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STAFF REPORT AND RECOMMENDATION

ON CONSISTENCY DETERMINATION

Consistency Determination No.	**CD-037-06**
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FEDERAL AGENCY: **U.S. Navy**

DEVELOPMENT LOCATION: Four ocean areas offshore of Monterey and Santa Cruz counties (Exhibits 1-2)

DEVELOPMENT DESCRIPTION: "Monterey Bay 2006," a series of coordinated, short term, oceanographic research efforts by the Navy and other research institutions, to measure oceanographic processes including use of 13 research vessels, various unmanned craft, and mobile and fixed sensors (Exhibits 4-7 & 12)

SUBSTANTIVE FILE DOCUMENTS: See page 22.

EXECUTIVE SUMMARY

The U.S. Navy (Navy) has submitted a consistency determination for a coordinated series of short-term oceanographic research projects (called Monterey Bay 2006, or MB 06), to be conducted by the Navy and other oceanographic research institutions in waters offshore of Monterey and Santa Cruz Counties. The research effort would be temporary, scheduled for a two-month period (between mid-July to mid-September 2006). The research is intended to build on past research in the area and would consist of four inter-related projects conducted over an eight-week period, involving 13 research vessels, various unmanned craft (sea gliders, kayaks) and mobile and fixed sensors.

The research institutions working with the Navy include: Monterey Bay Aquarium Research Institute (MBARI), Moss Landing Marine Laboratories, Naval Postgraduate School, Scripps Institute of Oceanography, Massachusetts Institute of Technology, Penn State University, University of California at Berkeley, University of California at Santa Cruz, University of Hawaii, University of Massachusetts Dartmouth, University of Rhode Island, Woods Hole Oceanographic Institution, and Oregon State University.

The project is primarily in federal waters and temporary, and would not include any onshore activities or cables to shore. While the research is intended to benefit awareness of coastal processes, it nevertheless has the potential for short term adverse impacts on marine resources due to: (1) discharges from research vessels and support vessel; (2) noise from research vessels, support vessel, and individual pieces of oceanographic equipment; (3) vessel strikes on marine mammals from vessel transit; (4) entanglement with anchoring lines or expendable equipment; (5) equipment left on the seafloor; and (6) interference with commercial and recreational fishing and diving.

Acoustic impacts would involve aircraft operations and 73, mostly high-frequency (i.e. >10 kilohertz (kHz)), active acoustic sources, 47 of which emit sound within the frequency ranges likely to be heard by marine mammals (i.e., <200 kHz), with most sources in the 140-185 decibel (dB) range (re 1 μPa @ 1m [one micropascal at one meter]). In recent years, regulators and scientists have been moving towards a "dual" criteria for acoustic thresholds, one which combines sound pressure level (SPL) and sound exposure level (SEL). The first measures instantaneous peak pressures, and the second is a more cumulative measure of energy received over time. While a dual criteria should be an improved set of criteria, how it should be applied remains an evolving science. For example in another highly different context involving Navy mid-frequency sonar associated with military exercises (in North Carolina and Hawaii), the Navy has proposed a 190 dB threshold, NOAA Fisheries (NMFS) prefers 173 dB, and several institutions and environmental organizations have suggested 154 dB may be the most appropriate threshold (again, for military mid-frequency sonar). Not much focus has occurred over thresholds that may be applicable to the fairly common types of research-related and shipping sounds at the frequencies, intensities and durations similar to those proposed here, and unlike strandings associated with military sonar, no documentation exists to date that these types of sources pose threats to marine mammals. Nor does NMFS believe a "take" permit is even needed for the proposed research.

For the proposed 47 audible sources, the Navy selected 186 dB as a behavioral SEL threshold, noting that only nine sources would involve source levels of 186 or greater dB, and only three of which would exceed 185 dB beyond 2 meters from the source. The nine sources are similar to those commonly used by researchers in the marine environment and consist of acoustic doppler current profilers, lagrangian floats, side scan sonars, a sub-bottom profiler, float tracking device, and bubble scan device. Based on its calculations, the Navy predicts: "Impacts of noise on marine mammals are expected to range from negligible to minor, with short term duration and exposure." In addition, the Navy has committed to including marine mammal monitors on the research vessels to assure protection of marine mammals.

Having been extensively involved in the Marine Mammal Commission's Advisory Committee on Acoustic Impacts on Marine Mammals, the Commission is well aware of the complexities associated with attempting to reach consensus on regulatory thresholds for marine mammal impacts. Criteria will continue to evolve over time, and the movement from a single to a dual criteria is a step in the right direction. At the same time, commonly occurring, predominantly high-frequency marine research activities should not be treated the same as mid-frequency military sonar. Even if 186 dB were not a proper threshold, given that the higher the frequency the more quickly sounds attenuate, the difference between 186 dB and 173 dB, or for that matter, the difference between 186 dB and 154 dB, is not likely to be very extensive for these sources. Again, based on the current level of knowledge, the types of sounds to be emitted during the proposed research activities are not the type that have typically caused concern.

In conclusion, the proposed research activities would include sounds typical of those emitted in the marine environment by ships, side-scan sonar, fish finding sonar, depth sounding sonar, bottom profilers, navigation transponders, military search and surveillance and mine avoidance sonars. Thousands of such noise-emitters operate worldwide and off the California coast, and while they may be of concern cumulatively, evidence to date has not established the type of cause and effect relationship sufficient to further regulate them. The Navy is including prudent monitoring and avoidance measures to minimize impacts, which should be adequate for the proposed activities to avoid adverse effects on marine mammals. In addition, the schedule would avoid the gray whale migration season and is of short duration. Where feasible, material used in the research will be removed from the marine environment, and where they would not, they would not adversely affect the marine environment. The proposed scientific research is an allowable use (under Section 30233(a)), no less environmentally damaging feasible alternatives (or alternative locations) are available, and monitoring and avoidance measures are adequate enable the Commission to find that marine resources would be adequately protected. The research will provide valuable oceanographic information to improve understanding of ocean processes. The project includes notice to mariners and divers, and the Navy states the research areas are too deep for the activities to affect recreational diving. The project is therefore consistent with the applicable marine resource, water quality, fill of coastal waters, commercial/recreational fishing, and recreational diving policies (Sections 30220, 30230, 20331, 30233, 30234, and 30234.5) of the Coastal Act.

STAFF SUMMARY AND RECOMMENDATION

I. STAFF SUMMARY

A. Project Description. The U.S. Navy (Navy) has submitted a consistency determination for a coordinated series of short-term oceanographic research projects to be conducted in offshore waters of the Monterey Bay National Marine Sanctuary (MBNMS) between mid-July and mid-September 2006. Called "Monterey Bay 2006" (or "MB 06"), this research effort is intended to build on earlier experiments conducted in the Sanctuary in 1999 and 2003. The research would consist of four inter-related projects conducted over an eight-week period, involving 13 research vessels, various unmanned craft (sea gliders, kayaks) and mobile and fixed sensors.

The Navy (Office of Naval Research) is funding and taking the lead for environmental compliance, although the project involves a number of nationally prestigious research institutions, including the Monterey Bay Aquarium Research Institute (MBARI), Moss Landing Marine Laboratories, Naval Postgraduate School, Scripps Institute of Oceanography, Massachusetts Institute of Technology, Penn State University, University of California at Berkeley, University of California at Santa Cruz, University of Hawaii, University of Massachusetts Dartmouth, University of Rhode Island, Woods Hole Oceanographic Institution, and Oregon State University.

The Navy states the research purpose is to "...demonstrate the capability to coordinate a diverse collection of manned and unmanned observing platforms within the context of data-assimilating models to form an effective ocean observing and undersea monitoring system." The Navy elaborates:

> *MB 06 will compliment* [sic] *ongoing research efforts and will help to accomplish sanctuary goals by making the oceanographic data collected and lessons learned during the proposed experiments available to the public. The insights into the Monterey Bay oceanographic processes resulting from MB 06 should prove beneficial to environmental agencies involved in ecosystem study/management and to commercial institutions that rely on oceanographic knowledge and predictions. In addition, MB 06 will provide for the continued collection of high quality, well characterized, ocean acoustic data sets, as required for refinement of oceanographic modeling and algorithm development and evaluation. Algorithms to be developed will be of significant value to the acoustic monitoring capabilities of the U.S. Navy.*
>
> *MB 06 will collect and record ocean data that:*
>
> - *Measure physical processes on scales relevant to model parameterizations.*
> - *Measure ecosystem responses on scales coherent with physical processes.*
> - *Produce ocean regional forecasts on a defined schedule.*
> - *Detect, classify and localize (DCL) ships or their acoustic surrogates.*
> - *Adapt (re-orient and re-direct) the distributed observational sensors in a timely way to reduce forecast and DCL error."*

Describing project needs and benefits, the Navy states:

> *The needs to accomplish the proposed action include:*
>
> - *To acquire current oceanographic data during upwelling and transition periods in the MBNMS;*
> - *To establish a communications architecture that supports the collection of oceanographic and acoustic data in near-real time;*
> - *To further refine oceanographic models and their predictive capabilities; and*
> - *To support the mandate of the MBNMS under the NMSA.*

The research benefits of MB 06 outweigh any environmental consequences that it may produce. The insights into the physical dynamics and acoustic nature of the coastal ocean environment of Monterey Bay will be both enlightening and substantial, resulting in an improved predictive capability, more efficient ecosystem management techniques, and a reduced dependence on fixed sensors for ocean monitoring.

The research would involve a total of 354 research vessel days and 40 aircraft days, planned to occur over a 60 day period between July 15 and Sept. 15, 2006, within "Op Areas" A, B, C and D (Exhibits 1-2) located offshore of Monterey Santa Cruz Counties. The four projects that make up the overall research program are called: Adaptive Sampling And Prediction (ASAP); Undersea Persistent Surveillance (UPS); Assessing the Effects of Submesoscale Ocean Parameterizations (AESOP) and Layered Organization in the Coastal Ocean (LOCO), further described as follows:

AESOP

The AESOP project (Assessing the Effects of Submesoscale Ocean Parameterizations) is [proposed] to define new methods and metrics to assess the submesoscale parameterizations (i.e., ~100 m to 10 km) used in basin and coastal ocean models, specifically with respect to their impact on synoptic model predictions. Project measurements will focus on short-term (i.e., one week) model predictions to determine how well the numerical parameterizations are capturing the unresolved physics of submesoscale changes in real time.

AESOP would include: (1) a floating instrumentation platform (FLIP), moored with three 800 lb. anchors at depths of 800-1000 meters (m)), acoustic Doppler current profilers, side scan sonar, and electric field (E-field) sensors, offshore of Soberanes Pt., Monterey County (Area C); and (2) research vessels in areas C (primarily over 100 miles offshore) and B, including surface operations (deployment and retrieval of three Lagrangian floats and deployment of 96 expendable current profilers (XCPs)). The XCPs will relay data to the float via extremely thin copper wire and transmit via radio frequency (RF) link to nearby platforms. No more than four XCPs will be active at any given period. XCP surface floats will be recovered; however, the Navy states copper wire (potentially up to approximately 1,500 ft./XCP) and probes are unrecoverable.

ASAP

The ASAP Project (Adaptive Sampling and Prediction[is proposed] ... to effectively deploy, direct and utilize autonomous vehicles (and other mobile sensing platforms) most efficiently to sample the ocean, assimilate the data into numerical models in real or near-real time, and predict future conditions with minimal error. Oceanographically, the area of interest is located off Point Año Nuevo at the north entrance to the bay, where adaptive sampling of three-dimensional upwelling and relaxation processes can be conducted.

At MBARI, this effort includes the Autonomous Ocean Sampling Network (AOSN), a project which brings together sophisticated new robotic vehicles with advanced ocean models to improve the ability to observe and predict the ocean. The operational system includes data collection by smart and adaptive platforms and sensors that relay information to a shore in near real-time (hours) where it is assimilated into numerical models that create four dimensional fields and predict future conditions. A key to the effort is adaptive sampling – the development of control strategies to command mobile vehicles to places where their data will be most useful. The ability to predict physical properties of the ocean (e.g., temperature, currents), as well as biological (ecosystem productivity) and chemical (nutrient fertilization) counterparts provides a fundamental test of our understanding of ocean processes, as well as an intrinsically useful capability.

ASAP would be within Op Area A and would include acoustic Doppler current profilers (self anchored, and to be recovered), two Seaweb radio frequency (RF) gateways (to be anchored with sand bags, which would be left in place), surface vessels and aircraft, and deployment and retrieval of six autonomous underwater vehicles (AUVs), 14 underwater gliders, and several unmanned kayaks.

UPS and PLUSNet

The UPS project (Undersea Persistent Surveillance), including the Persistent Littoral Undersea Surveillance Network (PLUSNet), ... consists of a semi-autonomous controlled network of fixed bottom and mobile sensors that communicate with each other and can make basic decisions independently. PLUSNet sensors will attempt to track ships or their acoustic surrogates as they operate in the shallow water environment of the MBNMS.

UPS/PLUSNet operations would be within Op Area B and would include use of a horizontal Vector sensor array and a vertical hydrophone array (both passive acoustic), to be anchored and later removed, two E-Field sensors for data storage, two Acoustic Gateways (to be anchored with 300 lb. cement blocks which will be recovered), surface vessels (one of which will be used for trawler avoidance), five underwater gliders, two AUVs, and several kayaks.

LOCO

The LOCO project (Layered Organization in the Coastal Ocean)... [would] investigate "thin layers" present in the MBNMS. Thin layers are comprised of miniscule life forms (e.g., phytoplankton, bacteria, and viruses) which converge into centimeter- to meter-thick layers or patches. These thin layers exhibit biotic densities as great as 1,000 times that of the water around them and can have profound effects on the way light and sound move through the water. Little is known about these thin layers and they are one of the latest oceanographic mysteries being investigated. One autonomous underwater

vehicle (AUV) will maneuver through the water column sampling thin layers using lidar (similar to radar but based on light scattering), bioacoustical analyses, and water sampling. Measurements will also be made in and near the seafloor.

LOCO operations would be within Op Area D and would include use of small, multiple oceanographic sensors and sensor systems placed in clusters on the seabed (cluster areas would be up to 1 km^2, although the footprint of individual instruments will be much smaller (1 m^2/instrument, with a total area of seafloor affected to be 6-8 m^2, and with corners of the instrument clusters marked by buoys), small amounts of sediment sampling, surface vessels, deployment and retrieval of underwater gliders, and plankton tows and water sampling conducted in and around the thin layers encountered.

B. Federal Agency's Consistency Determination. The Navy has determined the project consistent to the maximum extent practicable with the California Coastal Management Program.

II. STAFF RECOMMENDATION:

The staff recommends that the Commission adopt the following motion:

MOTION: **I move that the Commission concur with consistency determination CD-037-06 that the project described therein is fully consistent, and thus is consistent to the maximum extent practicable, with the enforceable policies of the California Coastal Management Program (CCMP).**

STAFF RECOMMENDATION:

Staff recommends a **YES** vote on the motion. Passage of this motion will result in an agreement with the determination and adoption of the following resolution and findings. An affirmative vote of a majority of the Commissioners present is required to pass the motion.

RESOLUTION TO CONCUR WITH CONSISTENCY DETERMINATION:

The Commission hereby **concurs** with consistency determination CD-037-06 by the U.S. Navy on the grounds that the project described therein is fully consistent, and thus is consistent to the maximum extent practicable, with the enforceable policies of the CCMP.

III. FINDINGS AND DECLARATIONS:

The Commission finds and declares as follows:

A. Marine Resources/Coastal Waters/Water Quality. The Coastal Act provides:

Section 30230: *Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.*

Section 30231*: The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface water flow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.*

Section 30233: *(a) The diking, filling, or dredging of open coastal waters, wetlands, estuaries, and lakes shall be permitted in accordance with other applicable provisions of this division, where there is no feasible less environmentally damaging alternative, and where feasible mitigation measures have been provided to minimize adverse environmental effects, and shall be limited to the following:*

(1) New or expanded port, energy, and coastal-dependent industrial facilities, including commercial fishing facilities. ...

(5) Incidental public service purposes, including but not limited to, burying cables and pipes or inspection of piers and maintenance of existing intake and outfall lines.

(8) Nature study, aquaculture, or similar resource dependent activities.

Section 30108.2 of the Coastal Act defines "fill" as "earth or any other substance or material ... placed in a submerged area," which would appear to include anchors. Because several of the anchors are proposed to be left in place (albeit in federal waters), in addition to the other marine resource protection policies a Section 30233(a) analysis (i.e., allowable use, alternatives, and mitigation tests) may be warranted. If so, the project qualifies as an allowable use for fill of coastal waters as either a coastal dependent or nature study/resource dependent activity, for at least the period of time the anchors are supporting the proposed research. Once the research is complete, they may cease to remain an allowable use, but given their small area (three 11 m^2 anchors) and distance over five miles seaward of the coastal zone boundary, on

softbottom habitat in water depths of 800-1000 meters, it is difficult to argue they could have adverse effects on any coastal zone resources (and the Navy maintains they are infeasible to remove). The project qualifies as the least environmentally damaging feasible alternative, since performing the research in the project area is necessary to build on past research and gather the data needed for the scientific studies proposed. No less damaging feasible alternatives or locations are available that would avoid the use of "fill," and the Navy states that all feasibly removable material will be removed once the research is complete. Concerning the mitigation test of Section 30233(a), the discussion below includes avoidance, monitoring and mitigation for potential marine resource impacts (and concludes that adequate mitigation is being provided).

The Navy's Enviromental Assessment for the project estimates marine mammal abundances and seasonal distributions in the project region (Exhibits 8-9) and has mapped hard-bottom habitat in the region (Exhibit 3). The project will avoid the gray whale migration season and effects on hard-bottom habitat. The Navy has focused its potential marine mammal impact discussion on impacts on: (1) discharges from research vessels and support vessel; (2) noise from research vessels, support vessel, and individual pieces of oceanographic equipment; (3) vessel strike on marine mammals from vessel transit; and (4) entanglement with anchoring lines or expendables.

Concerning **water quality** and **benthic habitat** impacts, the Navy states that, where feasible, bottom-founded equipment will be removed at the end of the research (exceptions will be thin copper wire and some of the anchoring materials: i.e., sand bags, anchor and chain, granite and stone blocks, and cement blocks). The Navy states it is infeasible to recover the 800 lb. FLIP anchors, that only two other anchors will be left in place, that two 1 m^2 granite blocks will remain, and that all other equipment will be fully recovered. No equipment will be placed or left on the bottom within state waters or within any areas of hardbottom habitat. All surface and water column equipment will be retrieved with the exception of the expendable probes and associated copper wire, two of three primary components of the expendable current profilers (XCPs); the third component, the drifter (or floater), will be retrieved. The Navy also indicates it is possible that several of the supposedly recoverable Lagrangian floats could be lost. The Navy states:

> ***In summary, discharges from all vessels will comply with requirements of the Federal Water Pollution Control Act (FWPCA) and the MBNMS***, including:
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> • *sanitary wastes, containing biodegradable effluent generated by approved marine sanitation devices, may be discharged in accordance with Section 312 of the FWPCA, as amended (33 USC 1322 et seq.); and*
> • *water generated by routine vessel operations (e.g., cooling water, deck wash down water, and gray water as defined by Section 312 of the FWPCA), excluding oily wastes from bilge water.*
>
> *... No trash or debris will be disposed of into the marine environment. All solid waste will be collected, stored, and transported to shore for processing and disposal.*

Setting and retrieving anchors is expected to cause local disturbance of the seafloor sediments. Anchor placement on the seafloor will result in shallow penetration of surficial sediments (i.e., several inches), depending on the amount of sediment overburden present and sediment cohesion and strength. The areal extent of these disturbances will be limited to ~1 m^2, in most cases, with the exception of the FLIP sensor package. The anchors for FLIP sensor package are each expected to occupy an area of seafloor of 11 m^2. Anchor placement and retrieval is not expected to result in any significant change in bottom topography or sediment quality. For the sand bag anchors which are not feasibly retrieved, the bags will degrade over time, releasing their contents. The use of Monterey Bay sand will result in the release of indigenous sediment at depth, with sand to be spread and dispersed via bottom currents or turbidity flows. Granite and cement block and anchor chain are expected to provide hard bottom habitat for encrusting epifauna and hard-bottom associated fishes.

Expendables include debris associated with specific pieces of oceanographic equipment (e.g., copper wire from XCP drifters that cannot be retrieved). The total amount of unretrievable copper wire is difficult to estimate. While a maximum of 1,500 ft of thin copper wire is contained in each XCP, the total amount used during XCP deployment is limited by water depth. Based on the maximum water depth of XCP deployment, the maximum amount of deployed copper wire is 1,500 ft, although this maximum amount is not likely to be released by each XCP. During deployment, copper wire is spooled out of both the drifter and the XCP probe. Once the probe contacts the seafloor, the copper wire breaks at some indeterminant point along its length. Retrieval of the drifter includes retrieval of some portion of the deployed copper wire. Segments of copper wire that remain attached to each drifter will be removed from the environment when each drifter is retrieved. This debris will drift with the currents and settle to the seafloor, possibly outside the bounds of the MBNMS, with settling rate depending upon buoyancy.

None of the MB 06 operations will have a significant effect on water or sediment quality. No Federal, state, or local water or sediment quality criterion or waste discharge requirements will be violated. Irreparable harm will not occur to human health, aquatic life, or the beneficial uses of the MBNMS. There will be no persistent degradation of the water or sediment quality of the Sanctuary's marine or coastal environment, nor will adjacent wetlands or tidal environments be adversely affected. ***Impacts to water and sediment quality are expected to range from negligible to minor on a local basis, negligible on a regional basis, and short to long term duration.***

During MB 06, prominent hard bottom areas will be avoided during equipment placement. ... Impacts to benthic communities will be localized, short to long term, and minor. On a regional basis, impacts from anchor placement will be negligible.

> *Sand bag anchors left in place will degrade over time, with sand to be dispersed by ambient currents and subsequently recolonized. Granite and metal anchors left in place will provide hard bottom substrate for larval settling and development of encrusting biota. Hard bottom substrate placed in a soft bottom environment will be colonized by epifauna (e.g., anemones, echinoderms, sponges; e.g., see Kogan et al., 2003). Flatfish and rockfish may also congregate near abandoned anchoring materials; increases in infaunal abundance within adjacent soft bottom areas are not expected.* ***Impacts will be locally minor, regionally negligible, and long term in duration.*** [Emphasis in original]

Concerning **vessel strike** impacts, the research vessels will include marine mammal observers; the Navy expects minimal to no vessel strike impacts to marine mammals, stating:

> *It is possible but unlikely that a collision would occur between a research or support vessel and a marine mammal. Routine shipboard operations include prudent seamanship to avoid large objects in the path of a vessel. Crews maintain continual visual contact forward and abreast of the vessel. Surface active species or individuals traveling in groups will be observable, pending acceptable visibility and sea state conditions. Lower vessel speeds to be realized during the conduct of research activities will also reduce the potential for vessel strike. Given these standard operating procedures, it is very unlikely that a vessel will collide with a marine mammal. In the unlikely event that such an impact occurred, it would be considered a Level A take under existing MMPA regulations.* ***Impacts from a vessel strike on a marine mammal range from negligible (regional context) to minor (local context) and of short term duration.*** [Emphasis in original]

Concerning potential **entanglement** of marine mammals, the Navy states:

> *The anchors and bottom founded sensors will be placed on the seafloor using a winch or crane aboard a Navy tug or research vessel. Anchor and equipment deployment may utilize an acoustic release system – where the sensor package (anchor and equipment) is deployed, positioned several feet above the seafloor and the acoustic release activated, releasing the sensor package to fall to the seafloor. The vessel cable used for deployment will only be in the water for a short period of time (i.e., minutes to several hours), depending upon complexity of the deployment and water depth, then retrieved. The potential for entanglement is very low.* ***Impacts to marine mammals from entanglement (i.e., copper wire, deployment cable) are considered negligible, short term, and intermittent.*** [Emphasis in original]

Concerning **noise/active acoustics** impacts, the project includes aircraft operations and 73, mostly high-frequency (i.e. >10 kilohertz (kHz)), active acoustic, both mobile and fixed, sources (Exhibits 6 & 11). Of the 73 active acoustic sources, 47 sources emit sound within the frequency ranges likely to be heard by marine mammal species (i.e., <200 kHz) that may be expected to be present during the research period. Most sources will emit in the 140-185 decibel (dB) range (re 1 µPa @ 1m), although the range is up to 230 dB.

The Navy has characterized and mapped the region's potentially affected marine mammals (Exhibits 8-10), summarized available information on their hearing sensitivities and analyzed those sources potential of concern to marine mammals (Exhibit 11), and provided for marine mammal observers on the research vessels.

The Navy estimates that:

> *"...[M]ysticetes [baleen whales] may have functional hearing over the range of roughly 12 Hz up to 22 kHz .... Odontocetes [toothed whales] commonly have good functional hearing between 200 Hz and 100,000 Hz (100 kHz), although some species may have functional ultrasonic hearing to nearly 200 kHz (Richardson et al., 1995) .... Most pinniped species have peak sensitivities between 1-20 kHz ... [with] [o]nly the elephant seal [having] good to moderate hearing below 1 kHz.*

Categorizing marine mammals on the basis of hearing sensitivity and/or vocalization characteristics (following basic groupings outlined by Ketten (1994, 2000) – low, mid, and high frequency vocalizers), the Navy states the following marine mammal species may be present in the Monterey Bay Sanctuary:

- Low-frequency (LF) cetaceans: 12 Hz – 22,000 Hz
  - Mysticetes, including *Megaptera* (humpback whale), *Balaenoptera* (blue, Bryde's fin, sei, minke whales), and *Eschrichtius* (California gray whale)

- Mid-frequency (MF) cetaceans: 150 Hz to 160,000 Hz
  - Dolphins, including *Tursiops* (bottlenose dolphin), *Stenella* (striped dolphin), *Delphinus* (common dolphin), *Lagenorhynchus* (Pacific white-sided dolphin), *Lissodelphis* (northern right whale dolphin), *Grampus* (Risso's dolphin), *Pseudorca* (false killer whale), *Orcinus* (killer whale), *Globicephala* (short-finned pilot whale)
  - Larger toothed whales, including *Physeter* (sperm whale) and *Kogia* (pygmy and dwarf sperm whales)
  - Beaked, including *Ziphius* (Cuvier's beaked whale), *Berardius* (Baird's beaked whales), and *Mesoplodon* (Hubbs' beaked whale).

- High-frequency (HF) cetaceans: 200 Hz to 180,000 Hz
  - Porpoises, including *Phocoena* (harbor porpoise) and *Phocoenoides* (Dall's porpoise)

Exhibits 6 & 11 list each source, frequency range, duty cycle, and acoustic intensity. The Navy summarizes the sources as follows:

> *MB 06 acoustic equipment exhibits a broad range of frequencies, as characterized in **Table 4-6** for frequencies ≤200 kHz. A total of 47 mobile and fixed acoustic sources have been evaluated. The vast majority of MB 06 acoustic sources are categorized as*

standard oceanographic systems, including 1) standard shipboard oceanographic measurement systems (e.g., sub-bottom profilers, acoustic Doppler current profilers [ADCPs]); 2) fixed or mobile oceanographic sensors (e.g., sector scan sonars, fixed or mobile ADCPs); or 3) standard acoustic communication systems (acoustic communication devices, uModems). Standard oceanographic systems typically have short pulse lengths and intermittent duty cycles. Three of the MB 06 acoustic sources are considered active sources, to be used specifically to generate low source output noise for passive detection by mobile or fixed sensors. As is evident in ***Table 4-6****, the 25 kHz uModems are the most abundant, single frequency acoustic source; 17 of these units will be either fixed or mobile during MB 06. Fixed or mobile acoustic sources are proposed for each OpArea, each to a varying degree of activity. OpArea B will realize the greatest number of acoustic sources.*

Of the 47 acoustic sources marine mammals could hear, most range from 140-185 dB (source level), which, combined with their frequencies, should not be of concern. For these 47 sources, the Navy has selected 186 dB as a behavioral threshold and states that only nine sources would use source levels of 186 or greater dB. These nine sources are:

Source type	Frequency	Source level	Pulse length	Radius to 186 dB
Shipboard ADCPs (Acoustic Doppler Current Profilers)	50-150 kHz	223.6 dB	12-24 ms	2-76 meters
Fixed or Mobile ADCPs	140-170 kHz	192 dB	6 ms	2 meters
Lagrangian Floats	8-16 kHz	192 dB	5 ms	2 meters
Side Scan Sonar	50 kHz	200 dB	30 ms	5 meters
Sub-bottom profiler	3.5/12 kHz	221 dB	5 ms	56 meters
Float tracking device	8-16 kHz	192 dB	5 ms	2 meters
Bubble scan device	0.75-1 MHz	210 dB	200 ms	16 meters

[Staff Note – Dual Criteria/Sound Exposure Levels: Regulators and acoustic experts have recently been moving towards "dual" criteria for acoustic thresholds, a combined "SPL" (sound pressure level) and "SEL" (sound exposure level). The first measures instantaneous peak pressures, and the second is a more cumulative measure of energy received over time. SPL is an instantaneous measurement and can be expressed as the peak, the peak-peak, or the root mean square (rms). Root mean square, which is the square root of the arithmetic average of the squared instantaneous pressure values, is typically used in discussions of the effects of sounds on vertebrates. The commonly used reference pressure level in underwater acoustics is 1 μPa (micropascal, sometimes written as "mPa") and the units for SPLs are dB re: 1 μPa. SPL (in dB) = 20 log (pressure/reference pressure). SPL does not take the duration of a sound into account.

SEL is an energy metric that integrates the squared instantaneous sound pressure over a stated time interval. The units for SEL are dB re: 1 μPa^2–s. SEL = SPL + 10 log (duration). If an animal is exposed to multiple pings, the SEL in each individual ping is summed to calculate the total SEL. The total SEL depends on

the SPL, duration, and number of pings received. The acoustic effects on hearing that result in temporary threshold shift (TTS) and permanent threshold shift (PTS) 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 SEL and determine whether the received SEL meets or exceeds the effect thresholds.]

The Navy's uses the following acoustic criteria for sound exposure level (SEL) from intermittent sounds:

- *Level A threshold – onset permanent threshold shift (PTS), or injury: 215 dB re: 1 μPa^2-s;*
- *Level B threshold – onset temporary threshold shift (TTS), or harassment: 195 dB re: 1 μPa^2-s; and*
- *Level B threshold – behavioral disruption: 186 dB re: 1 μPa^2-s.*

Based on these criteria, the Navy has estimated marine mammal harassment impacts based on spherical (20 log R) spreading model and calculated distances within which mammals could be considered harassed. The Navy states:

Source Levels and Exposure Levels of MB 06 Acoustic Sources

Source levels (in dB re 1μPa at 1 meter) of each acoustic source have been used to calculate the distance to exposure level thresholds, assuming a 1 second pulse duration for the purposes of discussion and to establish a standard frame of reference. In reality, pulse length is typically much shorter (i.e., 45 to 30 ms). The three MB 06 sound sources (i.e., active sources) emit longer pulses at much lower source levels. Under circumstances where a short pulse is produced, exposure level will be dependant upon the repetition rate of the pulse and the proximity of the individual to the sound source, as well as how long the individual stays within the sound field. Beam width is also a major point of consideration, given that many of the standard oceanographic sound sources use a narrow beam, severely restricting the zone of ensonification at each level of concern.

Table 4-7 [Exhibit 11, p. 8] *summarizes each of the MB 06 audible sound sources and provides calculations of a single exposure level and the radial distance to threshold levels under specific assumptions (i.e., an exposure of 1 second).*

Based on these calculations the Navy states:

For the acoustic sources proposed for MB 06, there is no potential for mortality. *While injury is possible, Level A harassment is only potentially associated with two sources: 1) the RV Point Sur ADCP (mobile), within 3 m of the source; and 2) RV Sproul sub-bottom profiler (mobile), within 2 m of the source. Given that both of these sources are mobile, that shipboard personnel will be conducting operations to avoid marine mammals, and the narrow beam nature of the acoustic pulse, it is extremely*

unlikely that a marine mammal will be found immediately below the vessel hull within 2-3 m of the sound source. It is also very unlikely that an individual would remain in close proximity to the sound source while the vessel is underway. Therefore, injury (Level A) impacts are not expected.

Only four acoustic sources have the potential to cause temporary threshold shift: 1) the RV Point Sur ADCP (mobile), within 27 m of the source; and 2) RV Sproul sub-bottom profiler (mobile), within 20 m of the source; 3) the bubble scan (fixed), within 6 m of the source; and 4) the sector scan sonar (fixed), within 2 m of the source. For the bubble scan, output frequency varies between 75 kHz and 1 MHz – i.e., the device also "rolls through" as many as 96 separate frequencies during its transmissions. Further, pulses are extremely short (i.e., 0.003 ms), as is the equipment duty cycle. Given these parameters, it is extremely unlikely that the bubble scan pulses will be heard. For the remaining mobile equipment, individuals would have to be found within the narrow cone below either the Point Sur or Sproul and within 20-27 m to realize TTS. The radial distance from the remaining fixed source to the TTS threshold is extremely small – 2 m. Individuals would have to encounter the sound source, affixed to the seafloor, during a dive, and remain within this distance of the sound source for a second or more, to realize TTS. For the reasons stated previously, it is extremely unlikely that a marine mammal will be found immediately below the vessel hull or within several meters of the sound source. Therefore, TTS (Level B) impacts are not expected.

Eight acoustic sources have the potential to cause behavioral disruption, including 1) the RV Point Sur ADCP (mobile), within 76 m of the source; and 2) the RV Sproul sub-bottom profiler (mobile), within 52 m of the source; 3) the sector scan sonar (fixed), within 5 m of the source; and 4) five sources (i.e., ADCPs and float tracking), all mobile, within 2 m of the source. The bubble scan (fixed), while estimated to have the potential to cause behavioral disruption within 16 m of the source, has been removed from further analysis due to the nature of its emissions (i.e., extremely short pulse duration and duty cycle; only limited frequency output within the hearing range of marine mammals). For the eight acoustic sources, individuals would have to be found within the narrow cone adjacent to each source and within the calculated radius to realize behavioral disruption. For mobile sources, marine mammals would have to be positioned beneath the vessel and moving with it to realize behavioral disruption. Radial distances from the fixed sources to the behavioral disruption threshold are also very small. As noted previously for fixed sources (i.e., ADCPs), exposed individuals would have to encounter the sound source, affixed to the seafloor, during a dive, and remain within this distance of the sound source for a second or more, to realize behavioral disruption. For the reasons stated previously, it is extremely unlikely that a marine mammal will be found immediately below the vessel hull or within several meters of the sound source. Behavioral disruption (Level B) impacts are not expected.

Twenty-six of the acoustic sources noted in ***Table 4-7*** [Exhibit 11, p. 8] *(i.e., denoted as lightly shaded regions) have source levels below the 186 dB threshold. However, long pulse lengths (e.g., 8 seconds) elevate a single exposure from a 185 dB source level to*

194 to 202.8 dB re 1μPa^2-s for a single exposure. For these omni-directional sources, a marine mammal would have to be located immediately adjacent to the sound source and remain in that position for the duration of the pulse to realize exposure levels sufficient to cause either TTS or behavioral disruption. For either mobile or fixed sources, this type of behavior (e.g., during a dive or while at or near the surface) is extremely unlikely.

For sound sources of concern, species capable of hearing the frequencies being emitted are identified in ***Table 4-8*** [Exhibit 11, p. 12]. *AESOP sources of concern (i.e., single sector scan sonar, FLIP w/ ADCP, and ADCP sources; three Lagrangian float sources), both fixed and mobile, will ... occur within OpArea C, in the general vicinity of FLIP. UPS mobile sources of concern will be restricted to OpArea B. The single LOCO source of concern will be restricted to OpArea D.*

The Navy concludes:

Short term exposure is based on the acoustic equipment duty cycle, the narrow beam nature of the acoustic sources of concern, the mode of use (e.g., fixed, mobile) for each piece of equipment, the life history (including diving habits) of sensitive marine mammal species, and the likelihood that a particular species will be present in the water depths where the acoustic source will be located. The conservative calculations of the proximity to sound source (for most acoustic sources) was on the order of several meters. Individuals will have to be in close proximity to the source – in most cases, within 76 m for one source, within tens of meters for several other sources, and 2 to 5 m for the remaining sources – to experience behavioral disruption. ...

Potential presence in one or more of the MB 06 OpAreas and in close proximity to the acoustic sources of concern must be evaluated relative to species-specific dive habits, reaction to vessel presence, and likelihood of presence near the mobile or fixed source. In terms of fixed or mobile sources, marine mammals exhibit diverse responses to audible sound. MB 06 operations will not occur in known breeding habitat, however, they may occur in a small portion of preferred feeding areas. Because the zone of ensonification for acoustic sources of concern is extremely limited (i.e., narrow beam; limited sound source radius), detrimental impacts to feeding activities from these sound sources are not expected. There are no breeding or feeding areas of limited areal extent within the MBNMS which would prompt an individual exposed to an audible sound to move closer to the sound or remain in very close proximity of the sound, thereby further increasing potential for impact and realizing injury or harassment.

In terms of mobile sources, marine mammals also exhibit variable response to vessel presence – species may avoid approaching vessels, may alter course or dive patterns (e.g., see Baker et al., 1982 and 1983; Bauer and Herman, 1986), or may move towards a vessel for bow-riding. Mysticetes may be expected to be disregard or avoid vessels; delphinids may be expected to investigate transiting vessels.

> *Based on either distance from source or frequency sensitivity or both, it is very unlikely that individuals would be affected by mobile acoustic sources. Fixed sources occur at depth, where only deep diving species (e.g., sperm whale) have the capability to approach an acoustic source.* ***Impacts of noise on marine mammals are expected to range from negligible to minor, with short term duration and exposure.*** [Emphasis in original]

Nevertheless, because of the potential for behavioral disruption, to further minimize marine mammal impacts, the Navy states the research activities will include marine mammal monitoring and avoidance measures, which would include:

> ***Mobile Sources***
>
> *This protective measures plan includes a requirement to conduct visual observations prior to use of the acoustic sources of concern and gradual increases in acoustic output (i.e., ramp up). Visual observations by trained marine mammal observers should be conducted in the area ahead and lateral to the vessel. Surface monitoring observations are designed to minimize the risk to marine mammals during research experiments using those acoustic devices of concern (see* ***Table 4-7****). Major objectives of the protective measures plan for mobile sources include:*
>
> - *Use of marine mammal observers or trained crew on board to monitor marine mammal presence*
> - *Evaluate source levels required to meet scientific objectives, and adjust as appropriate*
> - *Implement soft start (ramp-up), if feasible*
> - *Minimize acoustic operations at night or during poor/significantly reduced visibility periods*
> - *Avoid coastal areas with complex, steep seabed topography*
> - *Adherence to reporting requirements (i.e., marine mammal observations)*
> - *Utilization of vessels or aircraft of opportunity to survey the OpArea immediately prior to or during acoustic experiments*
>
> *Ramp-up source gradually from 150 dB re 1 µPa at 1 m or lowest possible setting if higher than 150 dB. The source should be increased at the rate of 5 to 10 dB per 5-minute period. If there is no evidence that marine mammals are present within a prescribed safety range, operations can be initiated after ramp-up; otherwise, delay and repeat. Continuous operations are permissible, however, source levels should be kept as low as possible consistent with scientific objectives. If APCD transmissions cease for more than 30 minutes, the start-up procedure should be repeated.*
>
> ***Fixed Sources***
>
> *Major objectives of the protective measures plan for the fixed sources of concern are very similar to those identified for marine mammals, and include:*

- *Evaluate source levels required to meet scientific objectives, and adjust as appropriate*
- *Implement soft start (ramp-up), if feasible*

Gradual increase in output to full power will ensure that individuals found in close proximity to the source will leave the area, thereby avoiding behavioral or TTS impacts.

In the context of quite different activities, more potentially disruptive military sonar proposals (proposed in other areas of the country), the scientific debate over applicable thresholds for military mid-frequency sonar remains unresolved. For Navy mid-frequency sonar proposed off North Carolina and Hawaii, the Navy initially proposed a 190 dB threshold, NOAA Fisheries (NMFS) selected 173 dB,[1] and several institutions and environmental organizations have suggested 154 dB may be the most appropriate threshold. Not much focus has occurred over thresholds that may be applicable to the fairly common types of research-related and shipping sounds at the frequencies, intensities and durations similar to those proposed here, and unlike strandings associated with military sonar, no documentation exists to date that these types of sources pose threats to marine mammals. Nor does NMFS believe a "take" permit is even needed for the proposed research.

In the separate, mid-frequency sonar dialogue, the Navy selected 190 dB as representing 50% of mammals behaviorally affected in a controlled study (Finneran and Schlundt (2004)). NMFS selected 173 dB from the same study (combined with two others)[2] but representing the level where 25% of the mammals showed an effect. Placing more emphasis on the right whale studies in the wild (Nowacek et al. 2003), comments on the same Navy mid-frequency sonar proposals included letters from the Natural Resources Defense Council (NRDC) and Woods Hole Oceanographic Institution (WHOI, which is also conducting some of the proposed research) urged a lowering of the behavioral threshold to 154 dB. Based on the Nowacek study WHOI noted "...significant behavioral responses (cessation of foraging and re-location) were

[1] NMFS recently requested that the Navy use 173 dB as an SEL threshold for behavioral impacts, in both: (1) NMFS' January 30, 2006, comments on the Navy's Draft Overseas EIS/EIR for the Dept. of the Navy's Undersea Warfare Training Range (proposed off North Carolina); and (2) NMFS' comments in its Federal Register Notice of April 24, 2006, on the Navy's NMFS Permit application for Small Takes of Marine Mammals Incidental to Specified Activities; Rim of the Pacific (RIMPAC) Antisubmarine Warfare (ASW) Exercise Training Events Within the Hawaiian Islands Operating Area (OpArea).

[2] NMFS believes that " ... in the absence of controlled exposure experiments, the following investigations and reports ... constitute the best available scientific information for establishing an appropriate acoustic threshold for sub- TTS behavioral disruption: (1) Finneran and Schlundt (2004), in which behavioral observations from TTS studies of captive bottlenose dolphins and beluga whales are analyzed as a function of known noise exposure; (2) Nowachek [sic] et al. (2004), in which controlled exposure experiments were conducted on North Atlantic right whales using ship noise, social sounds of con-specifics, and an alerting stimulus; and (3) NMFS (2005), in which the behavioral reactions of killer whales in the presence of tactical midfrequency sonar were observed, and analyzed after the fact. Based on these three studies, NMFS has set the sub-TTS behavioral disruption threshold at 173 dB re 1 μPa –s (SEL)." (Fed. Reg. Notice, April 24, 2006, Navy's NMFS Permit application for "RIMPAC")

reported at ELs (energy levels, or received levels) of about 154 dB ....[3] NRDC echoed similar concerns in its May 24, 2006, comments on "RIMPAC."

Having been extensively involved in the Marine Mammal Commission's Advisory Committee on Acoustic Impacts on Marine Mammals, the Commission is well aware of the difficulty in achieving consensus on regulatory thresholds for marine mammal impacts. At the same time, unlike the above-discussed Hawaii and North Carolina activities (Navy mid-range sonar, 1 to 10 kHz), for which a NMFS take permit *was* required,[4] and for which documentation does exist that similar past comparable activities have been associated with, and likely caused in some cases,[5] marine mammal strandings and thus that the sound levels in those activities warrant serious concern, NMFS does *not* believe the proposed research activities in Monterey Bay even trigger the need for a take permit.

Thus, commonly occurring, predominantly high-frequency marine research activities should not be treated the same as mid-frequency military sonar. Criteria will continue to evolve over time, and the movement from a single to a dual criteria is a step in the right direction. Even if 186 dB were not a proper threshold, given that the higher the frequency the more quickly sounds attenuate, the difference between 186 dB and 173 dB, or for that matter, the difference between 186 dB and 154 dB, is not likely to be very extensive, given the frequencies and durations involved. Again, based on the current level of knowledge, the types of sounds to be emitted during the proposed research activities are not the type that have typically caused concern.

Finally, one of the four programs would also include aircraft operations, which would consist of daily overflights of Monterey Bay on 26 or 27 July and between 1 through 15 August to monitor weather and the development of oceanographic features of interest. Flight altitudes will vary between 100 and 1,000+ ft, depending upon location, and will adhere to Monterey Bay National Marine Sanctuary permit conditions (under an existing permit) including maintaining a 1000 ft. altitude within 1.0 nm of the shoreline, at or above 100 ft. more than 1.0 nm from the shoreline, and at or above 500 ft. if whales are observed.

In conclusion, the Commission notes that the proposed research would include sounds typical of those emitted in the marine environment by ships, side-scan sonar, fish finding sonar, depth sounding sonar, bottom profilers, navigation transponders, military search and surveillance and mine avoidance sonars. Thousands of such noise-emitters operate worldwide and off the California coast, and while they may be of concern cumulatively, evidence to date has not established the type of cause and effect relationship sufficient to further regulate them. The Navy is including prudent monitoring and avoidance measures to minimize impacts, which should be adequate for the proposed activities to avoid adverse effects on marine mammals. In addition, the schedule would avoid the gray whale migration season, is of short duration, and

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[3] Letter dated 27 January, 2006, from Dr. Mark P. Johnson, Woods Hole Oceanographic Institution, to Keith Jenkins, U.S. Navy.

[4] NMFS estimated a "Level B" take of up to 30,000+ marine mammals for the Navy's "RIMPAC" exercise.

[5] For example, the March 2000 Bahamas beaked whale stranding.

the proposed research will provide useful information about the marine environment. Where feasible, materials used in the research will be removed from the marine environment, and where they would not, they would not adversely affect the marine environment. The proposed scientific research is an allowable use (under Section 30233(a)), no less environmentally damaging feasible alternatives (or alternative locations) are available, and monitoring and avoidance measures are adequate enable the Commission to find that marine resources would be adequately protected. The Commission therefore concludes that the proposed research would be consistent with the applicable marine resource, water quality, and fill of open coastal waters policies (Sections 30230, 20331, and 30233) of the Coastal Act.

B. Public Recreation (Diving) and Commercial and Recreational Fishing.
Section 30220 of the Coastal Act provides for the protection of water oriented recreation, including recreational diving:

> *Coastal areas suited for water-oriented recreational activities that cannot readily be provided at inland water areas shall be protected for such uses.*

In addition, aside from the commercial fishing protection afforded under Section 30230, quoted above on page 8, Sections 30234 and 30234.5 provide for the need to protect commercial and recreational fishing opportunities, as follows:

> **30234.** *Facilities serving the commercial fishing and recreational boating industries shall be protected and, where feasible, upgraded. Existing commercial fishing and recreational boating harbor space shall not be reduced unless the demand for those facilities no longer exists or adequate substitute space has been provided. Proposed recreational boating facilities shall, where feasible, be designed and located in such a fashion as not to interfere with the needs of the commercial fishing industry.*

> **30234.5.** *The economic, commercial, and recreational importance of fishing activities shall be recognized and protected.*

The Navy maintains that the project is consistent with the public access, recreation, and fishing policies of the Coastal Act. The Navy states that for all four research programs, public notice for the operations would include publication of a Notice to Mariners announcing the operations and broadcasting a security announcement on channel 16 (e.g., during ROV operations). Concerning impacts on fish and fishing activities (both acoustic, and preclusion impacts), the Navy states:

> *Commercial and Recreational Fisheries*
>
> *MB 06 vessel operations will occur on a periodic basis throughout the four OpAreas. Several research vessels will also continue their operations beyond the boundaries of the MBNMS, moving further offshore for data acquisition.*

Acoustic sources have the potential to affect fish. Hearing sensitivity is known for approximately 100 of the 250,000 extant fish species (NRC, 2003). While the hearing sensitivity of fish, including sharks and rays, generally ranges from 0.5 to 200 kHz, Popper (2003) notes that most fish species detect sound within the frequency range of 0.5 to 1 kHz. ... Source levels and frequency characteristics for MB 06 acoustic sources has been summarized in Table 4-6. Equipment frequencies <10 kHz include standard oceanographic sources (e.g., oceanographic sensors and communications systems, including sub-bottom profilers, ADCPs, and Seaweb modems) and the active acoustic sources. While source levels for this equipment generally fall within the 185-200 dB range, the area ensonified around each device is limited to several meters radial distance. Limited duty cycles and the relatively short duration of the MB 06 experiments also support the determination that impacts to fish and fisheries will be extremely localized and short term. ***Impacts to commercial and recreational fish species are expected to be negligible on both a local and regional scale, and will be short-term in duration.***

All fishing methods would potentially be subject to areal exclusion due to research vessel presence, deployed water column gear (e.g., gliders, AUVs), or bottom founded equipment. Anchoring material left in place will also present a limited potential as a trawl hazard.

Standard operating procedures for MBARI offshore operations relative to the local fishing community is via two mechanisms: 1) broadcasting a security announcement on channel 16 (e.g., during ROV operations), and 2) issuance of a Notices to Mariners via the USCG for activities that could be hazards to navigation (e.g., surface moorings). The MB 06 operations schedule will also be posted on the MBARI website to facilitate public access. In addition, a security announcement can be issued on channel 16 during ROV operations.

MB 06 activities will not preclude extensive areas from commercial and recreational fishing activity. Research vessels either underway or involved in the deployment or retrieval of scientific equipment will operate under rules of prudent seamanship, avoiding large objects in the path of a vessel, including commercial fishing vessels which may have nets or trawl equipment over the side. Most bottom founded equipment will occupy a very small area of seafloor (<1 m^2). FLIP and its associated bottom founded equipment will be well marked with USCG-approved navigational aids, however, the immediate area surrounding FLIP should be avoided by commercial fishers. ***Impacts to commercial and recreational fisheries from areal exclusion are expected to be negligible on both a local and regional scale, and will be short-term in duration.*** [Emphasis in original]

The Navy also states that the autonomous vehicles (AAVs & gliders) will be limited to use in areas "... that have water depths far beyond that used by recreational divers." The Commission agrees with the Navy and concludes that the project would not adversely affect commercial and

recreational fishing and recreational diving and is consistent with Sections 30220, 30234, and 30234.5) of the Coastal Act.

IV. SUBSTANTIVE FILE DOCUMENTS:

1. Environmental Assessment, Monterey Bay 2006 – Research Activities Within and Adjacent to Monterey Bay National Marine Sanctuary, U.S. Navy, May 2006.
2. CDP E-05-007/Consistency Certification CC-076-05, MBARI marine research fiber optic cable offshore of Moss Landing.
3. Consistency Determination CD-15-05, Navy cable repairs/replacement, Southern California Anti-Submarine Warfare Range (SOAR), offshore of San Clemente Island.
4. Consistency Determination CD-20-95, Navy San Clemente Island Cable Repair.
5. Consistency Determination CD-2-01, Navy Point Mugu Sea Range testing and training activities.
6. Consistency Determinations CD-045-89 and CD-50-03, Navy FOCUS Cable and Cable repairs, San Nicolas Island.
7. Consistency Certification CC-111-01/CDP E-01-029, Tyco Fiber Optic Cable, offshore of Los Angeles County.
8. Consistency Certification CC-028-00/CDP E-99-011, MFSGlobenet/MCI WorldCom Fiber Optic Cable, offshore of San Luis Obispo County.
9. Consistency Certification CC-110-00/CDP E-00-008, Global West Fiber Optic Cable, offshore of San Luis Obispo, Los Angeles, and San Diego Counties.
10. Small Takes of Marine Mammals Incidental to Specified Activities; Rim of the Pacific (RIMPAC) Antisubmarine Warfare (ASW) Exercise Training Events Within the Hawaiian Islands Operating Area (OpArea), National Oceanic and Atmospheric Administration Federal Register Notice, Vol. 71, No. 78, Monday, April 24, 2006.
11. Finneran, J.J. and C.E. Schlundt. 2004. *Effects of intense pure tones on the behavior of trained odontocetes*. Report of the Space and Naval Warfare Systems Center, San Diego, California.
12. Marine Mammal Populations and Ocean Noise, Determining When Noise Causes Biologically Significant Effects, Ocean Studies Board, Division of Earth and Life Studies, National Research Council of the National Academies Press, 2005.
13. NMFS' January 30, 2006 comments on the Navy's Draft Overseas EIS/EIR for the Dept. of the Navy's Undersea Warfare Training Range.
14. Federal Register Notice, April 24, 2006, Navy's NMFS Permit application for Small Takes of Marine Mammals Incidental to Specified Activities; Rim of the Pacific (RIMPAC) Antisubmarine Warfare (ASW) Exercise Training Events Within the Hawaiian Islands Operating Area (OpArea).
15. Coastal Commission Comments on the Effects of Anthropogenic Sound on Marine Mammals, Statement for The Report of the Advisory Committee on Acoustic Impacts on Marine Mammals to the Marine Mammal Commission, December 13, 2005.
16. Nowacek D., Johnson, M., Tyack P.L., "North Atlantic right whales (*Eubalaena glacialis*) ignore ships but respond to alerting stimuli," Proc. R Soc. Lond. B 271, p. 227-231, 2003. http://hdl.handle.net/1912/248

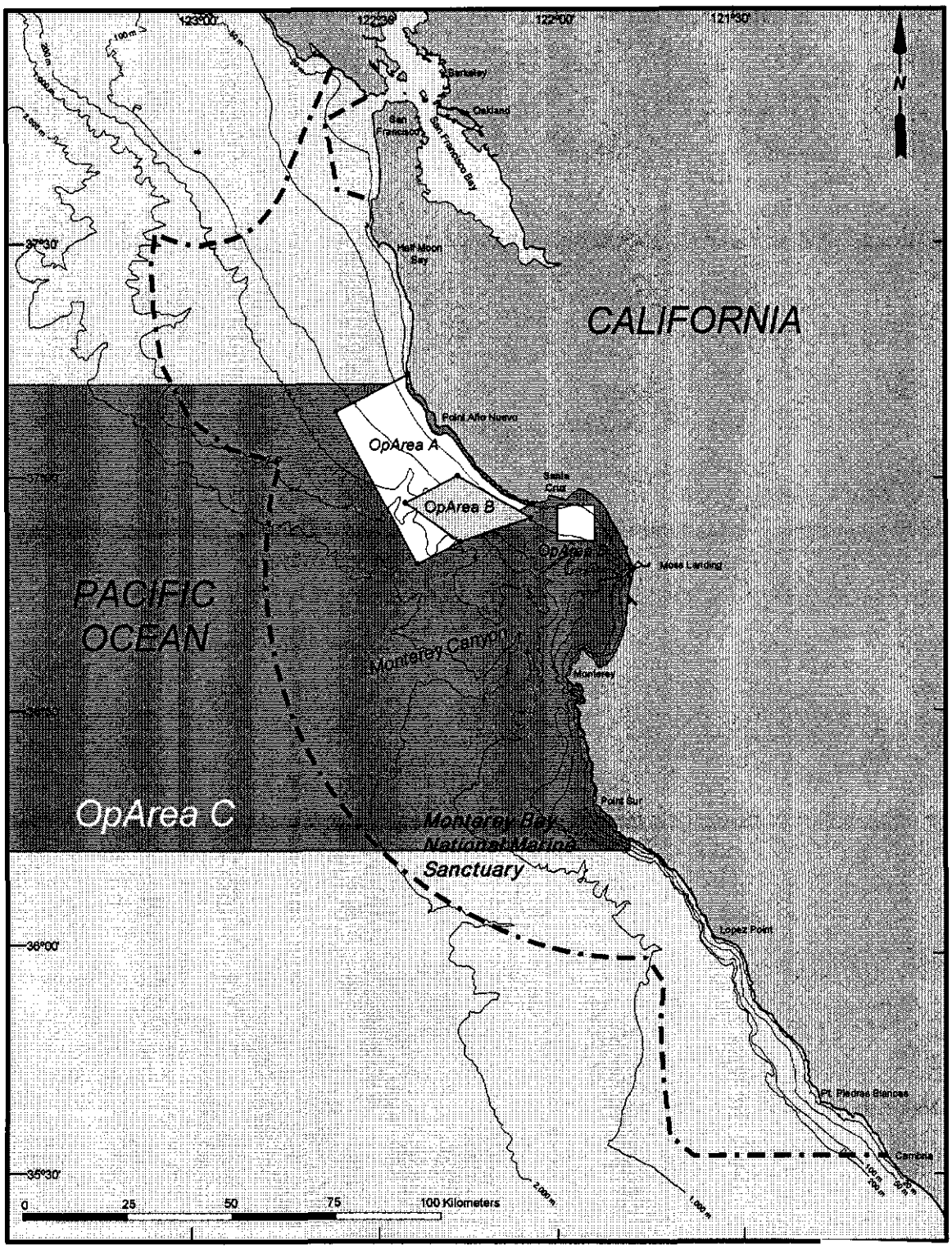

Figure 2-1. Location of Monterey Bay 2006 operational areas.

EXHIBIT NO. 1
APPLICATION NO.
CD-37-06

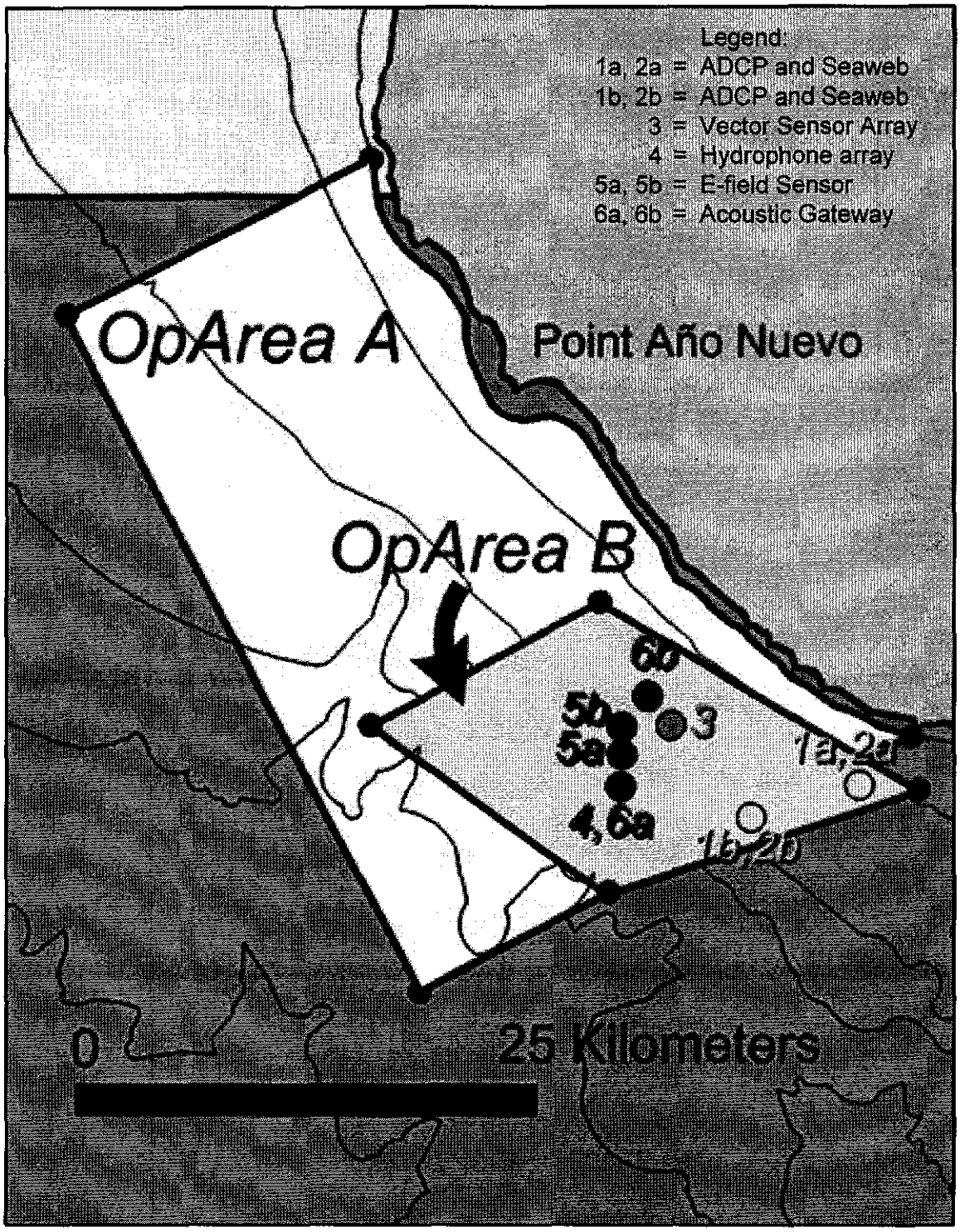

Figure 2-3. Bottom founded equipment, OpAreas A and B.

EXHIBIT NO. 2
APPLICATION NO.
CD-37-06

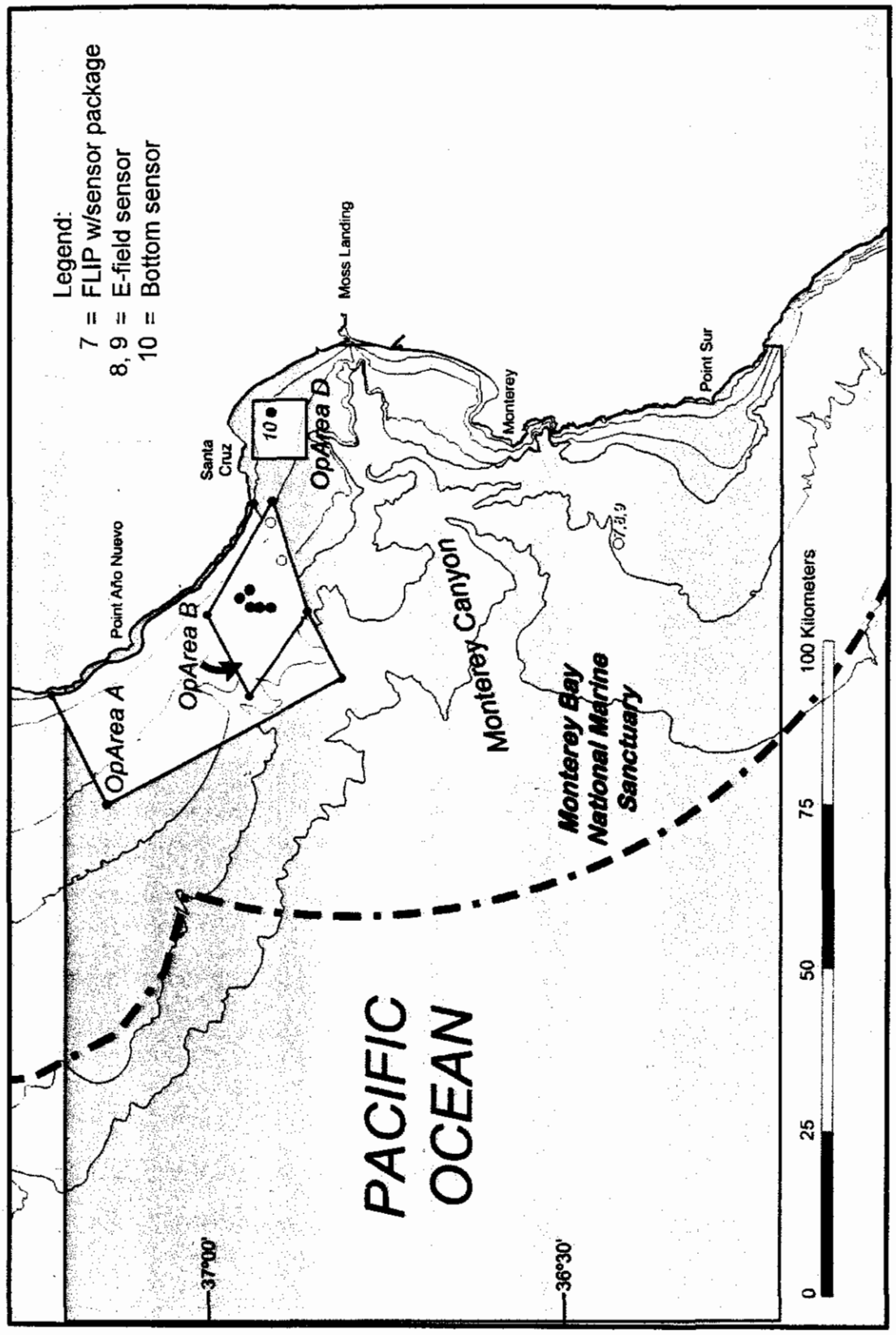

Figure 2-4. Bottom founded equipment, OpAreas C and D.

Exh. 2, p.2

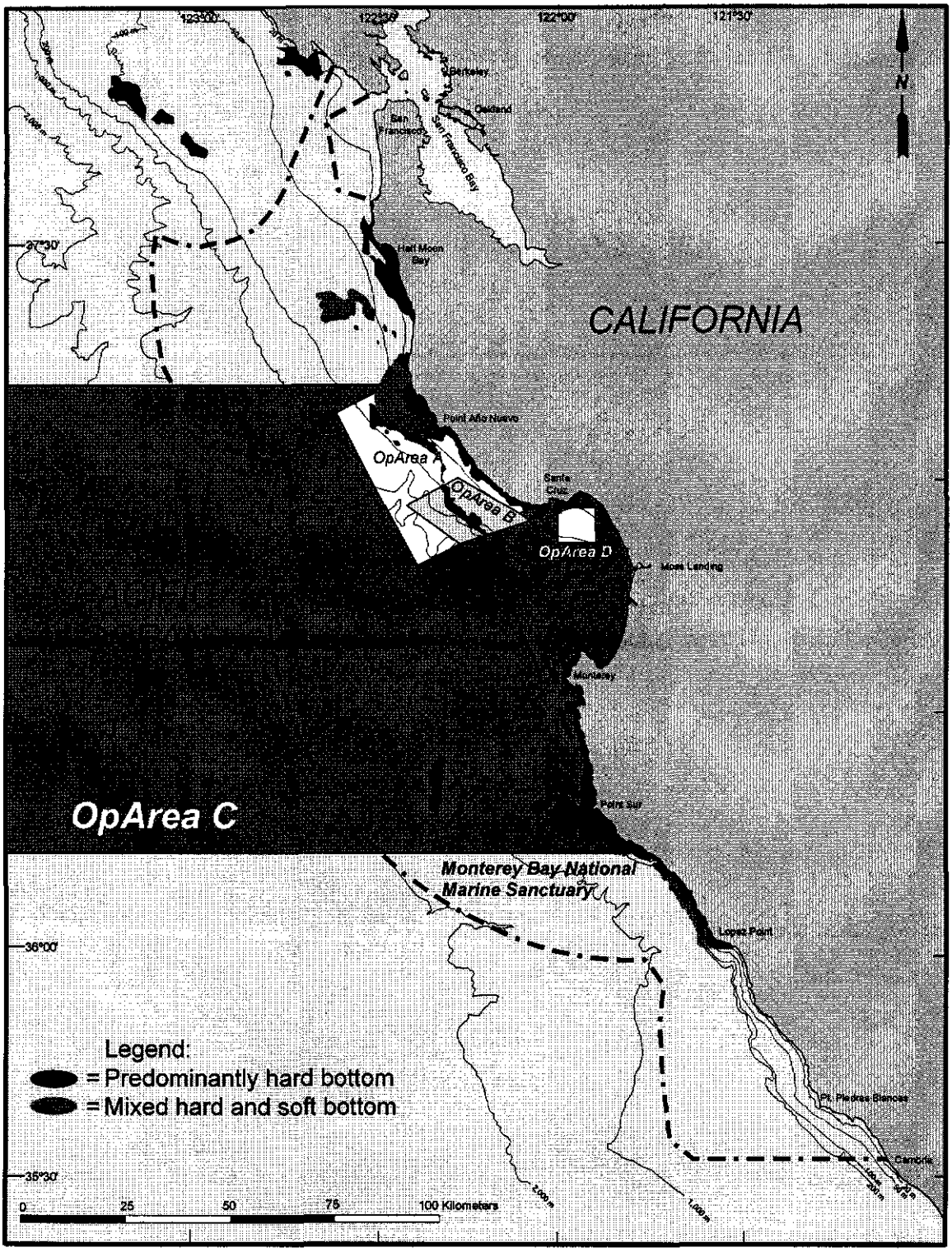

Figure 4-2. Soft and hard bottom distribution on the continental shelf and slope of the MBNMS. in the vicinity of MB06 OpAreas (From: Starr et al., 2000).

EXHIBIT NO. 3
APPLICATION NO.
CD-37-06

Table 2-2. Summary of MB 06 vessel and aircraft activity by OpArea and timeframe.

Vessel or Aircraft	OpArea	Dates	Days	Project	Comments
Research Vessel or Floating Platform					
Cypress Sea	A	24 Jul-30 Aug	7	ASAP	Launch, monitor, and recover REMUS and ARIES AUVs on alternating days
Thompson	D	14 Jul-1 Aug	17	LOCO	Survey beginning at 36.93° N, 121.91° W extending offshore 30-40 km. Includes collection of zooplankton by 0.7 diameter 170 micrometer mesh net and pump
Zephyr	A, B & D	23 Jul-7 Sep	15	ASAP	L/ R platform for DORADO 1 & 2
Shana Rae	A	20-21 Jul, 7-10 Aug (as req), 1-2 Sep	8 max	ASAP	Monitor Spray Glider operations; alternate launch and recovery platform
	D	10/11 Jul-29/31 Jul	22	LOCO	Servicing/monitoring instrument clusters; deploy & recover gateway buoy
FLIP	C	1-28 Aug	28	AESOP	2 Doppler sonars and 2 rapidly profiling CTDs
Revelle	C	14 Jul-4 Aug	22	AESOP	--
	C	8-24 Aug	17	AESOP	Acoustic back scattering system, ADCPs and towed SWIMS3
Wecoma	C	19-21 Jul	3	AESOP	Triaxus survey in conjunction with Lagrangian floats
	C	31 Jul-31 Aug	32	AESOP	Towed SeaSoar w/ CTD, fluorometer, transmissometer
Sproul	B	14-31 Jul	18	UPS	--
	B	10-29 Aug	20	UPS	Launch, monitor, and recover X-ray glider, sea gliders
New Horizon	B	29 Jul-1 Aug	2	UPS	Deployment and recovery of E-field sensors
	B	16-25 Aug	10	UPS	Launch, monitor, and recover Bluefin (2), fixed nodes
Montague	B	9-30 Aug	22	UPS	Trawler avoidance operations
Point Sur	B/C	2-29 Jul, 4-5 Sep	10	AESOP	--
	A	1-7 Aug, 8-15 Sep	14	ASAP	--
	A	10 and 30 Aug	2	ASAP	--
	C	12-18 Aug	7	AESOP	--
	B	18-29 Aug	12	ASAP	Kayaks - navigational aids and acoustic communications pathway for BLUEFIN 21
Relentless	D	11-31 July	21	LOCO	--
Sheila B	D	11-31 July	21	LOCO	Transect survey vicinity of instrument cluster; monitor REMUS and glider operations
Shuttle Vessel	A, B, C, D	1-31 Aug (as required)	31	N/A	Move personnel/equipment to/from RVs
All Research and Shuttle Vessels, Research Platform:			***354 vessel days total***		
Aircraft					
Twin Otter	A	26 or 27 Jul, 1-15 Aug; 16 Aug-8 Sep	40	ASAP and NOAA	--

Table 2-3. Summary of MB 06 bottom-founded equipment, by project.

Equipment	No.	Location Designation and Figure Number	Location - OpArea and Coordinates	Description
ASAP				
ADCP	2	Plotted as 1a and 1b, Figure 2-3	OpArea A; one ADCP at 36.92° N, 122.12° W on the 60 m isobath; the second ADCP at 36.90° N, 122.19° W on the 100 m isobath	To be deployed from RV *Point Sur* on 11 August and recovered 31 August. Self-anchored on bottom resting on fiberglass grid. Footprint <1 m^2 for each ADCP. Node will be 100% recovered using an acoustic release/float mechanism post experiment.
Seaweb Gateway for ADCPs	2	Plotted as 2a and 2b, Figure 2-3	OpArea A; one Seaweb Gateway at 36.92° N, 122.12° W on the 60 m isobath; the second at 36.90° N, 122.19° W on the 90 m isobath	Anchored using bagged Monterey Bay sand. Footprint <1 m^2 for each gateway. Node will be fully recovered using an acoustic release post experiment. Sand bags will remain in place.
PLUSNet				
Vector sensor array (horizontally mounted)	1	Plotted as 3, Figure 2-3	OpArea B; 36.95° N, 122.24° W on the 95 m isobath	Anchored on bottom at both ends using bagged Monterey Bay sand. Footprint <1 m^2. Footprint <1 m^2 for each. A 300 pound battery/instrument pack will be recovered post experiment using an acoustic release for retrieval. Sand bags will remain in place.
Hydrophone array (Kelp, vertically mounted)	1	Plotted as 4, Figure 2-3	OpArea B; 36.93° N, 122.28° W on the 110 m isobath	Anchored on bottom using bagged Monterey Bay sand. Footprint <1 m^2. Two 75 pound cylinders measuring 27" long x 5" (diameter) will be recovered post experiment using an acoustic release for retrieval. Sand bags will remain in place.
E-Field Sensor	1	Plotted as 5a, Figure 2-3	OpArea B; 36.94° N, 122.27° W on the 98 m isobath	Anchored on bottom using bagged Monterey Bay sand. Footprint <1 m^2. Tripod frame and an 80 pound battery/instrument pack will be recovered post experiment using an acoustic release for retrieval. Sand bags will remain in place.
E-Field Sensor	1	Plotted as 5b, Figure 2-3	OpArea B; 36.95° N, 122.25° W on the 90 m isobath	Anchored on bottom using bagged Monterey Bay sand. Footprint <1 m^2. Tripod frame and an 80 pound battery/instrument pack will be recovered post experiment using an acoustic release for retrieval. Sand bags will remain in place.
Acoustic Gateway	2	Plotted as 6a and 6b, Figure 2-3	OpArea B; one Acoustic Gateway at 36.92° N, 122.27° W on the 150 m isobath; the second at 36.98° N, 122.26° W on the 87 m isobath	Anchored on bottom using ~300 pounds of cement block & chain for each Acoustic Gateway. Approximate footprint of 1 m^2 each. Nodes will be fully recovered post experiment. Cement block and chain will remain in place.
AESOP				
FLIP w/ integral sensor package	1	Plotted as 7, Figure 2-4	OpArea C; 36.44° N, 122.16° W at the 800 m isobath; sensor package includes two ADCPs and one Sector Scan Sonar	Secured to the bottom at 800-1,000 m at three points, each point consisting of a modified Danforth anchor and scrap anchor chain. Each anchor/chain arrangement to create a footprint of 11 m^2. Anchors and chain to be emplaced by Navy tug. Anchors and chain to remain on bottom once released by a shear link and are expected to encrust over with marine life and provide hard bottom habitat.
E-Field Sensor	2	Plotted as 8 and 9, Figure 2-4.	OpArea C; 36.44 N°, 122.16° W at the 800 m isobath	Anchored to bottom with granite/stone drop weight. Footprint approximately 1 m^2. Sensor to be recovered post experiment. Granite/stone drop weight to remain on seabed.
LOCO				
Bottom Sensor	6-8	Plotted as 10, Figure 2-3	OpArea D; northeast corner of Monterey Bay, offshore Santa Cruz (36.92° N, 121.92° W), near the 18-22 m (60-72 ft) depth contour	Small, multiple oceanographic sensors and sensor systems placed in a cluster/array on the seabed. Footprint ~6-8 m^2. Instruments will be fully recovered post experiment.

Table 2-5. Summary of MB 06 fixed and mobile acoustic sources, by project.

Name	No.	Sensor/Acoustic Communications	Mobility/ Platform	OpArea and Location	Source dB (re 1µPa @ 1 m)	Frequency	Pulse Characteristics
ASAP							
ADCP	2	ADCP/Seaweb	Fixed	OpArea A; 36.92° N, 122.12° W; 60 m OpArea A; 36.90° N, 122.19° W; 100 m	185 dB	300 kHz	1 ping/sec
Acoustic Gateway	2	Seaweb	Fixed	OpArea A; 36.92° N, 122.12° W; 60 m OpArea A; 36.90° N, 122.19° W; 90 m	185 dB	8-14 kHz	1 min every 10 min; omni
Bluefin 21 UUV (ASAP and UPS)	2	WHOI uModem	M-AUV	OpArea B	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni
DORADO (MBARI)	1	SSS sub-bottom profiler	M-AUV	OpArea A	206 dB	2-10 kHz	N/A
ARIES (NPS)	1	Seaweb	M-AUV	OpArea A	185 dB	8-14 kHz	8 sec on, 2 min off; 4 kHz b/w; omni
	1	ADCP (down)			216 dB	600 kHz	2 Hz
REMUS (NPS)	1	uModem	M-AUV	OpArea A	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni
	1	ADCP (up)			190 dB	900 kHz	2 Hz
	1	ADCP (down)			190 dB	900 kHz	2 Hz
Spray Glider	4	ADCP	M-Glider	OpArea A	172 dB	750 kHz	5 ms pings; 24 pings/min; quiet 50%
PLUSNet							
Vector sensor array	1	uModem	Fixed	OpArea B; 36.95° N, 122.24° W; 95 m	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni
Hydrophone array	1	uModem	Fixed	OpArea B; 36.93° N, 122.28° W; 110 m	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni
Acoustic Gateway	2	uModem	Fixed	OpArea B; 36.92° N, 122.27° W; 150 m	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni
		uModem	Fixed	OpArea B; 36.98° N, 122.26° W; 87 m	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni
Acoustic Seaglider	4	uModem	M-Glider	OpArea B	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni
Slocum Glider	1	uModem	M-Glider	OpArea B	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni
Standard Active Source J15	1	Active Source	M-Vessel	OpArea B	140-160 dB	50-1,000 Hz	2 sec; 30 sec on; 60 sec off
High Frequency	1	Active Source	M-Vessel	OpArea B	140-160 dB	1-30 kHz	30 sec; 30 sec on; 60 sec off
Transient	1	Active Source	M-Vessel	OpArea B	160-165 dB	350-3500 Hz	30 sec; 30 sec on; 60 sec off
UPS							
Liberdade Glider	1	uModem	M-Glider	OpArea B	185 dB	25 kHz	8 sec on, 2 min off; omni

Table 2-5. (Continued).

Name	No.	Sensor/Acoustic Communications	Mobility/ Platform	OpArea and Location	Source dB (re 1µPa @ 1 m)	Frequency	Pulse Characteristics
ASAP/ PLUSNet							
Kayaks	4	uModem	M-USV	OpArea B	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni
AESOP							
FLIP w/ ADCP	1	ADCP	Fixed	OpArea C; 36.44° N, 122.16° W; 800 m	192 dB	170 kHz	6 ms; 1 Hz; narrow beam width (13 deg)
ADCP	1	ADCP	Fixed	OpArea C; 36.44° N, 122.16° W; 800 m	192 dB	140 kHz	6 ms; 1 Hz; narrow beam width (13 deg)
Sector Scan Sonar (horiz)	1	Sector Scan Sonar	Fixed	OpArea C; 36.44° N, 122.16° W; 800 m	200 dB	50 kHz	30 ms, 0.5 Hz; narrow beam width
E-Field Sensors	2	Acoustic communications	Fixed	OpArea C; 36.44° N, 122.16° W; 800 m	185 dB	9-14 kHz	
XCP	96	ADCP	M-Floaters	OpArea C; near FLIP	192 dB	75 kHz	20 ms, 1 Hz; in air transmissions
Lagrangian floats	3	ADCP	M-Floaters	OpArea C	192 dB	8-16 kHz	0.05 Hz; 2 sources; narrow beam width
Moored Doppler	1	ADCP	Fixed	OpArea C	185 dB	300 kHz	6 ms, 0.5 Hz continuous, 4 beams 4 degrees
LOCO							
Bubble Scan	1	Bubble Scan	Fixed	OpArea D	180-210 dB	.075-1 MHz	Extremely short pulses across 96 frequencies
Solar AUV	4	Benthos Modem	M-AUV	OpArea D	185 dB	16-21 kHz	0.038 ms; 5 sec per 15 min; 1% duty cycle; omni
Research Vessels							
Revelle	1	ADCP	M-Vessel	OpArea C	192 dB	50 kHz	20 ms; .5 Hz; narrow
	1	Sub-bottom profiler	M-Vessel	OpArea C	185 dB	3.5/12 kHz	5 ms; 1 Hz
	1	ADCP	M-Vessel	OpArea C	175 dB	150 kHz	6 ms, 1 Hz; narrow
	1	ADCP	M-Vessel	OpArea C	175 dB	140 kHz	6 ms, 1 Hz; narrow
	1	Float tracking	M-Vessel	OpArea C	192 dB	8-16 kHz	0.05 Hz; narrow
	1	Fish finder	M-Vessel	OpArea C	185 dB	120/212 kHz	5 ms, 1 Hz continuous, 16 degrees (narrow)
Wecoma	1	ADCP	M-Vessel	OpArea C	185 dB	3.5/12 kHz	5 ms; 1 Hz
	1	ADCP	M-Vessel	OpArea C	180 dB	75 kHz	20 ms; 1 Hz; narrow
	1	ADCP	M-Vessel	OpArea C	175 dB	150 kHz	6 ms; 1 Hz; narrow
Sproul	1	ADCP	M-Vessel	OpArea B	215-221 dB	3.5/12 kHz	5 ms (estimated)
Point Sur	1	ADCP	M-Vessel	OpArea D	223.6 dB	75 or 150 kHz	5 kHz BW, 24.6 ms, 2 sec or 10 kHz BW, 12.3 ms, 1 sec; narrow

Key: M = Mobile (AUV, Glider, Vessel, or Free floating); F = Fixed (Anchored on the seafloor).

Exhibit 6 (cont'd.)

Table 2-6. MB 06 research and shuttle vessel characteristics, including the research platform FLIP (Adapted from: Research Vessels, 2006; Scientific Fishery Systems, Inc., 2006).

Vessel (operator)	OpArea	Days	Project	Length (m)	Draft (max; m)	Acoustics and profiling	Compliment (maximum)
DV *Cypress Sea* (Diver Dan's)	A	7	ASAP	15.24	N/A	Depth finder	10 (est.)
RV *Thomas G. Thompson* (SIO)	D	17	LOCO	83.52	5.8	30 kHz multibeam; 3.5 kHz sub-bottom; two 12 kHz bottom profilers; bottom/sub-bottom profiler; 150 kHz ADCP	60
RV *Zephyr* (MBARI)	A	15	ASAP	26.0	N/A	Sonteck ADCP	10
RV *Shana Rae* (Monterey Canyon Research Vessels)	A	4-8	ASAP	15.85	1.98	Furuno 50 and 200 kHz echosounders	7
	D	22	LOCO				
RP *FLIP* (SIO)	C	28	AESOP	108.2	3.83	75-200 kHz sonar	15
RV *Roger Revelle* (SIO)	C	22	AESOP	83.21	5.18	RDI Narrowband 150 kHz ADCP; doppler sonar; echosounder	59
	C	17	AESOP				
RV *Wecoma* (OSU)	C	3	AESOP	56.39	5.64	ADCP; 3 and 12 kHz chirp	37
	C	32	AESOP				
RV *Robert Gordon Sproul* (SIO)	B	18	UPS/PLUS Net	38.1	2.62	RDI Narrowband 300 ADCP	17
	B	20	UPS/PLUS Net				
RV *New Horizon* (SIO)	B	2	UPS/PLUS Net	51.82	3.9	Narrowband 150 ADCP	31
	B	10	UPS/PLUS Net				
RV *Montague* (Scientific Fishery Systems, Inc.)	B	22	UPS/PLUS Net	17.68	2.74	None noted	8
RV *Point Sur* (MLML)	B/C	10	AESOP	41.15	2.74	150 and 300 kHz ADCP; Knudsen dual frequency echosounder, 3.5 and 12 kHz	21
	A	14	ASAP				
	A	2	ASAP				
	C	7	AESOP				
	B	12	ASAP				
RV *Sheila B*	D	21	LOCO	9.28	0.41	None noted	15
RV *Relentless*	D	21	LOCO	68.3	4.9	None noted	33
Shuttle vessel	A,B,C,D	1-31	N/A	15 (est.)	3-4 (est.)	None noted	10 (est.)

Table 4-4. Presence of marine mammals in the study area (Adapted from: CSLC, 2005).

Species - Common and Scientific Name	Status	Upwelling Period (Apr-Jul)			Davidson Period (Aug-Nov)		
		IS	OS	Slo	IS	OS	Slo
Fin whale (*Balaenoptera physalus*)	FE	○	◘	◘	○	◘	◘
Blue whale (*Balaenoptera musculus*)	FE	○	◘	◘	○	■	■
Sei whale (*Balaenoptera borealis*)	FE	○	○	○	○	○	○
Humpback whale (*Megaptera novaeangliae*)	FE	◘	◘	◘	◘	■	■
Minke whale (*Balaenoptera acutorostrata*)	-	○	◘	◘	○	◘	◘
Bryde's whale (*Balaenoptera edeni*)	-	○	○	○	○	○	○
California gray whale (*Eschrichtius robustus*)	-	◘	◘	◘	○	○	○
Pacific right whale (*Eubalaena glacialis*)	FE	○	○	○	○	○	○
Sperm whale (*Physeter macrocephalus*)	FE	○	○	◘	○	○	◘
Pygmy sperm whale (*Kogia breviceps*)	-	○	○	○	○	○	○
Dwarf sperm whale (*Kogia simus*)	-	○	○	○	○	○	○
Beaked whales [*Berardius bairdi* (Baird's); *Ziphius cavirostris;* (Cuvier's); *Mesoplodon carlhubbsi* (Hubbs')]	-	○	○	◘	○	○	◘
Killer whale (*Orcinus orca*)	FT C	○	◘	◘	○	◘	◘
False killer whale (*Pseudorca crassidens*)	-	○	○	○	○	○	○
Short-finned pilot whale (*Globicephala macrorhynchus*)	-	○	○	○	○	○	○
Bottlenose dolphin (*Tursiops truncatus*)	-	■	○	○	■	○	○
Risso's dolphin (*Grampus griseus*)	-	○	■	■	○	■	■
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*)	-	○	■	■	○	■	■
Northern right whale dolphin (*Lissodelphis borealis*)	-	○	■	■	○	■	■
Common dolphin [*Delphinus delphinus* (short beaked); *Delphinus capensis* (long beaked)]	-	○	◘	◘	○	◘	◘
Striped dolphin (*Stenella coeruleoalba*)	-	○	○	○	○	○	◘
Dall's porpoise (*Phocoenoides dalli*)	-	◘	■	■	◘	■	■
Harbor porpoise (*Phocoena phocoena*)	-	■	■	○	■	■	○
Guadalupe fur seal (*Arctocephalus townsendi*)	FT, ST	○	○	○	○	○	○
Steller sea lion (*Eumetopias jubatus*)	FT	○	◘	◘	○	○	○
Harbor seal (*Phoca vitulina richardsi*)	-	■	■	○	■	■	○
California sea lion (*Zalophus californianus*)	-	◘	◘	◘	■	■	■
Northern fur seal (*Callorhinus ursinus*)	D	○	○	◘	○	○	◘
Northern elephant seal (*Mirounga angustirostris*)	-	○	◘	◘	○	◘	◘
Southern sea otter (*Enhydra lutris*)	FT	■	◘	○	■	◘	○

Key: FE – Federal, endangered (ESA); FT – Federal, threatened (ESA); FTC – Federal, threatened, candidate species; ST – State, threatened (CA list); D – Identified as "depleted" under MMPA, Special Status; IS – inner to mid shelf; OS – outer shelf, shelf edge; Slo – slope.

Symbols: ■ – abundant; ◘ - moderately abundant; ○ – present but not abundant.

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Table 4-5. Summary marine mammal survey information for the California stratum, northern and central California stratum, and the MBNMS.

Species	California Stratum (Barlow, 2003)		Northern/Central California Stratum (Ferguson & Barlow, 2003)		West Coast CSCAPE (July 2005)		
	Survey Abundance	Density (Individuals/km^2)	Survey Abundance	Density (Individuals/km^2)	Total Sightings	Average Group Size	Survey Abundance
Fin whale	3,257	0.0040	600	0.0048	15	1.2	18
Blue whale	788	0.0010	442	0.0035	27	1.3	35
Sei whale	0	0.0000	0	0.0000	-	-	-
Humpback whale	743	0.0009	869	0.0069	255	1.5	383
Minke whale	716	0.0009	258	0.0004	7	1	7
Bryde's whale	0	0.0000	0	0.0000	-	-	-
California gray whale	-	-	-	-	-	-	-
Pacific right whale	-	-	-	-	-	-	-
Sperm whale	1,581	0.0019	440	0.0035	3	1.7	5
Pygmy sperm whale	0	0.0000	974	0.0015	-	-	-
Dwarf sperm whale	-	-	-	-	-	-	-
Beaked whales	863	0.0023 [a]	128-1,991	0.0005-0.0031	2	2.7	5
Killer whale	6,489	0.0006	37	0.0003	4	4.2	17
False killer whale	-	-	-	-	-	-	-
Short-finned pilot whale	0	0.0000	288	0.0023	-	-	-
Bottlenose dolphin	4,666	0.0057	0	0.0000	-	-	-
Risso's dolphin	9,357	0.0114	2,344	0.0186	49	16.2	794
Pacific white-sided dolphin	15,899	0.0194	24,581	0.195	43	25.5	1,097
Northern right whale dolphin	10,915	0.0134	4,214	0.0334	12	105.2	1,262
Common dolphin [b]	516,938	0.6323	34,314/ *10,961*	0.2725/ *0.087* [c]	-	-	-
Striped dolphin	22,316	0.0273	57	0.0005	-	-	-
Dall's porpoise	41,940	0.0513	73,877	0.1158	-	-	-
Harbor porpoise	-	-	-	-	33	2.1	69
Guadalupe fur seal	-	-	-	-	-	-	-
Steller sea lion	-	-	-	-	-	-	-
Harbor seal	-	-	-	-	1	-	-
California sea lion	-	-	-	-	-	-	-
Northern fur seal	-	-	-	-	-	-	-
Northern elephant seal	-	-	-	-	3	-	-
Southern sea otter	-	-	-	-	-	-	-

Footnotes and Notes: [a] – Cuvier's beaked whale estimates; [b] – single values for short beaked species; [c] – second values for long beaked common dolphin; "-" – not sighted.

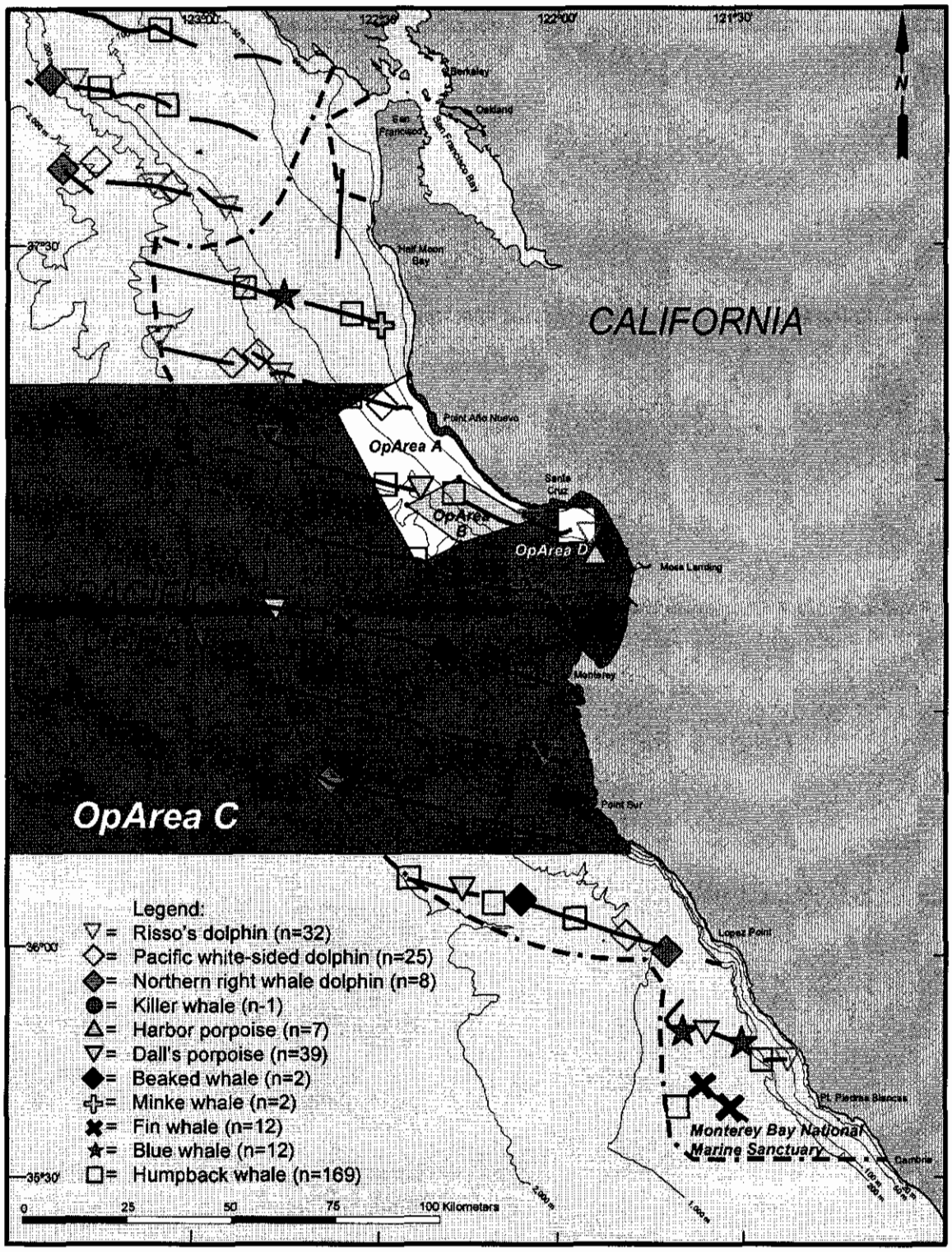

Figure 4-3. Representative marine mammal sightings data for central California national marine sanctuaries, July 2005. Total number of sightings noted parenthetically. (Adapted from: Monterey Bay National Marine Sanctuary, 2006b).

EXHIBIT NO. 10
APPLICATION NO.
CD-37-06

attempts to harm or harass protected species. Under the MMPA, two categories of harassment are defined:

- the potential to injure a marine mammal or marine mammal stock in the wild, termed ***Level A harassment***; and
- disturbance to a marine mammal or marine mammal stock by causing disruption of natural behavioral patterns (e.g., migration, breathing, nursing, breeding, or feeding), termed ***Level B harassment***.

Level A harassment, therefore, includes any act with the significant potential to injure marine mammals or marine mammal stocks. Injury, as defined in analysis and in previous rules (NOAA, 2001a, 2002), is the destruction or loss of biological tissue. Level B harassment occurs only when there is "a potential for a significant behavioral change or response in a biologically important behavior or activity," as determined in recent rules (National Oceanic and Atmospheric Administration [NOAA}, 2001a, 2002). In other words, impacts that qualify as Level A harassment address mortality and
address behavioral disruption of

it qualify as Level B harassment

Slight behavior disruptic
addressed in previous actions an
2001). Under those rulings, a m
an acoustic event that is both bri

ysiological effects has been
02; Department of the Navy,
protected marine mammal to
ualify as Level B harassment.

Impact Determination

Discharges

Discharges will produce minor, localized increases in turbidity, biological oxygen demand (BOD), and temperature within several meters of the discharge point. These minor impacts will decrease with increasing distance from the discharge point due to wave action, current flow, and mixing. Residual amounts of chlorine, which is used for disinfection of the wastewater, will have a minor and transient impact on water quality. As noted previously, ambient water quality conditions are expected to quickly return to normal following cessation of the discharge. It is unlikely that marine mammals will be exposed to discharges from research vessels that are either stationary or in transit. ***Should marine mammals be exposed, impacts from discharges are expected to be minor, regionally negligible, and of short duration.***

Noise Exposure

If marine mammals can hear a sound source, they may react to that source. Further, a source within a species' hearing range has the potential to cause auditory damage. Assessment of impact of MB 06 activities and associated noise sources considers 1) marine mammal presence in the MBNMS (see **Table 4-4**); 2) marine mammal hearing sensitivities (as determined from direct measurements of sensitivities, or inferred from vocalizations); 3) equipment source level, pulse length, repetition rate, and duty cycle; and 4) calculated sound exposure levels (i.e., distance from equipment sources to recognized threshold levels).

A tabular summary of marine mammal vocalizations has been provided in **Appendix A, Table A-1**. A total of 73 acoustic sources, comprised of both mobile and fixed equipment, have been proposed for MB 06 (see **Appendix B, Table B-1**). A comparison of MB 06 acoustic sources against marine mammal vocalizations provides an indication of the potential overlap –

sources potentially audible to marine mammals. Of the 73 acoustic sources, 47 sources emit sound within the frequency ranges likely to be heard (i.e., ≤200 kHz) by marine mammal species that may be expected to be present within the Sanctuary during MB 06. Remaining acoustic sources to be used in MB 06 have source frequencies >200 kHz, none of which will produce acoustic impacts to marine mammals (or other marine resources).

Results of the analysis of audible sound source characteristics and marine mammal vocalization indicate that there is potential for acoustic overlap with all marine mammal species that may be present in the MBNMS, except for the northern fur seal. Therefore, there is a potential for marine mammals to hear the noise of oceanographic equipment and/or acoustic communications for equipment emitting frequencies ≤200 kHz, if the individual is close enough to the sound source. Species, their likelihood of presence anywhere within the bounds of the MBNMS during the MB 06 period of operations, and vocalization overlap with specific pieces of equipment are depicted in **Figure 4-5**.

MB 06 acoustic equipment exhibits a broad range of frequencies, as characterized in **Table 4-6** for frequencies ≤200 kHz. A total of 47 mobile and fixed acoustic sources have been evaluated. The vast majority of MB 06 acoustic sources are categorized as standard oceanographic systems, including 1) standard shipboard oceanographic measurement systems (e.g., sub-bottom profilers, acoustic Doppler current profilers [ADCPs]); 2) fixed or mobile oceanographic sensors (e.g., sector scan sonars, fixed or mobile ADCPs); or 3) standard acoustic communication systems (acoustic communication devices, uModems). Standard oceanographic systems typically have short pulse lengths and intermittent duty cycles. Three of the MB 06 acoustic sources are considered active sources, to be used specifically to generate low source output noise for passive detection by mobile or fixed sensors. As is evident in **Table 4-6**, the 25 kHz uModems are the most abundant, single frequency acoustic source; 17 of these units will be either fixed or mobile during MB 06. Fixed or mobile acoustic sources are proposed for each OpArea, each to a varying degree of activity. OpArea B will realize the greatest number of acoustic sources.

Sources levels for the 47 acoustic sources proposed for MB 06 identified in **Table 4-6** typically range from 140 to 185 dB re 1 μPa at 1 meter, with most pulse durations in the 4 to 20 millisecond (ms) range and several considerably longer. Exceptions include nine sources with source levels of 186 dB (re: 1 μPa at 1 m) or greater and pulse length of 5 to 30 ms.

Noise from aircraft overflights is not expected to produce any impacts to marine mammals, as the Twin Otter will ascend to 500 ft altitude when mammals are sighted offshore. The aircraft will also maintain a safe distance from the shoreline and offshore features (pinnacles, rock outcrops) while surveying and will attain the proper altitude (1,000 ft or greater) when crossing the shoreline.

Many of these standard oceanographic systems or project-specific components have been evaluated previously in various applications on the U.S. east and west coast and in the Gulf of Mexico. Of particular interest are the following environmental assessments which led to negative declarations or FONSIs:

Exh. 11, p. 2

Figure 4-5. **Acoustic overlap of MB 06 equipment with vocalization characteristics of marine mammals. Deep shading indicates that the equipment will be heard if the individual is close enough to the sound source; light shading indicates that species presence is possible but not likely and the species of interest will hear the equipment if close enough to the sound source.**

Species	Expected Presence in MBNMS During *MB 06/* Density Characterization	Acoustic Equipment Characteristics											
		Broad Frequency Range				Narrow Frequency Range							
		.35-3.5 kHz	0.5-1 kHz	2-10/ 1-30 kHz	8-14/ 8-16/ 9-14/ 16-21 kHz	3.5 kHz	12 kHz	25 kHz	50 kHz	75 kHz	140 kHz	150 kHz	170 kHz
Baleen Whales (Mysticetes):													
Fin whale	**Likely; Very Low Density**	■	■	■	■	■		■					
Blue whale	**Likely; Low Density**	■		■	■			■					
Sei whale	Possible, Not Likely	▒		▒		▒							
Humpback whale	**Likely; Low Density**	■	■	■	■	■							
Minke whale	***Likely; Low Density***	■	■	■	■	■	■						
Bryde's whale	Possible, Not Likely	▒	▒										
CA gray whale	Seasonal Absence	▒	▒	▒	▒	▒							
Pacific right whale	Unknown	■											
Toothed Whales (Odontocetes):													
Sperm whale	**Likely; Low Density**	■	■	■	■	■	■	■					
Pyg. sperm whale	Possible, Not Likely									▒	▒	▒	▒
Beaked whales	**Likely; Low Density**	■	■	■	■	■	■	■	■	■			
Killer whale	**Likely; Low Density**	■	■	■	■	■	■	■					
False killer whale	Unknown			■	■		■	■					
SF pilot whale	Possible, Not Likely	▒	▒	▒	▒	▒	▒		▒				

Exh. 11, p. 3

Figure 4-5. (Continued).

Species	Expected Presence in MBNMS During MB 06/ Density Characterization	Acoustic Equipment Characteristics											
		Broad Frequency Range				Narrow Frequency Range							
		.35-3.5 kHz	0.5-1 kHz	2-10/ 1-30 kHz	8-14/ 8-16/ 9-14/ 16-21 kHz	3.5 kHz	12 kHz	25 kHz	50 kHz	75 kHz	140 kHz	150 kHz	170 kHz
Bottlenose dolphin	Possible, Not Likely												
Risso's dolphin	**Likely; Moderate to High Density**												
Pacific white-sided dolphin	**Likely; Moderate to High Density**												
Northern right whale dolphin	**Likely; Moderate Density**												
Common dolphin	Possible, Not Likely												
Striped dolphin	Possible, Not Likely												
Dall's porpoise	Possible, Not Likely												
Harbor porpoise	**Likely; Density Unknown**												
Seals and Sea Lions (Pinnipeds):													
Harbor seal	**Likely; Density Unknown**												
California sea lion	**Likely; Density Unknown**												
Northern fur seal	Possible, Not Likely												
Sea Otter (Fissiped):													
Sea otter	**Likely; High Density Inshore**												

Notes and Abbreviations: 1) Source characteristics: numbers denote number of sources; M – mobile (RV or AUV); F – fixed (seafloor); distance equals conservative radius from source to Level B threshold distance – see text for distance calculation assumptions and narrow beam discussion; 2) Equipment specifications taken from **Table 4-7**; 3.5 and 12 kHz equipment (sub-bottom profiler) assigned to 3.5 kHz category for counts; 75 or 150 kHz equipment (ADCP) assigned to 75 kHz category for counts; density information from **Table 4-4**.

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Table 4-6. Summary of MB 06 audible acoustic sources, organized by sound source group and presented by source level in descending order.

Name	No.	Project	Sensor/Acoustics	Mobility/ Platform (M-Mobile; F-Fixed)	Source Level	Frequency Range	Pulse Characteristics
MB 06 Standard Oceanographic Sources							
Standard Shipboard Oceanographic Systems							
RV *Point Sur*	1	UPS	ADCP	M, RV *Point Sur*	223.6 dB	75 or 150 kHz	5 kHz BW, 24.6 ms, 2 sec or 10 kHz BW, 12.3 ms, 1 sec; narrow beam width
RV *Sproul*	1	UPS	Sub Bottom Profiler	M, RV *Sproul*	215-221 dB	3.5/12 kHz	5 ms estimated
RV *Revelle*	1	AESOP	ADCP	M, RV *Revelle*	192 dB	50 kHz	20 ms, .5 Hz; narrow beam width
RV *Wecoma*	1	AESOP	Knudsen Sub-bottom profiler	M, RV *Wecoma*	185 dB	3.5/12 kHz	5 ms, 1 Hz
RV *Revelle*	1	AESOP	Knudsen Sub-bottom profiler	M, RV *Revelle*	185 dB	3.5/12 kHz	5 ms, 1 Hz
RV *Wecoma*	1	AESOP	ADCP	M, RV *Wecoma*	180 dB	75 kHz	20 ms, 1 Hz; narrow beam width
RV *Wecoma*	1	AESOP	ADCP	M, RV *Wecoma*	175 dB	150 kHz	6 ms, 1 Hz; narrow beam width
RV *Revelle*	1	AESOP	ADCP	M, RV *Revelle*	175 dB	150 kHz	6 ms, 1 Hz; narrow beam width
RV *Revelle*	1	AESOP	ADCP	M, RV *Revelle*	175 dB	140 kHz	4 ms, .5 Hz; narrow beam width
RV *Revelle*	1	AESOP	Fish finder	M, RV *Revelle*	185 dB	120/212 kHz	5 ms, 1 Hz; narrow beam width
Standard Fixed or Mobile Oceanographic Sensors							
Bubble-Scan	1	LOCO	Bubble-Scan	Fixed	180-210 dB	.075-1 MHz (75-1,000 kHz)	Extremely short pulses (0.0021 ms) across 96 frequencies; narrow beam width
Sector Scan Sonar (horizontal)	1	AESOP	Sector Scan Sonar	Fixed	200 dB	50 kHz	30 ms, .5 Hz; narrow beam width
FLIP w/ ADCP	1	AESOP	ADCP (upward)	Fixed	192 dB	170 kHz	6 ms, 1 Hz; narrow beam width - 13° (est.)
ADCP	1	AESOP	ADCP (downward)	Fixed	192 dB	140 kHz	6 ms, 1 Hz; narrow beam width
Lagrangian Floats	3	AESOP	ADCP	Mobile-Floats	192 dB	8-16 kHz	0.05 Hz, 2 sources; narrow beam width
RV *Revelle*	1	AESOP	Float tracking	M, RV *Revelle*	192 dB	8-16 kHz	0.05 Hz ; narrow beam width
Standard Acoustic Communication Systems							
E-Field Sensors	2	AESOP	Acoustic comms w/E-field sensors	Fixed	185 dB	9-14 kHz	
Acoustic Gateway	1	ASAP	Seaweb	Fixed	185 dB	8-14 kHz	1 min every 10 min; omni-directional
Acoustic Gateway	1	ASAP	Seaweb	Fixed	185 dB	8-14 kHz	1 min every 10 min; omni-directional
Bluefin 21 UUV	1	ASAP/UPS	WHOI uModem	Mobile-AUV	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni-directional
Bluefin 21 UUV	1	ASAP/UPS	WHOI uModem	Mobile--AUV	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni-directional
ARIES	1	ASAP/NPS	Seaweb	Mobile-AUV	185 dB	8-14 kHz	8 sec on, 2 min off; 4 kHz b/w; omni-directional
REMUS	1	ASAP/NPS	WHOI uModem	Mobile-AUV	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni-directional

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Table 4-6. (Continued).

Name	No.	Project	Sensor/Acoustics	Mobility/ Platform (M-Mobile; F-Fixed)	Source Level	Frequency Range	Pulse Characteristics
Vector sensor array (horizontal)	1	PLUSNet	uModem	Fixed	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni-directional
Hydrophone array (Kelp, vertical)	1	PLUSNet	uModem	Fixed	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni-directional
Acoustic Gateway	1	PLUSNet	uModem	Fixed	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni-directional
Acoustic Gateway	1	PLUSNet	uModem	Fixed	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni-directional
Acoustic Seaglider	4	PLUSNet	uModem	Mobile-Glider	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni-directional
Slocum Glider	1	PLUSNet	uModem	Mobile-Glider	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni-directional
Liberdade Glider	1	UPS	uModem	Mobile-Glider	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni-directional
Kayaks	4	ASAP/ PLUSNet	uModem	Mobile-USV	185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w; omni-directional
Solar AUV	4	LOCO	Benthos Modem	Mobile-AUV	185 dB	16-21 kHz	0.038 ms; 5 sec per 15 min; 1% duty cycle; omni-directional
MB 06 Sound Sources							
Active Source	1	PLUSNet	Transient (Impulsive)	M, RV TBD	160-165 dB	350-3500 Hz (0.35-3.5 kHz)	2.0 sec; 30 sec on, 60 sec off
Active Source	1	PLUSNet	Standard Active Source J15	M, RV TBD	140 dB (BB) 160 dB (CW)	0.50-1 kHz	30.0 sec; 30 sec on, 60 sec off
Active Source	1	PLUSNet	High Frequency	M, RV TBD	140 dB (BB) 160 dB (CW)	1-30 kHz	30.0 sec; 30 sec on, 60 sec off
Total	***47 audible sources***						

Notes: Pulse characteristics include pulse length, pulse repetition, duty cycle, and beam width.

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- Environmental Assessment for a Demonstration of Autonomous Underwater Vehicle Technology Offshore of Gulfport, Mississippi, also known as AUV Fest (U.S. Department of the Navy, Office of Naval Research, 2001)
- Overseas Environmental Assessment for the Passive Synthetic Aperture Sonar Research Program to be Conducted at Sea, 60 km West of San Diego, California, 7 July – 2 August 2002 (U.S. Department of the Navy, Office of Naval Research, 2002)
- Acoustic Communications and Autonomous Underwater Vehicle Experiments in the Waters Surrounding Woods Hole, Massachusetts (Department of the Navy, Office of Naval Research, 2004)

Other documents with relevance to this assessment include the Draft Overseas Environmental Impact Statement/Environmental Impact Statement prepared for the Undersea Warfare Training Range, U.S. East Coast (Department of the Navy, 2005), and the RIMPAC Draft EIS (Department of the Navy, 2006). While these EISs address impacts associated with the use of acoustic sources and explosives on a range-wide basis over a longer period of time, they also identify and summarize the current state of knowledge regarding acoustic impacts to marine resources and acceptable acoustic exposure level thresholds. A general discussion of sound attenuation in water is now warranted, followed by an analysis of MB 06 sound sources and their impact on marine mammals of the Sanctuary.

Sound, Zones of Influence, and Calculation of Radii

There are several zones or radii around a strong sound source within which various effects on marine mammals could be expected. The zones include the area within which the underwater noise is audible to the marine mammal, the areas with behavioral responses, temporary threshold shift (TTS; both of which are Level B take) or auditory masking, and the zones within which there could be physical injury or mortality (Level A take). Of primary interest to this assessment are potential Level A and Level B takes. Many of the acoustic sources being employed in MB 06 are characterized by a narrow beam width, while other sources are considered omni-directional. A major ramification associated with narrow beam width is that only a small portion of the water column is ensonified (e.g., immediately beneath or above the source).

Radii to a particular distance, or threshold, represent the volumes of ocean in which Level A and B harassment are predicted to occur, or harassment zones. All animals which may occur in a zone are considered "taken" within the applicable harassment category. The Level A harassment zone extends from the source out to the distance and exposure where the slightest amount of injury is predicted to occur, beam width limitations notwithstanding. The acoustic exposure that produces the slightest degree of injury is therefore the threshold value defining the outermost limit of the Level A harassment zone. The Level B harassment zone begins just beyond the point of slightest injury and extends outward from that point. It includes all animals that may potentially experience Level B harassment. Physiological effects extend beyond the range of slightest injury to a point where slight temporary distortion of the most sensitive tissue occurs, but without destruction or loss of that tissue. The animals predicted to be in this zone experience Level B harassment by virtue of temporary impairment of sensory function (i.e., altered physiological function) that can disrupt behavior. Beyond that distance, the Level B harassment zone continues to the point at which no biologically significant behavioral disruption is expected to occur.

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Current acoustic criteria for sound exposure level from intermittent sounds are:

- Level A threshold – onset permanent threshold shift (PTS), or injury: 215 dB re: 1 μPa^2-s;
- Level B threshold – onset temporary threshold shift (TTS), or harassment: 195 dB re: 1 μPa^2-s; and
- Level B threshold – behavioral disruption: 186 dB re: 1 μPa^2-s.

Note: NMFS is currently in the process of developing an EIS and establishing new threshold criteria – developing science-based thresholds, with exposure guidelines derived from empirical data and categorized by species groups (i.e., species groupings by hearing characteristics) and sound type. Currently, both sound pressure level and sound energy (e.g., dB re: 1 μPa^2-sec; energy exposure as a function of time) exposure criteria provide the thresholds for sound exposure for intermittent and continuous noise. ***Threshold criteria applied in this analysis are identical to one of the several alternatives presently being evaluated by NMFS as part of their EIS process.***

Source Levels and Exposure Levels of MB 06 Acoustic Sources

Source levels (in dB re 1µPa at 1 meter) of each acoustic source have been used to calculate the distance to exposure level thresholds, assuming a 1 second pulse duration for the purposes of discussion and to establish a standard frame of reference. In reality, pulse length is typically much shorter (i.e., 45 to 30 ms). The three MB 06 sound sources (i.e., active sources) emit longer pulses at much lower source levels. Under circumstances where a short pulse is produced, exposure level will be dependant upon the repetition rate of the pulse and the proximity of the individual to the sound source, as well as how long the individual stays within the sound field. Beam width is also a major point of consideration, given that many of the standard oceanographic sound sources use a narrow beam, severely restricting the zone of ensonification at each level of concern.

Table 4-7 summarizes each of the MB 06 audible sound sources and provides calculations of a single exposure level and the radial distance to threshold levels under specific assumptions (i.e., an exposure of 1 second).

Analysis of Distance to Thresholds and Potential for Impact

A spherical spreading model (20 log R) has been applied to each source level, regardless of frequency, to predict a conservative distance to the Level A and Level B thresholds from each sound source. While it is recognized that sound attenuation in seawater is affected by frequency of the sound source (i.e., low frequency sounds travel farther than high frequency sounds of the same pressure level), the duty cycle of each piece of equipment and the estimated distances to the thresholds of interest are, generally, so low as to not warrant further analysis in this regard.

For the acoustic sources proposed for MB 06, there is no potential for mortality. While injury is possible, Level A harassment is only potentially associated with two sources: 1) the RV *Point Sur* ADCP (mobile), within 3 m of the source; and 2) RV *Sproul* sub-bottom profiler (mobile), within 2 m of the source. Given that both of these sources are mobile, that shipboard personnel will be conducting operations to avoid marine mammals, and the narrow beam nature of the acoustic pulse, it is extremely unlikely that a marine mammal will be found immediately below the vessel hull within 2-3 m of the sound source. It is also very unlikely that an individual would remain in close proximity to the sound source while the vessel is underway. Therefore, injury (Level A) impacts are not expected.

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Table 4-7. **Summary of MB 06 audible sound sources, single exposure levels and radial distance to threshold levels under specific assumptions. Darkly shaded areas denote sources with potential for injury, harassment, and/or behavioral disruption; lightly shaded areas indicate source levels below thresholds, but with long pulse lengths which increase exposure levels (see text).**

Name	No.	Sensor/Acoustic Communications	Frequency Range	Source Level	Pulse Length (sec)	Single EL (dB re 1 uPa^2-s)	Δ dB relative to 215	Δ dB relative to 195	Δ dB relative to 186	Radius to 215 (m)	Radius to 195 (m)	Radius to 186 (m)
MB 06 Sound Sources												
Active Source	1	Transient (Impulsive)	350-3500 Hz	165	2.0	168.0	-50	-30	-21	0	0	0
Active Source	1	Standard Active Source J15	0.50-1 kHz	160	30.0	174.8	-55	-35	-26	0	0	0
Active Source	1	High Frequency	1-30 kHz	160	30.0	174.8	-55	-35	-26	0	0	0
MB 06 Standard Oceanographic Systems												
Standard Shipboard Oceanographic Systems												
Wecoma	1	KSBP	3.5/12 kHz	185	0.005	162.0	-30	-10	-1	0	0	0
Revelle	1	KSBP	3.5/12 kHz	185	0.005	162.0	-30	-10	-1	0	0	0
Wecoma	1	ADCP	75 kHz	185	0.02	168.0	-30	-10	-1	0	0	0
Wecoma	1	ADCP	150 kHz	175	0.006	152.8	-40	-20	-11	0	0	0
Revelle	1	ADCP	150 kHz	175	0.006	152.8	-40	-20	-11	0	0	0
Revelle	1	ADCP	140 kHz	175	0.004	151.0	-40	-20	-11	0	0	0
Point Sur	1	ADCP	75 or 150 kHz	223.6	0.0246 or 0.0123	207.5 or 204.5	8.6	28.6	37.			
Sproul	1	SBP	3.5/12 kHz	221	0.005 (est.)	162.0 (est.)	6	26	35			
Revelle	1	ADCP	50 kHz	192	0.02	175.0	-23	-3	6	0	0	
Revelle	1	Fish finder	120/212 kHz	185	0.005	162.0	-30	-10	-1	0	0	0
Standard Fixed or Mobile Oceanographic Sensors												
Sector Scan Sonar (horizontal)	1	SSS	50 kHz	200	0.030	184.8	-15	5	14	0	2	
FLIP w/ ADCP	1	ADCP (upward looking)	170 kHz	192	0.006	169.8	-23	-3	6	0	0	
ADCP	1	ADCP (downward looking)	140 kHz	192	0.006	169.8	-23	-3	6	0	0	
Lagrangian Floats	3	ADCP	8-16 kHz	192	0.005	169.0	-23	-3	6	0	0	
RV *Revelle*	1	Float tracking	8-16 kHz	192	0.005 (est.)	169.0 (est.)	-23	-3	6	0	0	
Bubble-Scan	1	Bubble-Scan	.075-1 MHz	210	0.200	0.00002	-5	15	24	0		

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Table 4-7. (Continued).

Name	No.	Sensor/Acoustic Communications	Frequency Range	Source Level	Pulse Length (sec)	Single EL (dB re 1 uPa^2-s)	Δ dB relative to 215	Δ dB relative to 195	Δ dB relative to 186	Radius to 215 (m)	Radius to 195 (m)	Radius to 186 (m)
Standard Acoustic Communications Systems												
E-Field Sensors	2	acoustic comms w/E-field sensors	9-14 kHz	185	8 (est.)	194.0	-30	-10	-1	0	0	0
Acoustic Gateway	1	Seaweb	8-14 kHz	185	60	202.8	-30	-10	-1	0	0	0
Acoustic Gateway	1	Seaweb	8-14 kHz	185	60	202.8	-30	-10	-1	0	0	0
Bluefin 21 UUV	1	WHOI uModem	25 kHz	185	8	194.0	-30	-10	-1	0	0	0
Bluefin 21 UUV	1	WHOI uModem	25 kHz	185	8	194.0	-30	-10	-1	0	0	0
ARIES	1	Seaweb	8-14 kHz	185	8	194.0	-30	-10	-1	0	0	0
REMUS	1	WHOI uModem	25 kHz	185	8	194.0	-30	-10	-1	0	0	0
Vector sensor array (horizontally mounted)	1	uModem	25 kHz	185	8	194.0	-30	-10	-1	0	0	0
Hydrophone array (Kelp, vertically mounted)	1	uModem	25 kHz	185	8	194.0	-30	-10	-1	0	0	0
Acoustic Gateway	1	uModem	25 kHz	185	8	194.0	-30	-10	-1	0	0	0
Acoustic Gateway	1	uModem	25 kHz	185	8	194.0	-30	-10	-1	0	0	0
Acoustic Seaglider	4	uModem	25 kHz	185	8	194.0	-30	-10	-1	0	0	0
Slocum Glider	1	uModem	25 kHz	185	8	194.0	-30	-10	-1	0	0	0
Liberdade Glider	1	uModem	25 kHz	185	8	194.0	-30	-10	-1	0	0	0
Kayaks	4	uModem	25 kHz	185	8	194.0	-30	-10	-1	0	0	0
Solar AUV	4	Benthos Modem	16-21 kHz	185	8 (est.)	194.0	-30	-10	-1	0	0	0

Abbreviations: KSBP – Knudsen sub-bottom profiler; SBP –sub-bottom profiler.

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Only four acoustic sources have the potential to cause temporary threshold shift: 1) the RV *Point Sur* ADCP (mobile), within 27 m of the source; and 2) RV *Sproul* sub-bottom profiler (mobile), within 20 m of the source; 3) the bubble scan (fixed), within 6 m of the source; and 4) the sector scan sonar (fixed), within 2 m of the source. For the bubble scan, output frequency varies between 75 kHz and 1 MHz – i.e., the device also "rolls through" as many as 96 separate frequencies during its transmissions. Further, pulses are extremely short (i.e., 0.003 ms), as is the equipment duty cycle. Given these parameters, it is extremely unlikely that the bubble scan pulses will be heard. For the remaining mobile equipment, individuals would have to be found within the narrow cone below either the *Point Sur* or *Sproul* and within 20-27 m to realize TTS. The radial distance from the remaining fixed source to the TTS threshold is extremely small – 2 m. Individuals would have to encounter the sound source, affixed to the seafloor, during a dive, and remain within this distance of the sound source for a second or more, to realize TTS. For the reasons stated previously, it is extremely unlikely that a marine mammal will be found immediately below the vessel hull or within several meters of the sound source. Therefore, TTS (Level B) impacts are not expected.

Eight acoustic sources have the potential to cause behavioral disruption, including 1) the RV *Point Sur* ADCP (mobile), within 76 m of the source; and 2) the RV *Sproul* sub-bottom profiler (mobile), within 52 m of the source; 3) the sector scan sonar (fixed), within 5 m of the source; and 4) five sources (i.e., ADCPs and float tracking), all mobile, within 2 m of the source. The bubble scan (fixed), while estimated to have the potential to cause behavioral disruption within 16 m of the source, has been removed from further analysis due to the nature of its emissions (i.e., extremely short pulse duration and duty cycle; only limited frequency output within the hearing range of marine mammals). For the eight acoustic sources, individuals would have to be found within the narrow cone adjacent to each source and within the calculated radius to realize behavioral disruption. For mobile sources, marine mammals would have to be positioned beneath the vessel and moving with it to realize behavioral disruption. Radial distances from the fixed sources to the behavioral disruption threshold are also very small. As noted previously for fixed sources (i.e., ADCPs), exposed individuals would have to encounter the sound source, affixed to the seafloor, during a dive, and remain within this distance of the sound source for a second or more, to realize behavioral disruption. For the reasons stated previously, it is extremely unlikely that a marine mammal will be found immediately below the vessel hull or within several meters of the sound source. Behavioral disruption (Level B) impacts are not expected.

Twenty-six of the acoustic sources noted in **Table 4-7** (i.e., denoted as lightly shaded regions) have source levels below the 186 dB threshold. However, long pulse lengths (e.g., 8 seconds) elevate a single exposure from a 185 dB source level to 194 to 202.8 dB re $1\mu Pa^2$-s for a single exposure. For these omni-directional sources, a marine mammal would have to be located immediately adjacent to the sound source and remain in that position for the duration of the pulse to realize exposure levels sufficient to cause either TTS or behavioral disruption. For either mobile or fixed sources, this type of behavior (e.g., during a dive or while at or near the surface) is extremely unlikely.

For sound sources of concern, species capable of hearing the frequencies being emitted are identified in **Table 4-8**. AESOP sources of concern (i.e., single sector scan sonar, FLIP w/ ADCP, and ADCP sources; three Lagrangian float sources), both fixed and mobile, will be occur within OpArea C, in the general vicinity of FLIP. UPS mobile sources of concern will be restricted to OpArea B. The single LOCO source of concern will be restricted to OpArea D.

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Table 4-8. MB 06 audible acoustic sources, respective radii to Level A and Level B threshold levels, and potentially sensitive species (likelihood of presence not noted).

Name	No.	Project	Onset PTS	Onset TTS	Behavioral Disruption	Frequency Range	Sensitive Species
Standard Shipboard Oceanographic Systems							
RV *Point Sur* ADCP	1	UPS	3 m, narrow beam	27 m, narrow beam	70 m, narrow beam	75 or 150 kHz	4 marine mammal species/species groups: Pygmy sperm whale, beaked whales, bottlenose dolphin, harbor seal; 0 sea turtle species: source above audible range
RV *Sproul* Sub Bottom Profiler	1	UPS	2 m	20 m	56 m	3.5/12 kHz	20 species/species groups: Fin, blue (?), sei, humpback, minke, Bryde's, Pacific right, sperm, beaked whales, killer whale, short-finned pilot, bottlenose dolphin, Risso's dolphin, Pacific white-sided dolphin, Northern right whale dolphin, Dall's porpoise, harbor porpoise, harbor seal, California sea lion, sea otter; 0 sea turtle species: source above audible range
RV *Revelle* ADCP	1	AESOP	Not possible	Not possible	2 m, narrow beam	50 kHz	4 marine mammal species/species groups: Pygmy sperm whale, beaked whales, bottlenose dolphin, harbor seal; 0 sea turtle species: source above audible range
Standard Fixed or Mobile Oceanographic Sensors							
Sector Scan Sonar	1	AESOP	Not possible	2 m, narrow beam	5 m, narrow beam	50 kHz	4 marine mammal species/species groups: Pygmy sperm whale, beaked whales, bottlenose dolphin, harbor seal 0 sea turtle species: source above audible range
FLIP w/ ADCP	1	AESOP	Not possible	Not possible	2 m, narrow beam	170 kHz	4 marine mammal species/species groups: Pygmy sperm whale, beaked whales, bottlenose dolphin, harbor seal 0 sea turtle species: source above audible range
ADCP	1	AESOP	Not possible	Not possible	2 m, narrow beam	140 kHz	3 marine mammal species/species groups: Pygmy sperm whale, bottlenose dolphin, harbor seal; 0 sea turtle species: source above audible range
Lagrangian Floats	3	AESOP	Not possible	Not possible	2 m, narrow beam	8-16 kHz	20 species/species groups: Fin, blue (?), sei, humpback, minke, Bryde's, Pacific right, sperm, beaked whales, killer whale, short-finned pilot, bottlenose dolphin, Risso's dolphin, Pacific white-sided dolphin, Northern right whale dolphin, Dall's porpoise, harbor porpoise, harbor seal, California sea lion, sea otter 0 sea turtle species: source above audible range
RV *Revelle*	1	AESOP	Not possible	Not possible	2 m, narrow beam	8-16 kHz	20 species/species groups: Fin, blue (?), sei, humpback, minke, Bryde's, Pacific right, sperm, beaked whales, killer whale, short-finned pilot, bottlenose dolphin, Risso's dolphin, Pacific white-sided dolphin, Northern right whale dolphin, Dall's porpoise, harbor porpoise, harbor seal, California sea lion, sea otter 0 sea turtle species: source above audible range

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Table B-1. Summary of all MB 06 acoustic sources, sorted by dB source level, and compared to marine mammal vocalizations and perceived hearing capabilities.

Source Level (dB re 1 µPa @ 1 m)	Frequency	Pulse Characteristics	Name	MarMam - Audible or Not Audible	Not Audible	Audible
223.6 dB	300 kHz	20 kHz BW 6 ms, .5 sec	RV *Sproul* narrowband ADCP	Not Audible	1	
223.6 dB	75 or 150 kHz	5 kHz BW, 24.6 ms, 2 sec or 10 kHz BW, 12.3 ms, 1sec	RV *Point Sur* ADCP	Audible		1
223.6 dB	300 kHz	20 kHz BW, 6ms, .5 sec	RV *Point Sur* ADCP	Not Audible	1	
215-221 dB	3.5/12 kHz	5 ms estimated	RV *Sproul* SBP	Audible		1
219.5 dB	600 kHz	670 ms	ADCP	Not Audible	3	
219.5 dB	1,000 kHz	670 ms	ADCP	Not Audible	1	
219.5 dB	600 kHz	670 ms	RV *Sheila B* ADCP	Not Audible	1	
216 dB	600 kHz	2 Hz	ARIES	Not Audible	1	
215 dB	1.5-3 MHz	715 ms	WHAPS	Not Audible	1	
210 dB	700 kHz	500 ms	Seabed Bubble Detector	Not Audible	1	
205-215 dB	265 kHz - 3 MHz	336 ms	TAPS-6	Not Audible	3	
180-210 dB	.075-1 MHz	200 ms	Bubble-Scan	Audible		1
200 dB	50 kHz	30 ms, .5 Hz	Sector Scan Sonar (horizontal)	Audible		1
192 dB	170 kHz	6 ms, 1Hz	FLIP ADCP (up)	Audible		1
192 dB	140 kHz	6 ms, 1Hz	FLIP ADCP (down)	Audible		1
192 dB	8--16 kHz	0.05 Hz, 2 sources	Lagrangian floats	Audible		3
192 dB	50 kHz	20 ms, .5 Hz	RV *Revelle* ADCP	Audible		1
192 dB	8-16 kHz	0.05 Hz	RV *Revelle* Float tracking	Audible		1
190 dB	900 kHz	2 Hz	REMUS	Not Audible	1	
190 dB	900 kHz	2 Hz	REMUS	Not Audible	1	
185 dB	300 kHz	6 ms, 0.5 Hz, 4 beams each 4 degrees	RV *Revelle* ADCP	Not Audible	1	
185 dB	120/212 kHz	5 ms, 1 Hz, 16 degrees	RV *Revelle* Fish finder	Audible		1
185 dB	9-14kHz	N/A	E-Field Sensors	Audible		2
185 dB	300 kHz	1 ping/sec	ADCP	Not Audible	1	
185 dB	300 kHz	1 ping/sec	ADCP	Not Audible	1	
185 dB	8-14 kHz	1 min every 10 min	Acoustic Gateway	Audible		1
185 dB	8-14 kHz	1 min every 10 min	Acoustic Gateway	Audible		1
185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w	Bluefin 21 UUV	Audible		1
185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w	Bluefin 21 UUV	Audible		1
185 dB	8-14 kHz	8 sec on, 2 min off; 4 kHz b/w	ARIES Seaweb	Audible		1
185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w	REMUS WHOI Modem	Audible		1
185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w	Vector sensor array (horizontally mounted) uModem	Audible		1
185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w	Hydrophone array (Kelp, vertically mounted) uModem	Audible		1
185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w	Acoustic Gateway uModem	Audible		1
185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w	Acoustic Gateway uModem	Audible		1
185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w	Acoustic Seaglider uModem	Audible		4
185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w	Slocum Glider uModem	Audible		1
185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w	Liberdade Glider uModem	Audible		1

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Table B-1. Summary of all MB 06 acoustic sources, sorted by dB source level, and compared to marine mammal vocalizations and perceived hearing capabilities (Continued).

Source Level (dB re 1 µPa @ 1 m)	Frequency	Pulse Characteristics	Name	MarMam - Audible or Not Audible	Not Audible	Audible
185 dB	25 kHz	8 sec on, 2 min off; 4 kHz b/w	Kayaks	Audible		4
185 dB	16-21 kHz	0.038 ms; 5 sec per 15 min; 1% duty cycle; omni-directional	Solar AUV	Audible		4
185 dB	3.5/12 kHz	5 ms, 1 Hz	RV *Wecoma* SB profiler	Audible		1
185 dB	3.5/12 kHz	5 ms, 1 Hz	RV *Revelle* SB profiler	Audible		1
180 dB	75 kHz	20 ms, 1 Hz	RV *Wecoma* ADCP	Audible		1
175 dB	150 kHz	6 ms, 1 Hz	RV *Wecoma* ADCP	Audible		1
175 dB	150 kHz	6 ms, 1 Hz	RV *Revelle* ADCP	Audible		1
175 dB	140 kHz	4 ms, .5 Hz	RV *Revelle* ADCP	Audible		1
172 dB	750 kHz	Normal ops - 5 ms pings. 50% of time quiet. 50% of time 24 pings/ min	Spray Glider	Not Audible	4	
160-165 dB	350-3500 Hz	2 sec on, 30 sec off	Transient (Impulsive)	Audible		1
140 dB (BB) 160 dB (CW)	0.50 -- 1 kHz	30 sec on, 60 sec off	Standard Active Source J15	Audible		1
140 dB (BB) 160 dB (CW)	1 - 30 kHz	30 sec on, 60 sec off	High Frequency	Audible		1
N/A	1 MHz	N/A	Slocum Glider	Not Audible	2	
N/A	600 kHz	N/A	RV *Thompson* ADCP	Not Audible	1	
N/A	1 MHz	N/A	RV *Thompson* ADCP	Not Audible	1	
					26	*47*
				TOTAL	*73*	

Notes:

- Data for the 3.5 and 12 kHz ADCPs was provided for a 16-element, 4x4 array, with peak output of 215-221 dB re 1uPa. Single ADCP use, as proposed in MB 06, suggests an estimated source level of 185 dB re 1 µPa.
- ADCPs and sub-bottom profilers are narrow beam (e.g., 13-16° beam width); most communication devices (e.g., uModems) are omin-directional.

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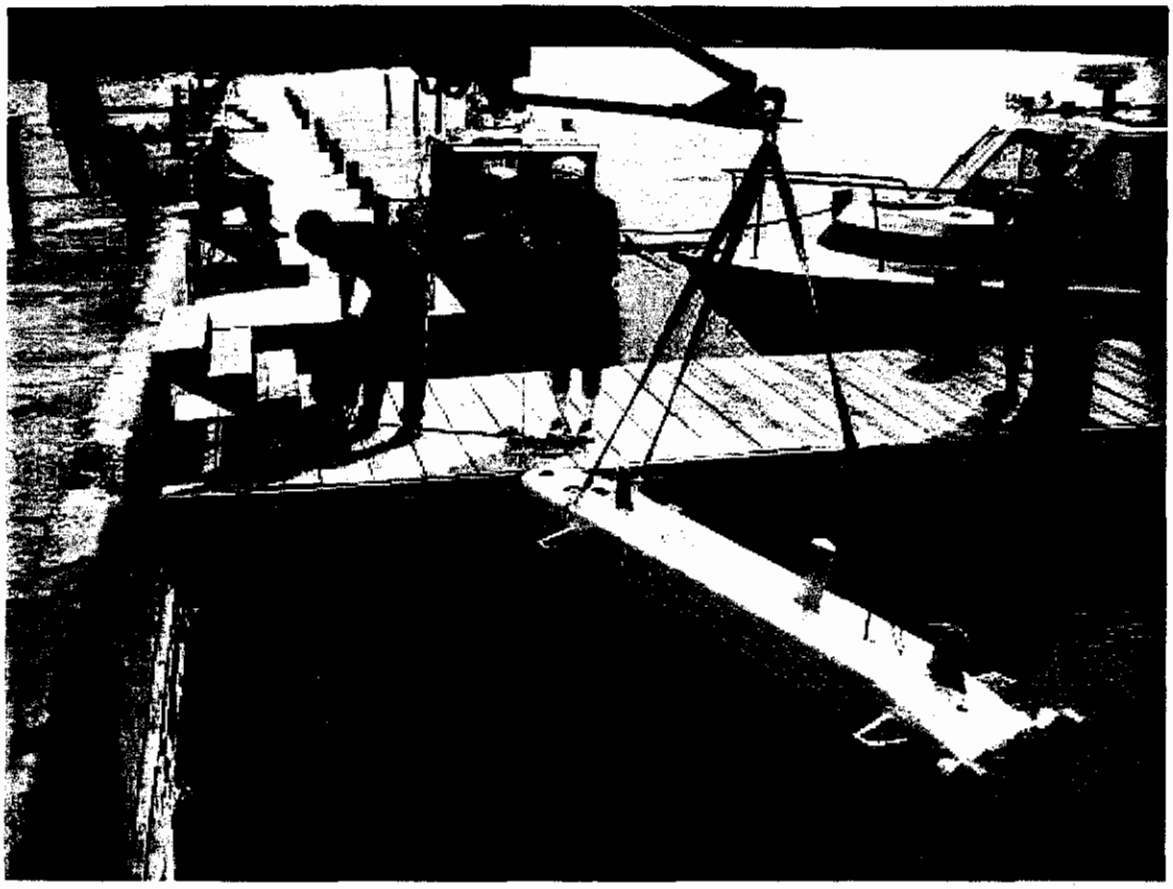
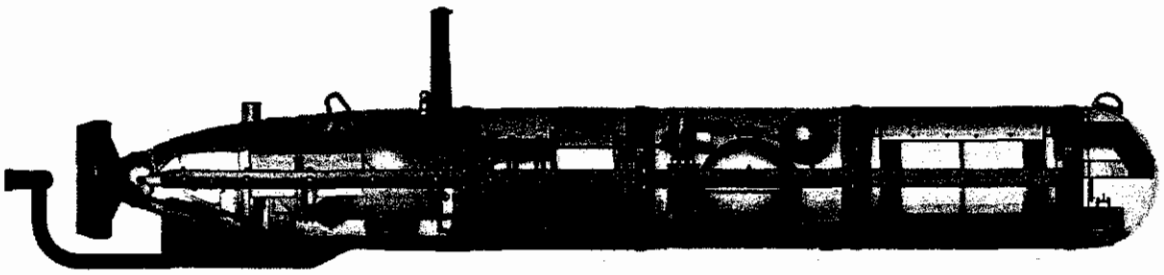
APPENDIX C. DATA SHEETS



NAME (abbreviation)	ARIES
PROGRAM(S).	ASAP (NPS)
FUNCTION.	Provide a mobile Acoustic/RF gateway.
OPAREA	Area A.
OPERATIONAL DATES	24 Jul-30 Aug
L & R PLATFORM	RV CYPRESS SEA

APPENDIX C. DATA SHEETS



NAME (abbreviation)	Bluefin 21 Autonomous Undersea Vehicle
PROGRAM(S).	PLUSNet (Bluefin Robotics, Inc.)
FUNCTION.	Two Bluefin 21 vehicles will be employed – launched and recovered each day during MB 06. The version shown will attempt to tow a hydrophone array. Another version will make use of a high-frequency passive nose array that protrudes from a more tapered forward conical head.
OPAREA	Area B.
OPERATIONAL DATES	16-25 Aug
L & R PLATFORM	RV NEW HORIZON

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APPENDIX C. DATA SHEETS

NAME (abbreviation)	Spray Glider
PROGRAM(S).	ASAP (SIO)
FUNCTION.	Oceanographic data collection. Collect and transmit CTD, Optical data, Acoustic Doppler Current Profiler data and receive commands via RF gateway.
OPAREA	Area A. Within 20 miles of the coast between Santa Cruz and Pigeon Point
OPERATIONAL DATES	19 Jul-15 Sep
L & R PLATFORM	Zodiac, RV SHANA RAE

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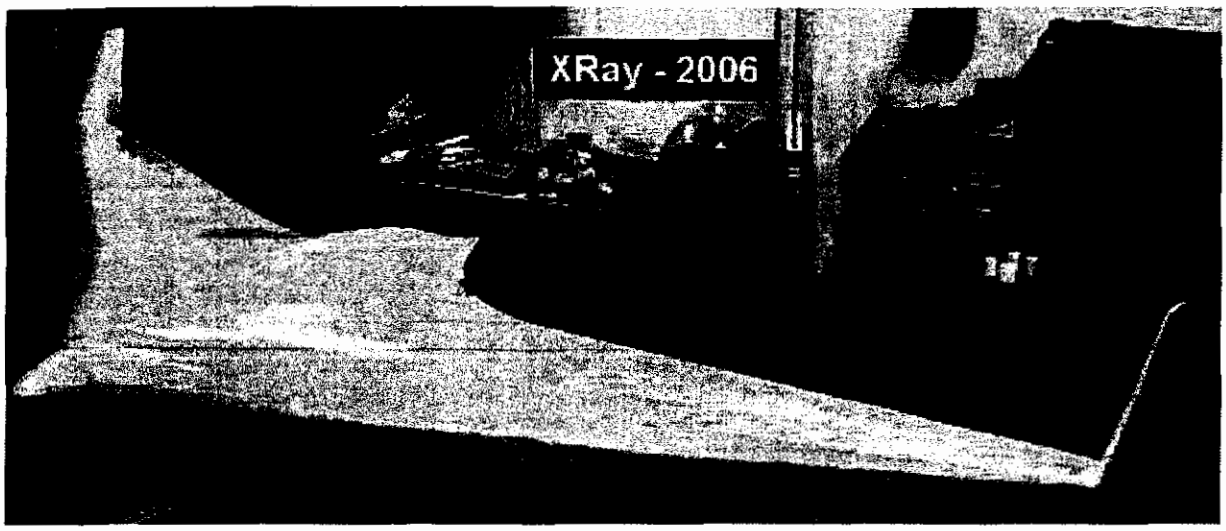
APPENDIX C. DATA SHEETS



NAME (abbreviation)	Liberdade/X-Ray flying wing glider
PROGRAM(S).	UPS (MPL/SIO), PLUSNet (MPL/SIO, APL/UW)
FUNCTION.	Acoustic and oceanographic data collection. Collect and transmit acoustic communications via Acoustic/RF gateway.
OPAREA	Area D.
OPERATIONAL DATES	10-29 Aug
L & R PLATFORM	RV SPROUL

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APPENDIX C. DATA SHEETS

NAME (abbreviation)	Expendable Current Profiler (XCP)
PROGRAM(S).	AESOP
FUNCTION.	Oceanographic data collection. Measures profile of water temperature and velocity and transmits data via wire link to surface buoy and RF link to receiver on surface vessel.
OPAREA	5 km by 5 km survey near FLIP over continental slope (700–2000 m water depth)
OPERATIONAL DATES	12-18 Aug 2006 (in two 12-hour surveys)
L & R PLATFORM	RV PT SUR

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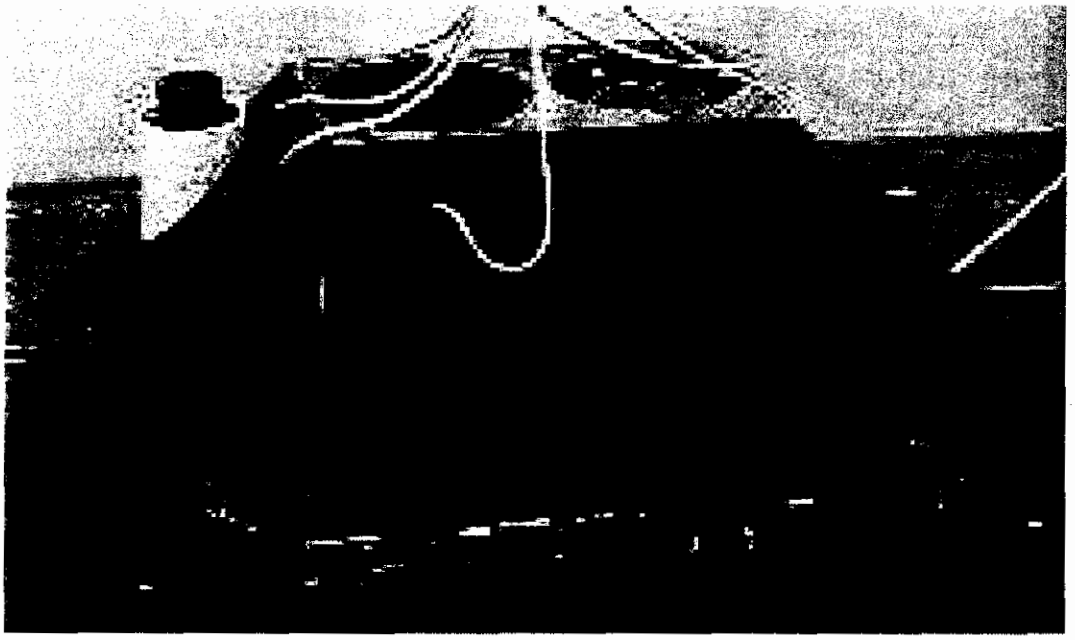
APPENDIX C. DATA SHEETS



NAME (abbreviation)	Acoustic Doppler Current Profiler (ADCP). Bottom-mounted ADCP in trawl-resistant bottom mount with acoustic modem
PROGRAM(S).	ASAP (NPS)
FUNCTION.	Observe vertical profiles of horizontal ocean currents and transmit data to land in real time via acoustic/RF link
OPAREA	Area A. vicinity of 36.92° N, 122.12° W (60 m) and 36.90° N, 122.19° W (100 m)
OPERATIONAL DATES	17 July to 31 August
L & R PLATFORM	RV POINT SUR

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APPENDIX C. DATA SHEETS

NAME (abbreviation)	Acoustic Gateway
PROGRAM(S).	LOCO
FUNCTION.	Allow human operator communications with SAUV vehicles through transparent Freewave RF – Benthos acoustic modem connection. Graphic shows 2 units.
OPAREA	Area D
OPERATIONAL DATES	10 July – 19 July
L & R PLATFORM	RV SHANA RAE

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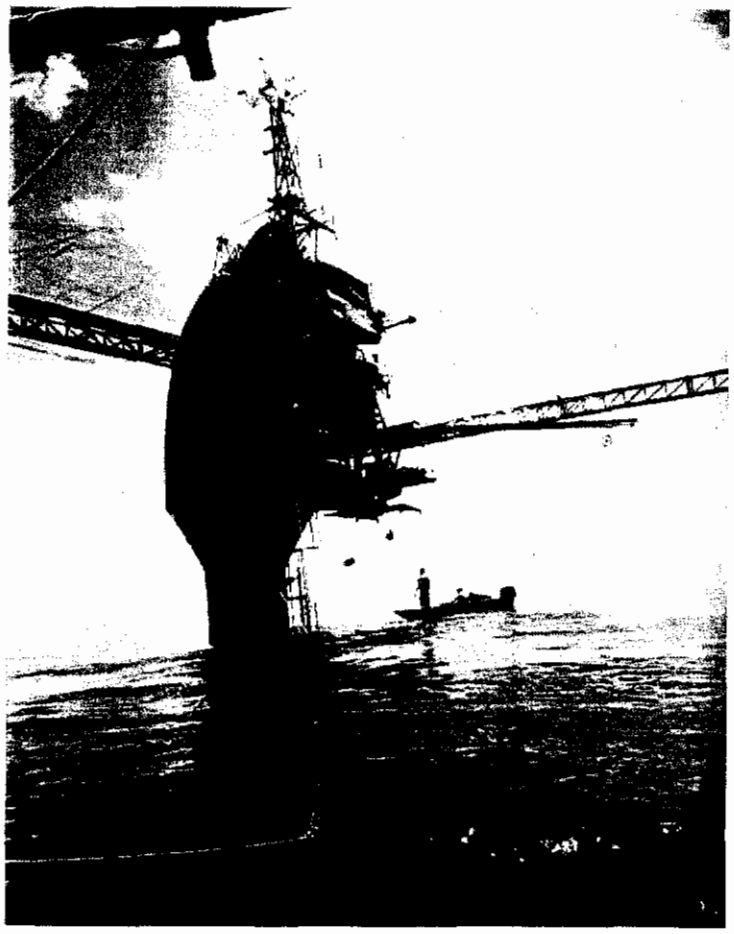
APPENDIX C. DATA SHEETS



NAME (abbreviation)	Research Platform (RP) FLIP w/FAST CTD & Deep-8 Doppler Sonar
PROGRAM(S).	AESOP
FUNCTION.	Oceanographic and acoustic data collection. Collect and transmit CTD and acoustic data and receive commands via an electro-optical sea cable.
OPAREA	36.44° N 122.16° W
OPERATIONAL DATES	11 Aug-5 Sep 2006
L & R	Navy Tug

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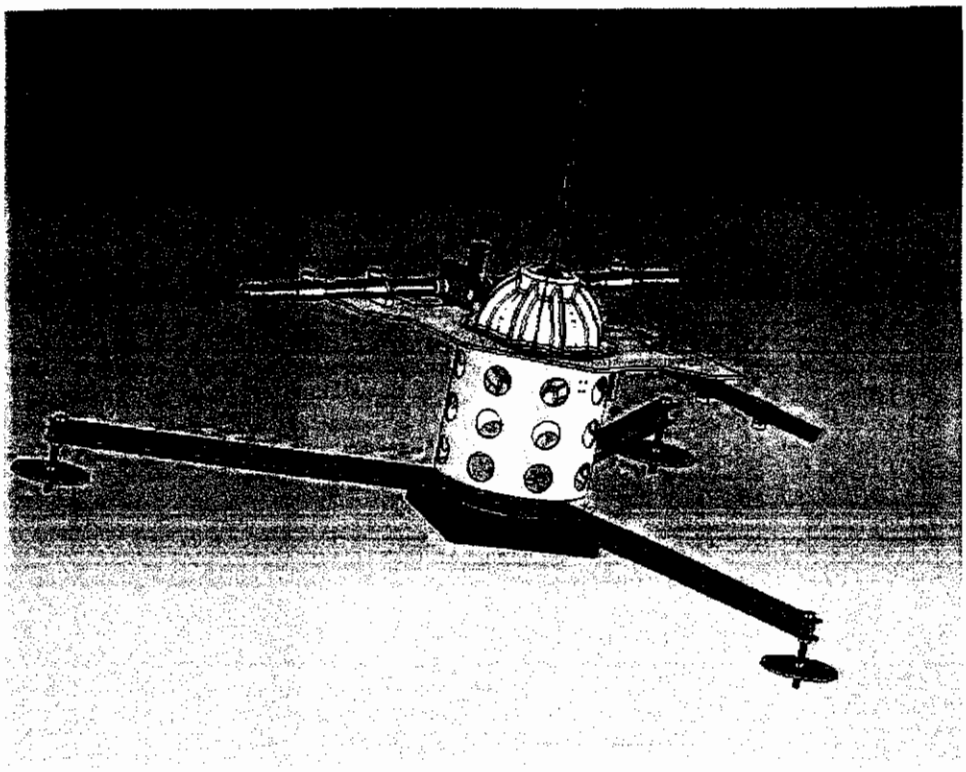
APPENDIX C. DATA SHEETS



NAME (abbreviation)	Horizontal Electrometer and Inverted Echo sounder (HPIES)
PROGRAM(S).	AESOP
FUNCTION.	Measures average water velocity and average temperature, in the water column above the bottom-mounted instrument and bottom pressure.
OPAREA	Area D. 36.44° N 122.16° W under footprint of FLIP
OPERATIONAL DATES	9 Aug – 17 Oct
L & R PLATFORM	RV PT SUR will deploy two HPIES

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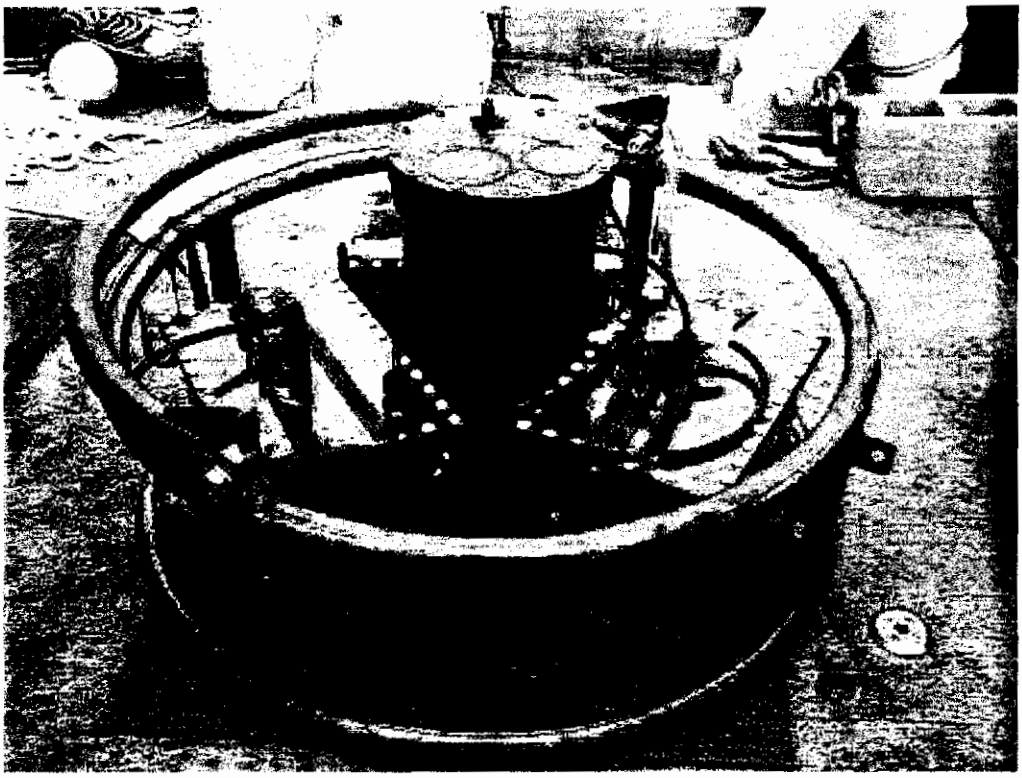
APPENDIX C. DATA SHEETS



NAME (abbreviation):	Instrument "Cluster" BubbleScan
PROGRAM:	Layered Organization in the Coastal Ocean (LOCO)
FUNCTION:	Acoustically detects vertical bubble distributions / size spectra (due to photosynthesis or in fish) and information re the local *in situ* environment. Data are transmitted to shore, and commands are received via RF telemetry to an antenna on a spar buoy (not shown). Part of one configuration of an LOCO "instrument cluster".
OPAREA:	Area D. Vicinity of 36.93° N, 121.93° W
OPERATIONAL DATES:	Initial deployment July 10-11; multiple recoveries & redeployments for maintenance at intervals dictated by rate of data acquisition (adapted to the *in situ* environment); Final retrieval July 29-31.
L & R PLATFORM:	RV SHANA RAE; Alternate: RV SHEILA B

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