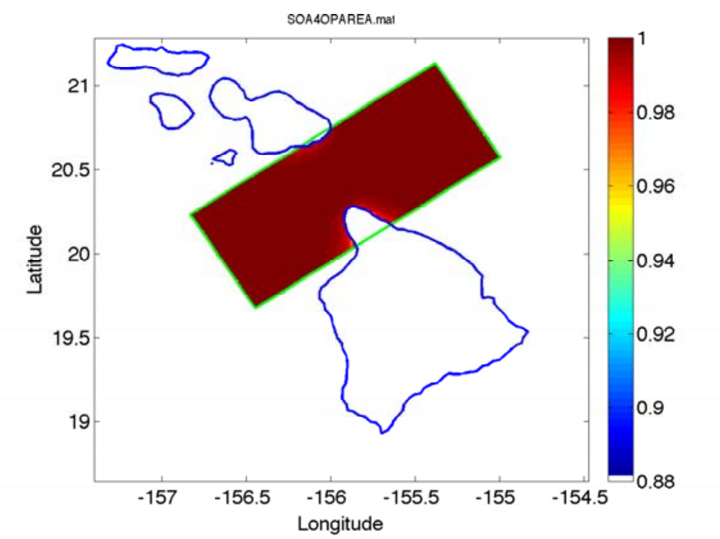

Figure J-30. Land Shadow Factor for SOA 4

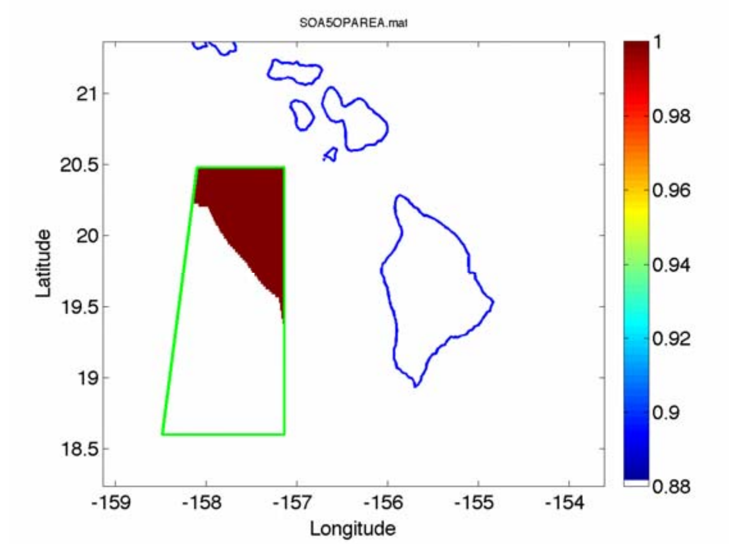

Figure J-31. Land Shadow Factor for SOA 5

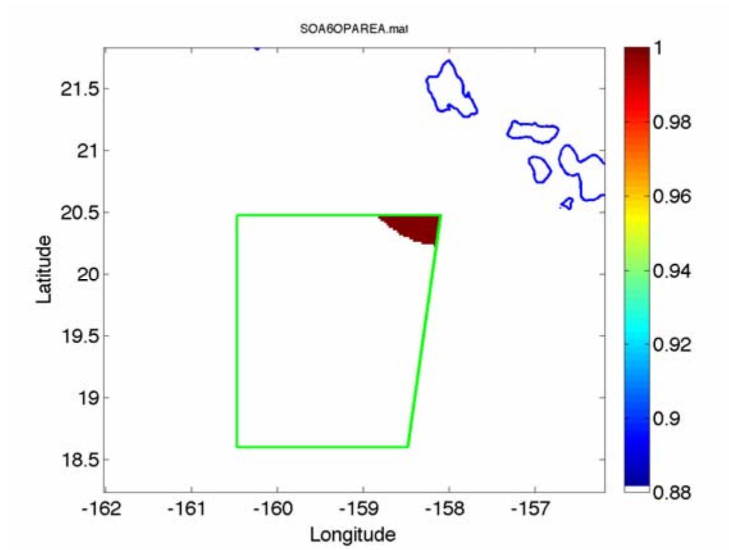

Figure J-32. Land Shadow Factor for SOA 6

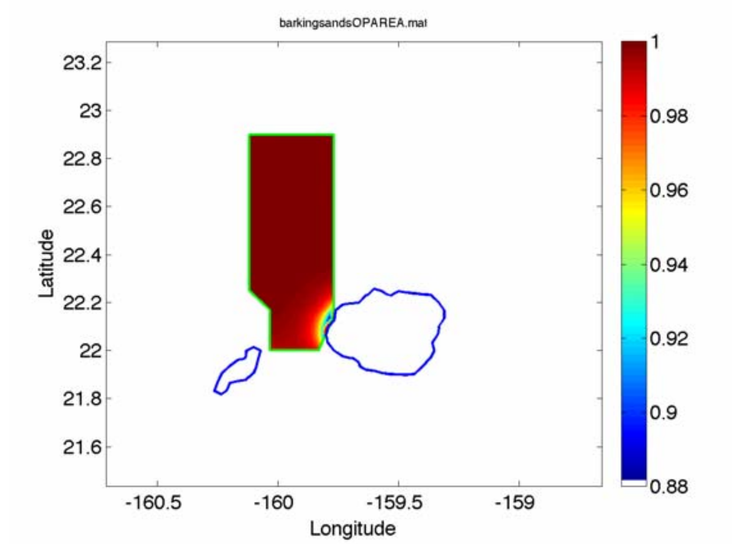

Figure J-33. Land Shadow Factor for Barking Sands Area

Computing the average of the factor value for each area by computing the mean of all sample points' factors yields a greater than 99 percent average factor for each area. In other words, assuming that action is evenly distributed over each SOA, land shadow effects affect the harassment count by less than 1 percent.

The Effect of Multiple Ships

Behavioral harassment, under risk function, uses maximum sound pressure level over a 24-hour period as the metric for determining the probability of harassment. An animal that receives sound from two sonars, operating simultaneously, receives its maximum sound pressure level from one of the ships. Thus, the effects of the louder, or closer, sonar determine the probability of harassment, and the more distant sonar does not. If the distant sonar operated by itself, it would create a lesser effect on the animal, but in the presence of a more dominating sound, its effects are cancelled. When two sources are sufficiently close together, their sound fields within the cutoff range will partially overlap and the larger of the two sound fields at each point in that overlap cancel the weaker. If the distance between sources is twice as large as the range to cutoff, there will be no overlap.

Computation of the overlap between sound fields requires the precise locations and number of the source ships. The general modeling scenarios of HRC do not have these parameters, so the effect was modeled using an average ship distance, 20 km, and an average number of ships per training event. The number of ships per training event varied based on the type of training event, as given in Table J-51.

Table J-51. Average Number of Ships in the HRC by Training Event Type

Training Event Type	Average Number of AN/SQS-53-Transmitting Ships
Other HRC ASW Training	1.5
USWEX	3
RIMPAC	4
Multiple Strike Group	4

The formation of ships in any of the above-referenced training events has been determined by Navy planners. For modeling purposes the ships are located in a straight line, perpendicular to the direction traveled. Figures J-34 and J-35 show examples with four ships, as in RIMPAC or a Multiple Strike Group, and their ship tracks.

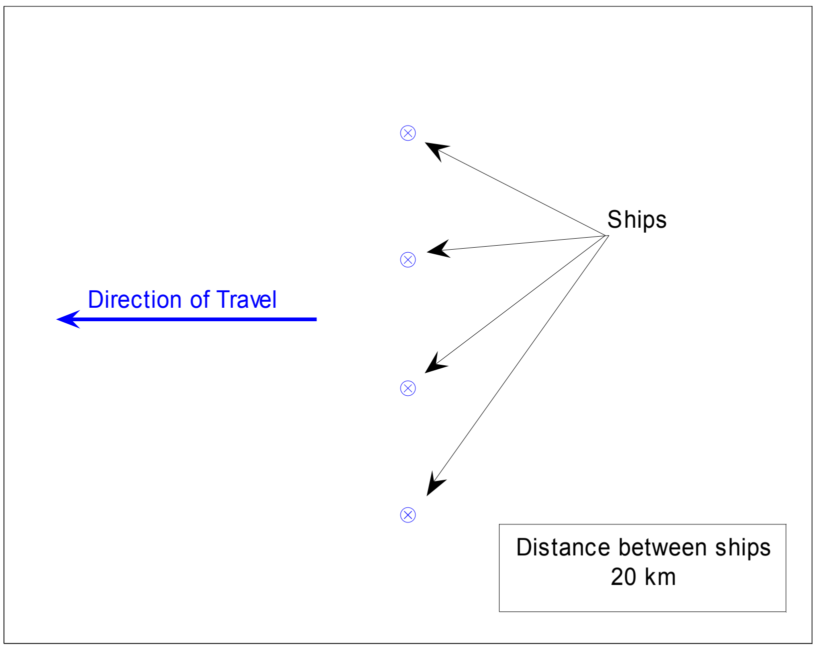

Figure J-34. Formation and Bearing of Ships in RIMPAC

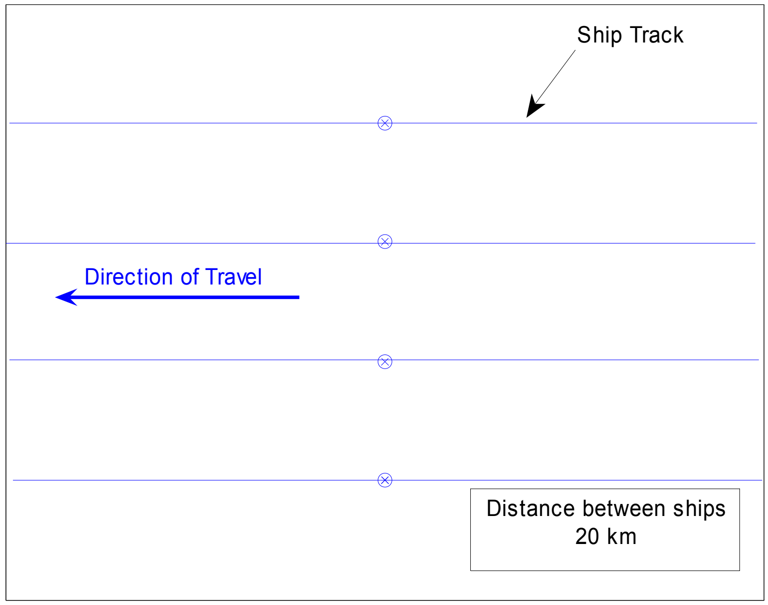

Figure J-35. Ship Tracks of Ships in RIMPAC

The sound field created by these ships (Figure J-36), which transmit sonar continually as they travel, will be uniform in the direction of travel (or the “x” direction), and vary by distance from the ship track in the direction perpendicular to the direction of travel (or the “y” direction).

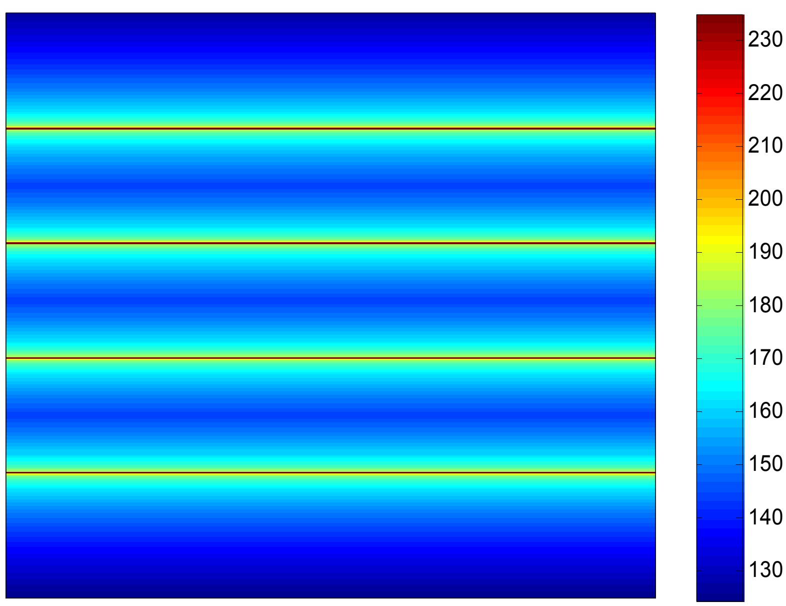

Figure J-36. Sound Field Produced by Multiple Ships

This sound field of the four ships operating together ensonifies less area than four ships operating individually. However, because at the time of modeling, even the average number of ships and mean distances between them were unknown, a post-calculation correction should be applied.

Referring to Figure J-37, the sound field around the ship tracks, the portion above the upper-most ship track, and the portion below the lower-most ship track sum to produce exactly the sound field as an individual ship.

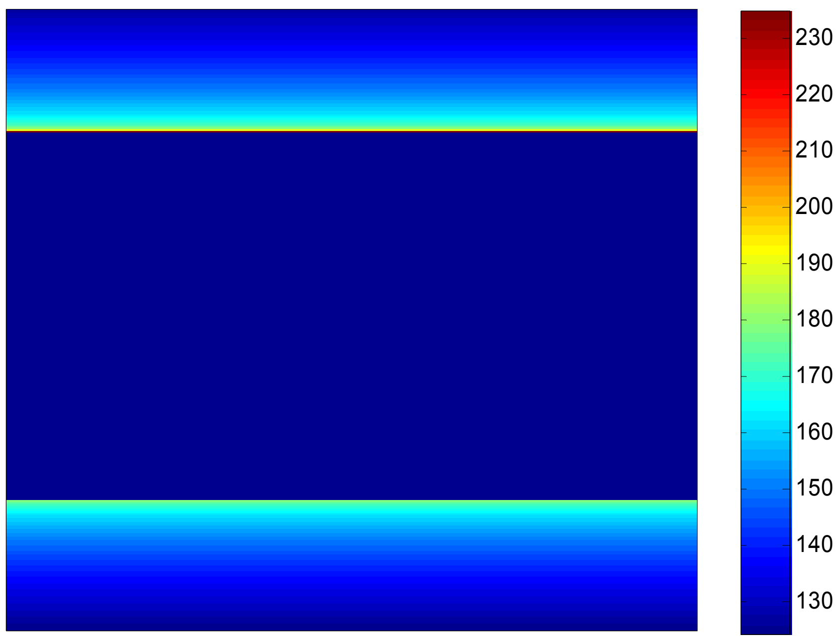

Figure J-37. Upper and Lower Portion of Sound Field

Therefore, the remaining portion of the sound field, between the uppermost ship track and the lowermost ship track, is the contribution of the three additional ships (Figure J-38).

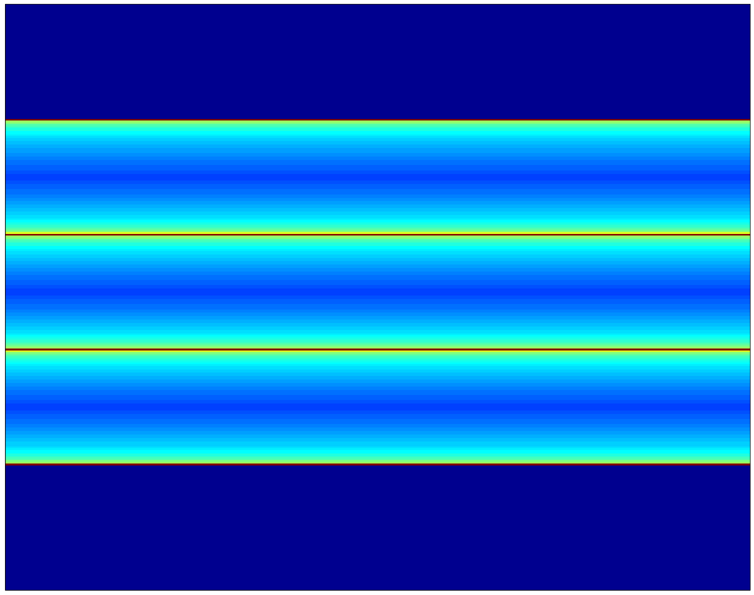

Figure J-38. Central Portion of Sound Field

This remaining sound field is made up of three bands. Each of the three additional ships contributes one band to the sound field. Each band is somewhat less than the contribution of the individual ship because its sound is overcome by the nearer source at the center of the band. Since each ship maintains 20-km distance between it and the next, the height of these bands is 20 km, and the sound from each side projects 10 km before it is overcome by the source on the other side of the band. Thus, the contribution to a sound field for an additional ship is identical to that produced by an individual ship whose sound path is obstructed at 10 km. The work in the previous discussion on land shadow provides a calculation of effect reduction for obstructed sound at each range. For example, an AN/SQS 53 MFA sonar with an obstructed signal at 10 km causes 94 percent of the number of harassments as a ship with an unobstructed signal. Therefore, each additional ship causes 0.94 times the harassments of the individual ship. Applying this factor to the four training event types from Table J-52, an adjustment from the results for a single ship can be applied to predict the effects of multiple ships.

Table J-52. Adjustment Factors for Multiple Ships in HRC Training Events

Training Event Type	Average Number of AN/SQS-53-Transmitting Ships	Adjustment Factor from Individual Ship for Formation and Distance
Other HRC ASW Training	1.5	1.47
USWEX	3	2.88
RIMPAC	4	3.82
Multiple Strike Group	4	3.82

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Appendix K
Missile Launch Safety and Emergency Response

APPENDIX K MISSILE LAUNCH SAFETY AND EMERGENCY RESPONSE

This appendix discusses in general terms the potential health and safety hazards associated with missile launch activities and the corresponding procedures that are in place to protect people and assets. The information herein focuses on the nature and control of the potential hazards and public risks associated with pre-launch, launch, and emergency response.

While range safety is location, facility, and mission-dependent, the Department of Defense (DoD) has established standards and protocols to eliminate or acceptably minimize potential health and safety risks/hazards. For missile launch activities, the safety offices coordinate efforts and standards through the Range Safety Group of the Range Commander's Council (RCC). Three key products of this group are the documents:

- RCC Standard 319, Flight Termination Systems Commonality Standard
- RCC Standard 321, Common Risk Criteria for National Test Ranges, Subtitle: Inert Debris
- RCC Standard 324, Global Positioning and Inertial Measurements Range Safety Tracking Systems Commonality Standard

The Pacific Missile Range Facility (PMRF) Range Safety Office is an active participant in the Range Safety Group, and the Range mandates specific policies that follow from these guidance documents in *PMRF Instruction 8020.16, Missile/Rocket Flight Safety Policy*.

Safety regulations are directed at preventing the occurrence of potentially hazardous accidents and minimizing or mitigating the consequences of hazardous events. This is accomplished by employing system safety concepts and risk assessment methodology to identify and resolve potential safety hazards.

The range safety process is predicated on risk avoidance, minimization of accident impacts, and protection of population centers. Risk values related to missile launch activities are categorized in two ways: probability of vehicle failure, including all possible failure modes that *could* lead to debris impact events, and the probabilities of the adverse consequences that could result from impact events. The consequence estimation is quantified by two key measures: the probability of individual casualty, defined as the probability of a person at a given location being injured, or the expected number of casualties (collective risk), defined as the average number of persons that may be injured in a launch (typically a very small number, such as a few injuries per million launches).

Range safety is accomplished by establishing:

- Requirements and procedures for storage and handling of propellants, explosives, radioactive materials, and toxics

- Evaluation of mission plans to assess risks and methods to reduce risk
- Performance and reliability requirements for flight termination systems on the vehicle
- A real-time tracking and control system at the range
- Mission rules that are sufficient to provide the necessary protection to people both on and outside the boundaries of the launch facility

Procedures and analyses to protect the public can be generally divided into five aspects:

- Ground safety procedures—handling of propellants, ordnance, noise, hazardous operations, toxics, etc.
- Pre-flight mission analysis—vehicle, trajectory, etc.
- Flight termination system verification
- In-flight safety actions
- Emergency response

Ground Safety Procedures

Procedures have been established to handle and store all materials (propellants, etc.) which may be a hazard, control and monitor electromagnetic emissions, and govern transportation of materials to and from a facility. Storage of propellants and explosives is controlled by quantity–distance criteria. Failure modes and effects analyses are prepared when necessary for all potentially hazardous activities and devices.

Accidents that occur before launch can result in on-pad explosions, potential destruction of the vehicle, damage to facilities within range of the blast wave, and dispersion of debris in the vicinity of the pad. The types of accidents depend upon the nature of the propellants. An accident in handling storable hypergolic propellants could produce a toxic cloud, likely to move as a plume and disperse beyond the boundaries of the facility. The risk to the public would then depend upon the concentration of population in the path of this toxic plume and on the ability to evacuate or protect the population at risk until the cloud is dispersed. It is obviously advantageous if the winds generally blow away from populated areas. There are also specific safety requirements and risks associated with ground support equipment. The design and use of this equipment must incorporate safety considerations.

In order to protect personnel and the public from these types of hazards, careful analysis is performed. Each missile is evaluated for the toxic release hazard and explosive potential. When appropriate, more-detailed modeling of the transport of the toxic species is performed that incorporates atmospheric effects, such as local winds and turbulence. Where needed, a region may then be cleared of personnel. At PMRF, the amount of toxic substances is sufficiently small that the public is highly unlikely to be exposed to unhealthful levels of toxic chemicals from a missile accident. However, the range safety community has extensive experience with this type of hazard due to the large amount of toxic chemicals aboard some large space lift vehicles. When considering explosive potential, again each missile is evaluated for the hazard posed. Specific action is then taken to protect personnel within the higher risk region, such as ensuring that they are inside hardened structures (such as block houses) that will protect them from the blast wave. Although large explosions can lead to effects relatively far from the launch pad, the motors proposed at PMRF are small compared to the large space lift vehicles, and the possibility of injury to a person outside the Ground Hazard Area from a missile explosion is extremely remote.

Pre-Flight Mission Analysis

Minimization of the probability of terminating a "good" flight and simultaneous minimization of the potential of risk due to malfunctioning missile is accomplished through careful mission planning, preparation, and approval before launch. Planning is in two parts:

- Mission definition such that land overflights or other higher risk aspects of launch are avoided and/or minimized
- Development of data that support the real-time decision and implementation of active control and destruct activities

Hazard potential exists for a missile in-flight because of the impact of falling debris (at speeds that can cause direct injury or damage buildings with occupants inside) and because of the potential for explosion upon impact of liquid and/or solid propellants. This potential hazard from propellants decreases with time into the flight because the quantities of on-board propellants decrease as they are consumed.

Range Safety Planning

The actual implementation of operational plans under launch conditions ultimately determines the actual risk exposure levels on and off site. Integral to the analysis are the constraints posed by the following:

- Launch area/range geometry and siting
- Nominal flight trajectories/profiles
- Launch/release points
- Impact limit lines, whether based on risk to population/facilities or balanced risk criteria
- Flight termination system and destruct criteria
- Wind/weather restrictions
- Instrumentation for ground tracking and sensing onboard the vehicle
- Essential support personnel requirements

The Range Safety Office typically reviews and approves launch plans, imposes and implements destruct lines, and verifies that appropriate warnings areas have been published.

The launch (normal and failure) scenarios are modeled, and possible system failure modes are superimposed against the proposed nominal flight plan. The hazard to third parties is dependent on the vehicle configuration, flight path, launch location, weather, and many other factors.

A blast danger area around the missile on the launch pad and a launch danger area (typically a circle centered on the pad with tangents extended along the launch trajectory) are prescribed for each missile depending on its type, configuration, amount of propellants and their toxicity, explosive blast wave potential, explosive fragment velocities anticipated in case of an accident, typical weather conditions, and plume models of the launch area.

Each launch is evaluated based on:

- Range user data submission requirements from the hazard analysis viewpoint
- Launch vehicle analyses to determine all significant failure modes and their corresponding probability of occurrence
- The vehicle trajectory, under significant failure mode conditions, which is analyzed to derive the impact of probability density functions for intact, structurally failed, and destructed options
- The vehicle casualty area based on anticipated (modeled) conditions at the time of impact, based on the vulnerability of people, buildings, and vehicles to the hazards to which they may be exposed
- Computed casualty expectations given the specific launch and mission profile, population data near the range and along the ground track. Shelters may be provided or evacuation procedures adopted, in addition to restricting the airspace along the launch corridor and notifying the air and shipping communities to avoid and/or minimize risks

Launch Hazards

Failures during the launch and ascent can be divided into two categories: propulsion and guidance/control. In-flight destruct of the vehicle enables dispersion of propellants, thus reducing the possibility of secondary explosions upon ground impact. The destruct systems on vehicles having cryogenics are designed to minimize the mixing of the propellants, i.e., holes are opened on the opposite ends of the fuel tanks. Solid rocket destruct systems usually consist of linear shaped charges running along the length of the rocket, which open up the side of the casing like a clam shell, causing an abrupt loss of pressure and thrust. They may, however, produce many pieces of debris in the form of burning chunks of propellant and fragments of the motor casing and engines.

Propulsion failures produce a loss of thrust and the inability of the vehicle to ascend. Depending on its altitude and speed when thrust ceases, the vehicle can fall to the ground intact or break up under aerodynamic stresses. The debris from these types of failures typically falls on or very near the intended flight track. If the vehicle falls to the ground intact, the consequences may be similar to those of an explosion on the ground. An explosion leads to a blast wave, which can directly injure people or damage structures with people inside. If there is potential for a significant explosion, a vehicle is destroyed during descent to prevent an impact intact. An example of a propulsion failure is a solid-rocket motor burn-through. Solid rocket motor failures can be due to a burn-through of the motor casing or damage or burn-through of the motor nozzle. In a motor burn-through there is a loss of chamber pressure and an opening is created in the side of the case, frequently resulting in structural breakup. The nozzle burn-through may affect both the magnitude and the direction of thrust. There is no way to halt the burning of a solid rocket once initiated. Hence, a solid rocket motor failure almost inevitably puts the entire launch vehicle and mission at risk.

The Range Safety System (RSS) is critical in the case of guidance or control failures. The purpose of the RSS is to destroy, halt, or neutralize the thrust of an errant vehicle before its debris can be dispersed off-range and become capable of causing damage or loss of life. Without a flight termination system, an errant missile could continue flying toward a population center or other valuable asset. The debris could then injure people or cause considerable damage. The destruct system generally is activated either on command or automatically soon after the time of failure.

In addition to complete loss of control, three other early flight guidance and control failures have been observed with launch vehicles over the life span of the space program: failure to pitch over, pitching over but flying in the wrong direction (i.e., failure to roll before the pitchover maneuver), and having the wrong trajectory programmed into the guidance computer. The likelihood of these circumstances depends on the type of guidance and control used during the early portion of flight. The types are open or closed loop (i.e., no feedback corrections) and programmer or guidance controlled. In the case of vehicles that use programming and open-loop guidance during the first portion of flight, failure to roll and pitch is possible, although relatively unlikely, based on historical flight data. If the vehicle fails to pitch over, it rises vertically until it is destroyed. As it gains altitude, the destruct debris can spread over an increasingly larger area. Consequently, most ranges watch for the pitchover, and if it does not occur before a specified time, they destroy the vehicle before its debris pattern can pose significant risk to structures and people outside the launch facility or the region anticipated to be a hazard zone, where restrictions on airspace and ship traffic apply. Failure to halt the vehicle within this time can produce a significant risk to those not associated with launch activities.

The potential for damage to ground sites from a launch vehicle generally decreases with time into flight since fuel is consumed as the vehicle gains altitude. If it breaks up or is destroyed at a higher altitude, the liquid fuels are more likely to be dispersed and lead to lower concentrations on the ground. In addition, if there are solid propellants, they would have been partially consumed during the flight period before the failure and would continue to burn in free fall after the breakup.

Risk Modeling

The evaluation of launch associated hazards is based on range destruct criteria designed to minimize risk exposure to on- and off-range population and facilities.

Range safety reports, safety analysis reports, and other such probabilistic hazard analyses are prepared by range users for each vehicle. An updated data package is provided for each mission with key unique parameters, such as the flight paths and minor vehicle changes.

Modeling by the Range Safety Office computes risks based on estimating both the probabilities and consequences of launch failures as a function of time into the mission. Input data includes the mission profile, launch vehicle specifics, local weather conditions, and the surrounding population distribution. In many cases, the Range works in advance with the user to optimize a launch trajectory to minimize risk while meeting mission objectives. Destruct lines, which will be implemented in real-time, are established during the risk evaluation process to confine and/or minimize potential public risk of casualty or property damage. The debris impact probabilities and consequences are then estimated for each launch considering the geographic setting, normal jettisons, failure debris, and demographic data.

For all launches, the boosters, sustainers, and other expendable equipment are always jettisoned and fall back to the Earth. Therefore, in planning a mission, care must be taken to keep these objects from impacting on land, aircraft, and shipping lanes. These impact locations are normally quite predictable, so risks can be avoided on a nominal mission.

Destruct lines are designed to protect the public from launch accident debris and are a key result in the risk modeling. They are offset from populated areas to accommodate:

- Vehicle performance characteristics and wind effects
- The scatter of vehicle debris following an explosion
- The accuracy and safety-related tolerances of the vehicle tracking and monitoring system
- The time delays between the impact point impingement on a destruct line and the time at which flight termination actually takes place (i.e., human decision time lag)

By proper selection of destruct lines, the probability of debris impacting inhabited areas can be reduced to extremely small levels.

The first step in modeling debris from failures is to understand the type of failures to which a particular vehicle may be subject. Estimates for failure mode probabilities are typically based on knowledge of a vehicle's critical systems and expert assessment of their reliability combined with historical data, when available.

Then the response of the vehicle to each failure must be modeled. Simulation of the vehicle systems and the resulting vehicle trajectory allow for understanding the effects of a failed component. The modeling is very vehicle-specific until thrust is terminated (by direct result of the failure, automatic on-board termination, flight safety action, or aerodynamic breakup). If the vehicle breaks apart or is destroyed, the resulting debris is then characterized by both aerodynamic properties and properties that affect the consequences if it impacts a person or object. There is inherent uncertainty in these parameters, which is included in the risk modeling.

After thrust is terminated the debris from the accident propagates ballistically (the only forces are drag, lift, and gravity). Debris that is very dense and has a high ballistic coefficient (β) is less affected by the atmosphere and will tend to land closer to the vacuum instantaneous impact point than lower ballistic coefficient pieces. High ballistic coefficients can be associated with pumps, other compact metal equipment, etc. Panels or pieces of motor and rocket skin offer a high drag relative to their mass (a low ballistic coefficient) and consequently slow down much more rapidly in the atmosphere. After slowing down they tend to fall and drift with the wind. A piece of debris with a very low ballistic coefficient (β =1) is shown to stop its forward flight almost immediately and drift to impact in the direction of the wind. Pieces having intermediate value ballistic coefficients show a combination of effects. The uncertainties in the wind and aerodynamics of the pieces are accounted for during this stage, resulting in a dispersion of debris.

For each debris piece that may impact, the consequence is then modeled. Impacting launch vehicle fragments can be divided into four categories:

- Inert pieces of vehicle structure,
- Pieces of solid propellant (some of which may burn up during free fall),
- Vehicle structures which contain propellant (solid or liquid) that may continue to burn after landing (but are non-explosive), and
- Fragments which contain propellant and which can explode upon impact

The consequence of a single fragment impact is quantified by the “casualty area.” The casualty area of an impacting fragment is the area about the fragment impact point within which a person would become a casualty. Casualties may result from a direct hit, from a bouncing fragment, from a collapsing structure resulting from an impact on a building or other shelter, from the overpressure pulse created by an explosive fragment, from a fire or toxic cloud produced by the fragment, or some combination thereof. The hazard area is increased if a fragment has any significant horizontal velocity component at impact which could result in bouncing or other horizontal motion near ground level. Casualty area is also affected by the sheltering of people by structures. Usually structures protect people from debris, but a very large impact may also cause portions of a building to collapse, and the people inside are then also hazarded by the debris from the structure. From a consequence standpoint, the pieces having a higher ballistic coefficient impact at a higher velocity (and usually have larger mass) so can cause more severe injuries and more damage.

The regions or areas exposed to accident hazards must be identified and the vulnerability to debris quantified. This is called population modeling. A population model includes the location and number of groups of people as well as the types of structures they are in.

The final step is the computation of risk, both individual probability of casualty and collective expectation of casualty. This calculation incorporates the debris dispersion, the consequence determination, and the population model.

Safety Criteria

Acceptable risk criteria at PMRF are based on the guidance of RCC 321-02, and are currently as follows (per mission):

For mission essential personnel and assets,

- Probability of casualty for each individual must be less than 3 in 1 million (3×10^{-6}),
- Total expectation of casualty must be less than 300 in 1 million (3×10^{-4}),
- Probability of impact upon each aircraft with a 1 gram or greater piece of debris must be less than 1 in 1 million (1×10^{-6}), and

- Probability of impact upon each ship of debris with greater than 11 foot-pounds force (ft-lbf) of energy must be less than 10 in 1 million (1×10^{-5}).

For the general public,

- Probability of casualty for each individual must be less than 1 in 10 million (1×10^{-7}),
- Total expectation of casualty must be less than 30 in 1 million (3×10^{-5}),
- Probability of impact upon each aircraft with a 1 gram or greater piece of debris must be less than 1 in 10 million (1×10^{-7}), and
- Probability of impact on each ship of debris with greater than 11 ft-lbf of energy must be less than 1 in 1 million (1×10^{-6}).

Aircraft and Ship Clearance Procedures

The criteria above are used to determine clearance area for aircraft and ships. Larger warning areas are also published that include the entire region where a hazard may exist.

For aircraft, clearance and warning areas are distributed through the Airmen's Information System and the Notice to Airmen (NOTAM) System. The Airmen's Information System consists of civil aeronautical charts and publications, such as airport/facility directories, published and distributed by the Federal Aviation Administration, National Aeronautical Charting Office. The aeronautical charts and the airport/facility directories contain more permanent data and are the main sources to notify airmen of changes in or to the National Airspace System.

The NOTAM System is a telecommunication system designed to distribute unanticipated or temporary changes in the National Airspace System, or until aeronautical charts and other publications can be amended. This information is distributed in the Notice to Airmen Publication. The Notice to Airmen Publication is divided into four parts: (1) NOTAMs expected to be in effect on the date of publication, (2) revisions to Minimum En Route Instrument Flight Rules Altitudes and Changeover Points, (3) international—flight prohibitions, potential hostile situations, foreign notices, and oceanic airspace notices, (4) special notices and graphics such as military training areas, large scale sporting events, air shows, and airport specific information—Special Traffic Management Programs. Notices in Sections 1 and 2 are submitted through the National Flight Data Center, ATA-110. Notices in Sections 3 and 4 are submitted and processed through Air Traffic Publications, ATA-10. Air Traffic Publications, ATA-10 issues the NOTAM Publication every 28 days.

For ship protection, clearance and warning areas are provided to the Coast Guard. The Coast Guard District is responsible for developing and issuing Local Notices to Mariners. Local Notices to Mariners are developed from information received from Coast Guard field units, the General Public, U.S. Army Corps of Engineers, U.S. Merchant Fleet, National Oceanic and Atmospheric Administration, National Ocean Service, and other sources, concerning the establishment of, changes to, and deficiencies in aids to navigation and any other information pertaining to the safety of the waterways within each Coast Guard District. This information includes reports of channel conditions, obstructions, hazards to navigation, dangers, anchorages, restricted areas, regattas, information on bridges such as proposed construction or modification, the establishment or removal of drill rigs and vessels, and similar items.

Range Safety System Validation

In order for mission rules such as destruct limits to be implemented, the range safety system must work, especially the flight termination system. For tracking (position and velocity data), multiple reliable, independent sources are required for each vehicle. Extensive effort is applied to the validation of the flight termination system. PMRF Instruction 8020.16 includes specific appendices for both tracking systems and for flight termination systems.

Tracking systems include both ground based systems (i.e., radar) and on-board systems (i.e., global positioning systems). Radar systems have been used extensively at PMRF for many years, and have very high reliability, having successfully tracked many vehicles. Radar tracking can either be performed to track a beacon on-board the vehicle or in skin-track mode. On-board data is sent to the ground through telemetry. On-board systems typically have very high accuracy. The standards in *RCC Standard 324, Global Positioning and Inertial Measurements Range Safety Tracking Systems Commonality Standard* provide guidance and specifications for testing of these systems to ensure their reliability.

A flight termination system consists of several components. The ground unit contains a transmitter, which can send simple tones on a mission-specific radio frequency. On the vehicle there is a radio receiver and a termination system. The termination system may either be a non-destructive thrust-termination action or a destruct charge that breaks apart the vehicle. The choice of the system depends on mission, vehicle, and safety constraints. This system must have high reliability, and numerous tests are performed on each flight termination system unit to ensure that it will work throughout all conceivable missile flight environments. *RCC Standard 319, Flight Termination Systems Commonality Standard* provides guidance and specifications for testing of these systems to ensure their reliability.

In-flight Safety Actions

In real-time, the impact points of debris are computed based on the current position and velocity of the vehicle. The impact points are based on telemetry and/or radar data of the vehicle position and velocity. These are displayed to the Missile Flight Safety Officer (MFSO), who monitors them relative to prescribed destruct lines. If the vehicle encroaches upon these lines, a destruct decision is made or withheld according to clearly formulated destruct criteria. A backup system during early flight is visual observation, where an observer watches the vehicle through a “skyscreen” with pre-determined boundaries. The observer advises the MFSO through handheld radio whether the missile is within the acceptable flight corridor.

Early in the flight the (predicted) instantaneous impact point advances slowly. As the vehicle altitude, velocity, and acceleration increase, the instantaneous impact point change rate also increases from zero to several miles per second. It is the instantaneous impact point that the Range Safety Officer usually observes during a launch. Prior to launch, a map with lines indicates the limits of excursion, which, when exceeded, would dictate a command signal to terminate flight.

Generally, the on-board destruct system is not activated early in flight (during the first few seconds or so) until the failed vehicle clears the launch. This is intended to protect valuable launch assets. Debris from such accidents will land within the Ground Hazard Area.

Emergency Response

PMRF has an Emergency Response Plan that defines the initial response requirements and procedures to be implemented in the event that a missile malfunction and/or flight termination occurs during flight activities. The following paragraphs present a general description of the emergency response process.

Initial response to any areas impacted by flight hardware shall be to secure and render safe the area for follow-on recovery and restoration activities. All areas affected by ground impact of flight hardware shall be cleared of all recoverable debris and environmentally restored. The recovery of launch hardware shall be accomplished in a manner consistent with each launch location's requirements as set forth in applicable environmental documentation and conditions specified by the appropriate land owner.

In the event of a flight termination or malfunction, Flight Safety would immediately determine the projected impact area(s) for all debris and flight hardware. The Emergency Response Coordinator would be notified, and the Emergency Response Plan would be initiated.

An initial assessment team would be immediately dispatched to the predicted impact area(s) to assess the situation.

Key elements of information to be obtained by the initial assessment team include:

- Exact impact location(s)
- Extent and condition of impact location(s)
- Personnel injuries
- Indications of fires and/or hazardous materials releases
- Extent of property damage

Results would be reported back to the Emergency Response Coordinator as expeditiously as possible. Based on this assessment, the Emergency Response Coordinator would call up and dispatch to the impact site(s) the appropriate elements of a contingency team.

The Contingency Team would be designated by the Emergency Response Coordinator and would consist of those elements determined to be required, based on the initial assessment. Elements that may be included on the Contingency Team may include, depending on the situation, communications, logistics, public affairs, staff judge advocate, security, health and safety, Explosive Ordnance Disposal, recovery, fire safety, and civilian agency personnel.

The initial priorities for the Contingency Team are the following:

- Emergency rescue and/or emergency medical treatment
- Establish site security
- Contain, control, and extinguish fires
- Confine hazardous materials

All elements of the Contingency Team would be under the control of an On Scene Incident Coordinator, designated by the Emergency Response Coordinator. The On Scene Incident Coordinator would retain on-scene control of all initial response elements until initial response operations are complete and recovery and site restoration activities commence.

The highest priorities during any emergency response operation are the rescue of injured or trapped personnel and the control of any fires produced by a launch or impact event. Rescue of injured and trapped personnel is of the highest priority. Responsibility for emergency rescue is shared among all initial response personnel but most especially by the first-on-scene security personnel and the fire response units (military or civilian). Rescues should be attempted using appropriate safety equipment and protective clothing (i.e., respirators, protective clothing, etc., as necessary). Since rescue may require entry into the impact area, care should be taken to avoid hazards associated with hazardous debris or fires. Under no circumstances shall rescue personnel unnecessarily endanger themselves during rescue activities. Rescue personnel should *never* require rescue by other response personnel.

Emergency response operations are complete once all impact sites have been secured, rescue operations are completed, any fires have been extinguished, and initial site reconnaissance has been performed. Recovery and site restoration activities can then be initiated. Using the results of the initial site reconnaissance, plans would be developed for the recovery of all debris and the restoration of the site(s) to natural conditions.

Additional post-launch recovery and restoration areas may be determined by the launch operator before and throughout mission-specific activities. The recovery of launch hardware would be accomplished in a manner consistent with the launch site procedures, and requirements set forth in applicable environmental documentation and conditions specified in agreements with appropriate land owners.

The launch site operator is responsible for planning, performance, and control of launch activities. This includes:

- Using results of analysis provided by Flight Safety to determine flight hardware impact zones which fully encompass the areas designated in the analysis
- Ensuring that appropriate agreements with all affected landowners are in place and adequately address recovery requirements
- Coordinating with local civilian authorities concerning recovery requirements
- Providing recovery plans to applicable agencies/personnel in accordance with current launch site policies
- Establishing appropriate travel routes (ground/air) prior to launch activities to outline access into recovery areas
- Perform visual inspections and obtain radar data to insure expeditious recovery of the missile
- Ensure complete recovery of missile hardware

The recovery team is responsible for the recovery of all missile debris and restoration of impact areas to their natural condition. Recovery personnel would have overall responsibility for controlling recovery and restoration activities. Air units composed of helicopters and support equipment would transport recovery personnel to road-inaccessible impact sites. Air support equipment would also transport the missile components out of all land and near-shore impact sites and perform quality assurance inspections or sweeps to ensure proper recovery procedures.

Each launch location is subject to all Federal and State regulations involving waste/material handling and disposal, endangered species, and historical resource preservation. Implementation of these regulations may require the assistance of civilian agencies and law enforcement authorities during recovery and restoration activities. Civilian assistance would be requested by each launch location in accordance with existing agreements.

The following is a list of personnel, equipment, transportation, and operational requirements that typically would be necessary to perform recovery activities.

Personnel

- Helicopter pilots
- Helicopter co-pilots
- Helicopter crew chief
- Explosive Ordnance Disposal personnel (two)
- Recovery personnel
- Project representative
- Owner representative (if required by controlling agent)
- Environmental representative (if required by controlling agent)

Roadblocks

Roadblocks shall be utilized to limit unauthorized access into recovery areas that include locations in the vicinity of public roadways or thoroughfares. The Recovery Team Coordinator would designate appropriate roadblock locations on roads leading into recovery areas. Roadblocks would be coordinated by the launch site security personnel, augmented as needed by local law enforcement personnel. At each roadblock positive communication would be established and maintained with the Recovery Team Coordinator and other security personnel/roadblocks. This communication would occur using either landlines (telephones), cellular telephone, or military radio systems.

Certain critical response personnel, such as ambulance/medical or fire response units, shall be permitted to pass through “active” roadblocks in the performance of their duties.

Debris Recovery

Personnel would arrive at impact site by appropriate mode. Recovery transportation vehicles would remain at the nearest accessible road. Explosive Ordnance Disposal members of the recovery team would be the first on scene and would be responsible for the identification, handling, control, and rendering safe of minor detonating charges and other minor hazardous debris. Other responsibilities include:

- Providing initial impact site control to prevent exposure for recovery personnel (Security personnel would assume this role as impact zone access controls are eased.)
- Maintaining area safety and rendering safe potential explosive materials
- Conducting initial impact site assessments for the identification of debris and the determination of recovery equipment requirements
- Assisting in dismantling of launch hardware prior to recovery and transport activities

Recovery personnel would then handle the next phase of the recovery including:

- Collect small missile parts
- Dismantle larger pieces into manageable sections
- Transport recovered parts by helicopter to recovery vehicles waiting at accessible roads

Environmental Restoration

Recovery activities would be coordinated with the Environmental Office at each launch site. If deemed necessary, an archaeologist and biologist would accompany Explosive Ordnance Disposal personnel during the initial site assessment to determine if cultural or sensitive biological resources are present at the impact site. These resource specialists would assist in the determination of recovery equipment requirements and recovery transport routes.

All recovery and restoration activities would be carried out in accordance with Memorandums of Agreement signed by appropriate State and Federal agencies and other potentially affected organizations. Impacted areas would be restored to a natural condition in accordance with land-owners' agreements and agency requirements.

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Acronyms and Abbreviations

ACRONYMS AND ABBREVIATIONS

A-A MISSILEX	Air-to-Air Missile Exercise
A-S GUNEX	Air-to-Surface Gunnery Exercise
A-S MISSILEX	Air-to-Surface Missile Exercise
AAF	Army Airfield
AAQS	Ambient Air Quality Standards
AAR	After Action Report
AAV	Amphibious Assault Vehicle
AAW	Anti-air Warfare
ABL	Airborne Laser
ABR	Auditory Brainstem Response
ACAM	Air Conformity Applicability Model
ACM	Air Combat Maneuver
ACTH	Adrenocorticotropic Hormone
ADAR	Air Deployable Active Receiver
ADCAP	Advanced Capability
AEP	Auditory Evoked Potentials
AFAST	Atlantic Fleet Active Sonar Training
AFB	Air Force Base
AFS	Air Force Station
AGL	Above Ground Level
AICUZ	Air Installation Compatible Use Zone
AIROPS	Aircraft Operations
AIS	Automatic Identification System
ALMDS	Airborne Laser Mine Detection System
ALTRV	Altitude Reservation
AMNS	Airborne Mine Neutralization System
AMPHIBEX	Amphibious Exercise
AMW	Anti-Missile Warfare
ANSI	American National Standards Institute
AP	Ammonium Perchlorate
API	Agricultural Preservation Initiative
APZ	Accident Potential Zone
ARDEL	Advanced Radar Detection Laboratory
ARP	Antenna Radiation Patterns
ARTCC	Air Route Traffic Control Center
ASDS	Advanced Sea, Air, and Land Delivery System
ASFA	Aquatic Sciences and Fisheries Abstract
ASRM	Advanced Solid Rocket Motor
AST	Aboveground Storage Tank
ASUW	Anti-Surface Warfare
ASW	Anti-Submarine Warfare
ATCAA	Air Traffic Control Assigned Airspace
ATF	Acoustic Test Facility

ATOC	Acoustic Thermometry of Ocean Climate
AWOIS	Automated Wreck and Obstruction Information System
BARSTUR	Barking Sands Tactical Underwater Range
BATS	Ballistic Aerial Target System
BMD	Ballistic Missile Defense
BMUS	Bottomfish Management Unit Species
BOMBEX	Bombing Exercise
BRAC	Base Realignment and Closure
BSURE	Barking Sands Underwater Range Extension
BWS	Board of Water Supply
C2	Command and Control
C3	Command, Control, and Communications
CAA	Clean Air Act
CAS	Close Air Support
CASEX	Close Air Support Exercise
CATM	Captive Air Training Missile
CCD	Coastal Consistency Determination
CEC	Cooperative Engagement Capability
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFFC	Commander, Fleet Forces Command
CFR	Code of Federal Regulations
CHAFFEX	Chaff Exercise
CHCRT	Currently Harvested Coral Reef Taxa
CHESS	Chase Encirclement Stress Studies
CHRIMP	Consolidated Hazardous Material Reutilization and Inventory Management Program
CMUS	Crustacean Management Unit Species
CNEL	Community Noise Equivalent Level
CNO	Chief of Naval Operations
COMNAVSURFPAC	Commander, Naval Surface Force, U.S. Pacific Fleet
COMPTUEX	Composite Training Unit Exercise
COSIP	Coherent Signal Processing
CPA	Closest Point of Approach
CPF	Commander, Pacific Fleet
CRRC	Combat Rubber Raiding Craft
CSAR	Combat Search and Rescue
CSG	Carrier Strike Group
CSSQT	Combat System Ship Qualification Trial
CV	Coefficient of Variation
CWA	Clean Water Act
CWB	Clean Water Branch
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
DA	Direct Action
dB	Decibel

dBA	A-Weighted Decibels
DBDBV	Digital Bathymetry Data Base Variable Resolution
dBP	Decibels (Peak)
DDC	Defense Distribution Center
DDC	Department of Design and Construction
DDT	Dichlorodiphyenyltrichloroethane
DEIS	Draft Environmental Impact Statement
DEMO	Demolition
DHHL	Department of Hawaiian Homelands
DICASS	Directional Command-Activated Sonobuoy System
DLNR	Department of Land and Natural Resources
DMR	Dillingham Military Reservation
DNT	Dinitrotoluene
DoD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
DRMO	Defense Reutilization and Marketing Office
DTS	Department of Transportation Services
EA	Environmental Assessment
EC	Electronic Combat
EC50	Effective concentration where 50 percent of maximal effect is observed
ECM	Electronic Countermeasures
EER	Extended Echo Ranging
EEZ	Exclusive Economic Zone
EFD	Energy Flux Density
EFDL	Energy Flux Density Level
EFH	Essential Fish Habitat
EFV	Expeditionary Fighting Vehicle
EIS	Environmental Impact Statement
EL	Energy Level
EM	Electromagnetic
EMESS	Electromagnetic Environmental System Simulator
EMI	Electromagnetic Interference
EMR	Electromagnetic Radiation
ENSO	El Niño Southern Oscillation
EO	Executive Order
EOD	Explosive Ordnance Disposal
EODMU	Explosive Ordnance Disposal Mobile Unit
EPCRA	Emergency Planning and Community Right-to-Know Act
ERGM	Extended Range Guided Munition
ESA	Endangered Species Act
ESG	Expeditionary Strike Group
ESM	Electronic Warfare Support Measures
ESQD	Explosive Safety Quantity Distance
ET	Electronically Timed
EW	Electronic Warfare

FAA	Federal Aviation Administration
ºF	Degree Fahrenheit
FACSFAC	Fleet Area Control and Surveillance Facility
FACSFACPH	Fleet and Area Control and Surveillance Facility Pearl Harbor
FAR	Federal Acquisition Regulation
FAST	Floating At Sea Target
FCLP	Field Carrier Landing Practice
FEIS	Final Environmental Impact Statement
FIR	Flight Information Region
FIREX	Fire Support Exercise
FL	Flight Level
FLAREX	Flare Exercise
FM	Frequency Modulation
FMP	Fishery Management Plan
FOIA	Freedom of Information Act
FORACS	Fleet Operational Readiness
FRTP	Fleet Response Training Plan
FSEL	Flat Sound Equivalent Level
ft	Foot (Feet)
ft^2	Square Foot (Square Feet)
FTEC	Fleet Technical Evaluation Center
FTF	Flexible Family Target
ft-lb	Foot-pound Force
FY	Fiscal Year
gal	Gallon
GDEM	Generalized Dynamic Environmental Model
GEM	Graphite Epoxy Motor
GHA	Ground Hazard Area
GPD	Gallons Per Day
GUNEX	Gunnery Exercise
HA/DR	Humanitarian Assistance/Disaster Relief
HAFB	Hickam Air Force Base
HAO/NEO	Humanitarian Assistance Operation/Non-Combatant Evacuation Operation
HAPC	Habitat Areas of Particular Concern
HAR	Hawaii Administrative Regulations
HARM	High-Speed Anti-Radiation Missile
HATS	Hawaii Area Tracking System
HCF	Hawaii Community Foundation
HDAR	Hawaii Department of Aquatic Resources
HDLNR	Hawaii Department of Land and Natural Resources
HE-ET	High Explosive Electronically Timed Projectile
HERF	Hazard of Electromagnetic Radiation to Fuel
HERO	Hazard of Electromagnetic Radiation to Ordnance
HERP	Hazard of Electromagnetic Radiation to Personnel
HF	High Frequency
HFA	High-Frequency Active

HFBL	High Frequency Bottom Loss
HIANG	Hawaii Air National Guard
HIHWNMS	Hawaiian Islands Humpback Whale National Marine Sanctuary
HMR	Helemano Military Reservation
HMX	High Melting Explosive
HRC	Hawaii Range Complex
HRS	Hawaii Revised Statutes
Hz	Hertz
ICAO	International Civil Aviation Authority
ICMP	Integrated Comprehensive Monitoring Plan
ICRMP	Integrated Cultural Resource Management Plan
IEER	Improved Extended Echo Ranging
IFF	Identification Friend or Foe
IFR	Instrument Flight Rules
IHA	Incidental Harassment Authorization
INRMP	Integrated Natural Resources Management Plan
IP	Implementation Plan
IR	Infrared
IRFNA	Inhibited Red Fuming Nitric Acid
IRP	Installation Restoration Program
ISTT	Improved Surface Towed Targets
ITAM	Integrated Training Area Management
IUCN	International Union for Conservation of Nature and Natural Resources (World Conservation Union)
IWC	International Whaling Commission
JATO	Jet-Assisted Takeoff
JNTC	Joint National Training Capability
JTF WARNET	Joint Task Force Wide Area Relay Network
JTFEX	Joint Task Force Exercise
KE-ET	Kinetic Energy Projectile
kHz	Kilohertz
KIUC	Kauai Island Utility Cooperative
km	kilometer
KTA	Kahuku Training Area
KTF	Kauai Test Facility
kV	Kilovolt
KW	Kilowatt
LASH	Littoral Airborne Sensor Hyper-spectral
LATR	Large Area Tracking Range
lb	Pound(s)
LC50	The lethal concentration that kills 50 percent of test animals
LCAC	Landing Craft, Air Cushioned
LCU	Landing Craft, Utility
L_{dn}	Day-Night Average Sound Level
L_{eq} 1 sec	1-Second Averaged Equivalent Sound Level
L_{eq}	Energy Equivalent Sound Level

LFA	Low-Frequency Active
LFBL	Low-Frequency Bottom Loss
LFX	Live Fire Exercise
L_{max}	Maximum Sound Level
LMRS	Long-term Mine Reconnaissance System
LOA	Letter of Authorization
LOS	Level of Service
LSRB	Laser Safety Review Board
LTO	Landing and Takeoff
LWAD	Littoral Warfare Advanced Development
m	Meter
m/sec	Meter per Second
MAGTF	Marine Air Ground Task Force
MATSS	Mobile Aerial Target Support System
MBTA	Migratory Bird Treaty Act
MCBH	Marine Corps Base Hawaii
MCM	Mine Countermeasures
MCTAB	Marine Corps Training Area–Bellows
MDA	Missile Defense Agency
MDSU-1	Mobile Diving and Salvage Unit One
MEU	Marine Expeditionary Unit
MFA	Mid-Frequency Active
MFSO	Missile Flight Safety Officer
MGD	Million Gallons Per Day
mg/kg	Milligrams Per Kilogram
mg/m^2	Milligrams Per Square Meter
mg/m^3	Milligrams Per Cubic Meter
$\mu g/m^3$	Micrograms Per Cubic Meter
MHz	Megahertz
mi	Mile
mi^2	Square Mile
MIDPAC	Mid-Pacific
MINEX	Mine Exercise
MISSILEX	Missile Exercise
MIW	Mine Warfare
MMHSRP	Marine Mammal Health and Stranding Response Program
MMPA	Marine Mammal Protection Act
MMR	Makua Military Reservation
MMR	Military Munitions Rule
µPa	Micropascal
µPa-m	Micropascal-Meter
μPa^2-s	Micropascal Squared-Second
MSAT	Marine Species Awareness Training
msec	Microsecond
MSE	Multiple Successive Explosions

MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSL	Mean Sea Level
MW	Megawatt
N/A	Not Applicable
NAA	Non-attainment Area
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NASA	National Aeronautics and Space Administration
NATO	North Atlantic Treaty Organization
NAVEDTRA	Naval Educational Training
NAVMAG	Naval Magazine
NAVSEA	Naval Sea Systems Command
NAVSEAOP	Naval Sea Systems Command Publication
NAWQC	National Ambient Water Quality Criteria
NCA	National Command Authority
NDAA	National Defense Authorization Act of 2004
NEO	Noncombatant Evacuation Operation
NEPA	National Environmental Policy Act
NEW	Net Explosive Weight
nm	Nautical Mile
nm^2	Square Nautical Miles
NMFS	National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NOTAM	Notice to Airmen
NOTMAR	Notice to Mariners
NPAL	North Pacific Acoustic Laboratory
NRHP	National Register of Historic Places
NSFS	Naval Surface Fire Support
NSW	Naval Special Warfare
NTA	Navy Tactical Task
NUWC	Naval Undersea Warfare Center
OAMCM	Organic Airborne Mine Countermeasures
OASIS	Organic Airborne and Surface Influence Sweep
OC	Oceanic Control
OEEZ	Outer Exclusive Economic Zone
OEIS	Overseas Environmental Impact Statement
OMCM	Organic Mine Countermeasures
ONR	Office of Naval Research
OPA	Oil Pollution Act
OPAREA	Operating Area
OPNAVINST	Office of the Chief of Naval Operations Instruction
ORMP	Ocean Resources Management Plan
OSHA	Occupational Safety and Health Administration

OTTO	Torpedo Fuel
oz/gal	Ounces per Gallon
oz/lb	Ounces Per Pound
PA	Programmatic Agreement
PAH	Polycyclic Aromatic Hydrocarbons
PBX	Plastic Bonded Explosive
PCB	Polychlorinated Biphenyl
PCMUS	Precious Corals Management Unit Species
PETN	Pentaerythritol Tetranitrate
pH	Hydrogen Ion Concentration (a measure of acidity/alkalinity)
PHCRT	Potentially Harvested Coral Reef Taxa
PL	Public Law
PM-10	Particulate Matter with an Aerodynamic Diameter Less Than or Equal to 10 Microns
PM-2.5	Particulate Matter with an Aerodynamic Diameter Less Than or Equal to 2.5 Microns
PMAR	Primary Mission Area
PMRF	Pacific Missile Range Facility
PMRFINST	Pacific Missile Range Facility Instruction
POL	Petroleum, Oil, and Lubricants
POW/MIA	Prisoner of War/Missing in Action
ppb	Parts Per Billion
ppm	Parts Per Million
psi	Pounds Per Square Inch
psi-ms	Pounds Per Square Inch–Millisecond
PTA	Pohakuloa Training Area
PUTR	Portable Undersea Tracking Range
Q/L	Quick Look
QDR	Quadrennial Defense Review
RAMICS	Rapid Airborne Mine Clearance System
RCC	Range Commanders Council
RCD	Required Capabilities Document
RCMP	Range Complex Management Plan
RCRA	Resource Conservation and Recovery Act
RDF	Radio Direction Finding
RDT&E	Research, Development, Test, and Evaluation
RDX	Royal Demolition Explosive
RF	Radio Frequency
RHIB	Rigid Hull, Inflatable Boat
RIMPAC	Rim of the Pacific
RL	Received Level
RMS	Remote Minehunting System
RMS	Root Mean Square
ROD	Record of Decision
RSOP	Range Safety Operation Plan

RSS	Range Safety System
S-A GUNEX	Surface-to-Air Gunnery Exercise
S-A MISSILEX	Surface-to-Air Missile Exercise
S-S GUNEX	Surface-to-Surface Gunnery Exercise
S-S MISSILEX	Surface-to-Surface Missile Exercise
SARA	Superfund Amendments and Reauthorization Act
SAT/UNSAT	Satisfactory/Unsatisfactory
SBMR	Schofield Barracks Military Reservation
SD	Standard Deviation
SDV	Sea, Air and Land Delivery Vehicle
SEAL	United States Navy Sea, Air and Land
sec	Second
SEL	Sound Equivalent Level
SEPTAR	Seaborne Target
SESEF	Shipboard Electronic Systems Evaluation Facility
SHPO	State Historic Preservation Office
SICO	System Integration Checkout
SINKEX	Sink Exercise
SM	Standard Missile
SMA	Sonar Modeling Area
SOA	Submarine Operating Area
SOP	Standard Operating Procedures
SPAWAR	Space and Naval Warfare
SPECWAROPS	Special Warfare Operations
SPL	Sound Pressure Level
SPORTS	Sonar Positional Reporting System
SR	Special Reconnaissance
SSC	SPAWAR Systems Center
SSG	Surface Strike Group
SSTA	Submarine Sonar Training Area
STS	Strategic Target System
STW	Strike Warfare
SUA	Special Use Airspace
SURFSAT	Surface Weapons System Accuracy Test
SURTASS	Surveillance Towed Array Sensor System
SVP	Sound Velocity Profile
SWSA	Submarine Warfare System Assessment
SWTR	Shallow Water Training Range
T&E	Test and Evaluation, Threatened and Endangered
T/G	Touch-and-Go Landing
TA	Training Area
TACAN	Tactical Air Navigation
TAP	Tactical Training Theater Assessment and Planning
TBP	Tributyl Phosphate
THAAD	Terminal High Altitude Area Defense

TL	Transmission Loss
TM	Tympanic Membrane
TMDL	Total Maximum Daily Load
TNT	Trinitrotoluene
TOA	Temporary Operating Area
TORPEX	Torpedo Exercise
TPY	Tons Per Year
TRACKEX	Tracking Exercise
TTS	Temporary Threshold Shift
U.S.	United States
U.S.C.	United States Code
UAV	Unmanned Aerial Vehicle
UESA	Ultra High Frequency Electronically Scanned Array
UHF/VHF	Ultra High Frequency/Very High Frequency
UME	Unusual Mortality Event
UNDS	Uniform National Discharge Standard
USACE	United States Army Corps of Engineers
USAKA	United States Army Kwajalein Atoll
USARHAW	United States Army, Hawaii
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USSPACECOM	United States Space Command
UST	Underground Storage Tank
USTRANSCOM	United States Transportation Command
USV	Unmanned Surface Vehicle
USWEX	Undersea Warfare Exercise
USWREF	Undersea Warfare Readiness Evaluation Facility
USWTR	Undersea Warfare Training Range
UXO	Unexploded Ordnance
VBSS	Visit, Board, Search, and Seizure
VERTREP	Vertical Replacement
VFR	Visual Flight Rules
VHF	Very High Frequency
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound
VTOL	Vertical Takeoff and Landing
W	Warning Area
WAAF	Wheeler Army Airfield
WIT	Waterfront Integration Test
WNTC	Wheeler Network Communications Control
WPRFMC	Western Pacific Regional Fishery Management Council
WWTP	Waste Water Treatment Plant
ZOI	Zone of Influence