Pinniped Monitoring during Missile Launches on San Nicolas Island, California, September 2012 - September 2013

Naval Air Warfare Center Weapons Division
Point Mugu, California

For Submittal To

National Marine Fisheries Service
Silver Spring, Maryland, and Long Beach, California

30 September 2013

Pinniped Monitoring during Missile Launches on San Nicolas Island, California, September 2012 - September 2013

by

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Suggested format for citation:

Ugoretz, J. 2013. Pinniped Monitoring During Missile Launches on San Nicolas Island, California, September 2012 - September 2013. Naval Air Warfare Center Weapons Division, Point Mugu, CA. 65 p.

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ACRONYMS AND ABBREVIATIONS

3-D	3-dimensional
APIM	Active Protection Interceptor Munition
ASL	above sea level
ATAR	Autonomous Terrestrial Acoustic Recorder
B807	Building 807
CFR	Code of Federal Regulations
cm	centimeter
CPA	Closest Point of Approach
F	Fahrenheit
FES	Front End Subsystem
FOV	field of view
ft	feet
hr	hour
IHA	Incidental Harassment Authorization
in	inches
kg	kilogram
km	kilometer (1 km = 3281 ft, 0.62 mi, or 0.54 n.mi)
kts	knots or nautical miles per hour
lb	pounds
LOA	Letter of Authorization
m	meter
mi	mile
min	minute
mm	millimeter
MMPA	Marine Mammal Protection Act
NAWCWD	Naval Air Warfare Center Weapons Division
nm	nautical miles
NMFS	National Marine Fisheries Service
PTS	Permanent Threshold Shift
s	second
SNI	San Nicolas Island
TTS	Temporary Threshold Shift

EXECUTIVE SUMMARY

The Naval Air Warfare Center Weapons Division (NAWCWD) holds a Letter of Authorization (LOA) issued by the National Marine Fisheries Service (NMFS) on 24 October 2012 allowing non-lethal takes of pinnipeds incidental to the Navy's missile launch operations on San Nicolas Island (SNI), California, from 1 December 2012 through 30 November 2013. The LOA was issued pursuant to 50 Code of Federal Regulations (CFR) 216.151–158 and §101(a)(5)(A) of the Marine Mammal Protection Act (MMPA), 16 United States Code (USC) §1371(a)(5)(A). Those regulations were initially issued for the period 2 October 2003 through 2 October 2008 and were reissued for the period 2 June 2009 through 2 June 2014. The regulations and associated LOAs allow for the 'take by harassment' of small numbers of northern elephant seals (*Mirounga angustirostris*), Pacific harbor seals (*Phoca vitulina*), and California sea lions (*Zalophus californianus*) during routine launches on Navy-owned SNI.

In the Navy's Petition for Regulations that led to promulgation of 50 CFR 216.151–158, a Monitoring Plan was proposed. This plan included provisions to monitor any effects of missile launch activities on pinnipeds hauled out at SNI in a manner similar to the preliminary monitoring that took place during 2001–2008. Pinniped species monitored on SNI during that period included the Pacific harbor seal, northern elephant seal, and California sea lion. In June 2010, a revised Monitoring Plan was submitted to NMFS that proposed the discontinuation of directed monitoring for northern elephant seals, as this species had shown little or no reaction to most missile launches. NMFS accepted this proposed change to the Monitoring Plan (NMFS 2010) and issued the new LOA to acknowledge the change. Thus, no elephant seal responses are discussed in this report.

Missiles Launched – September 2012 to September 2013

As required by the LOA, this report describes the results of the visual and acoustic monitoring program for missile launches from SNI during the September 2012 to September 2013 time period. It includes results from eight missile launch events on seven separate days. All launches occurred in daytime hours between February and August, 2013 with two launches on one day separated by 5 hours. Missiles launched included the GQM 163A "coyote" (GQM) and the Active Protection Interceptor Munition (APIM).

The launch azimuths caused the missiles to cross the SNI shoreline on the island's western end and pass over or near various pinniped haul-outs. Monitoring sites were established at beaches occupied by pinnipeds and Autonomous Terrestrial Acoustic Recorders (ATARs) and video systems were deployed. Audio recordings were obtained to document launch sounds at several distances from the launch trajectories of the missiles. The video and visual monitoring provided data on the behavioral reactions of pinnipeds hauled out during launches.

Pinniped Behavior during Missile Launches

Behavior of pinnipeds (California sea lions and Pacific harbor seals) hauled out on SNI beaches during missile launches was monitored by unattended video cameras which were set up before each launch. The video data were supplemented by direct visual scans of the haul-out groups several hours prior to the launches and following the launches. Monitoring was attempted at up to three sites during each launch, with launch-to-launch variation in the locations monitored and number of locations depending upon presence of hauled out pinnipeds. For each launch, the number, proportion, and (where determinable) maturity of the individual pinnipeds that responded in various ways were tabulated from the video, along with comparable data for those that did not respond overtly. No evidence of injury,

mortality, pup abandonment, or other significant impact beyond movement was observed during or immediately succeeding any launches for the monitored pinniped species.

Estimated Numbers of Pinnipeds Affected

Approximately 405 California sea lions, 95 Pacific harbor seals, and no northern elephant seals were estimated to have been affected during the monitoring period. These figures are approximate and may over- or underestimate pinnipeds affected because they; (a) include extrapolations for pinnipeds on beaches that were not monitored on any given launch day, (b) very likely count some of the same individuals more than once in the same monitoring period, and (c) also may exclude pinnipeds on some beaches that were not monitored. The pinnipeds included in these estimates either left the haul-out site in response to the launch, or exhibited prolonged movement or behavioral changes relative to their behavior immediately prior to the launch.

The results from the 2012–2013 monitoring period (and those from previous monitoring periods) suggest that any effects of the launch operations were minor, short-term, and localized, at least for northern elephant seals and California sea lions. Some Pacific harbor seals may have left their haul-out site until the following low tide, but numbers occupying haul-out sites shortly after a launch or the next day, were generally similar to pre-launch levels. It is not likely that any of the pinnipeds on SNI were adversely impacted by such behavioral reactions. While audio recordings of launch sounds were taken during this monitoring period, due to contracting delays caused by the Federal Sequestration analyzed data on the sound levels recorded are not yet available. Based on prior data analysis and reactions of pinnipeds during this period, it is not expected that any pinnipeds were exposed to sound levels that could lead to permanent threshold shift (PTS). In the unlikely event that any pinnipeds did incur temporary TTS during launches at SNI, this would have presumably been mild and recoverable. Audio data from this monitoring period will be analyzed and included in the Draft Comprehensive Technical Report due to NMFS 2 December 2013.

1. MONITORING PROGRAM AND MISSILE LAUNCHES DESCRIBED

1.1 Monitoring Program

San Nicolas Island (SNI) is located approximately 65 miles (m) (~100 kilometers (km)) from the mainland coast of southern California (Fig. 1.1). Missiles are launched from one of two land-based launch complexes on the western part of SNI: Building 807 Launch Complex (B807) is located on the west coast of SNI, approximately 35 feet (11 meters (m)) above sea level (ASL), and the Alpha Launch Complex is located approximately 625 feet (190.5 m) ASL on the west-central part of SNI (Fig. 1.2). The missiles pass over or near pinniped haul-out sites located around the periphery of SNI. The pinniped species that commonly occur on SNI include northern elephant seals (*Mirounga angustirostris*), Pacific harbor seals (*Phoca vitulina*), and California sea lions (*Zalophus californianus*).

The Naval Air Warfare Center Weapons Division (NAWCWD) holds a Letter of Authorization (LOA) issued by the National Marine Fisheries Service (NMFS) on 24 October 2012 allowing non-lethal takes of pinnipeds incidental to the Navy's missile launch operations on San Nicolas Island (SNI), California, from 1 December 2012 through 30 November 2013. The LOA was issued pursuant to 50 Code of Federal Regulations (CFR) 216.151–158 and §101(a)(5)(A) of the Marine Mammal Protection Act (MMPA), 16 United States Code (USC) §1371(a)(5)(A). Those regulations were initially issued for the period 2 October 2003 through 2 October 2008 and were reissued for the period 2 June 2009 through 2 June 2014. The regulations and associated LOAs allow for the 'take by harassment' of small numbers of northern elephant seals, Pacific harbor seals, and California sea lions during routine launches on Navy-owned SNI.

Previously, separate LOAs were issued for this purpose for the periods October 2003 to October 2004, October 2004 to October 2005, February 2006 to February 2007, February 2007 to February 2008, February to October 2008, June 2009 to June 2010, June 2010 to June 2011 (later superseded by a December 2010 to November 2011 LOA) and December 2011 to December 2012. No launches took place during the February to October 2008 LOA period or during two intervals between expiration of one LOA and issuance of another (8 October 2005 to 2 February 2006 and 3 October 2008 through 3 June 2009).

A Monitoring Plan was proposed in the Petition for Regulations under which the first LOA was issued. The purpose of the monitoring was to characterize any effects of missile launch activities on Pacific harbor seals, northern elephant seals, and California sea lions hauled out at SNI. In June 2010, a revised Monitoring Plan was submitted to NMFS that proposed the discontinuation of monitoring for northern elephant seals, as this species had shown little reaction to most missile launches at SNI. NMFS accepted this proposed change to the Monitoring Plan (NMFS 2010); thus, elephant seals were not targeted for monitoring during the current report period, but occurred in the field of view (FOV) of some cameras monitoring other species.

The monitoring plan requires that, for each missile launched from SNI, simultaneous autonomous audio recording of launch sounds and video recording of sea lion and harbor seal behavior will occur. Generally monitoring will occur at three sites during each launch, dependent upon the presence of pinnipeds in various locations. The land-based monitoring provides data required to characterize the extent and nature of "taking". In particular, it provides the information needed to document the nature, frequency, occurrence, and duration of any changes in sea lion and harbor seal behavior resulting from missile launches, including the occurrence of stampedes (if any). These video and audio records are used to further document sea lion and harbor seal responses to the launches. This includes the following components:

- Identify and document any change in behavior or movement that may occur at the time of the launch;
- Compare pre- and post-launch behavioral data on each launch day to quantify the interval required for pinniped numbers and behavior to return to normal[1] if there is a change as a result of launch activities;
- Compare received levels of launch sound with pinniped responses, based on acoustic and behavioral data from up to three monitoring sites at different distances from the launch site and flightline during each launch; from the data accumulated across a series of previous and future launches, establish the "dose-response" relationship[2] for launch sounds under different launch conditions;
- Ascertain periods or launch conditions when pinnipeds are most and least responsive to launch activities, and
- Document take by harassment and, although unlikely, any mortality or injury.

This report describes the results of the visual monitoring program during the period between September 2012 and September 2013. During that period, eight missile launch events occurred on seven separate days. All launches occurred in daytime hours between February and August, 2013 with two launches on one day separated by 5 hours. Missiles launched included the GQM 163A "coyote" (GQM) on 27 February, 3 April, 10 and 12 May (2 launches) and 12 June and the Active Protection Interceptor Munition (APIM) on 7 and 8 August.

This report describes the missiles and their launch processes, the associated monitoring program, and the monitoring program results. The report includes four chapters: (1) background, introduction, and description of the Navy's missile launches [this chapter]; (2) acoustical monitoring during the missile launches [Chapter 2]; (3) visual monitoring of pinnipeds during those launches [Chapter 3]; and (4) estimated numbers of pinnipeds affected by the missile sounds during these launches [Chapter 4].

1.1.1 Acoustical Monitoring of Missile Launches

Audio recordings were attempted to document launch sounds at several distances from the launch trajectories of the missiles (See Chapter 2 for details). Audio recorders were placed near video cameras and documenting pinniped reactions, thus obtaining paired acoustic and pinniped-response data. In addition to recording launch sounds, these audio recordings also documented the ambient noise levels to which the pinnipeds were exposed prior to and following launches. Objectives of the audio monitoring program included:

1. Documenting the levels and characteristics of launch sounds at several distances from the azimuths of the missiles;
2. Documenting the levels and characteristics of ambient sounds at the same locations as for the launch sounds, as a measure of the background noise against which the pinnipeds will (or will not) detect the launch sounds; and
3. Determining whether the sound levels from missile overflights were high enough to have the potential to induce Temporary Threshold Shift (TTS) in pinnipeds exposed to launch sounds.

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[1] If numbers and/or behavior have not returned to "normal" within the duration of the autonomous recording, the duration of the period with reduced numbers will be reported as "greater than *x* minutes".

[2] This is equivalent to estimating behavioral zones of influence by comparing pinnipeds' reactions to varying received levels of launch sounds.

While audio recordings of launch sounds were taken during this monitoring period, due to contracting delays caused by the Federal Sequestration analyzed data on the sound levels recorded are not yet available. Information on the recording locations is included in Chapter 2 and audio data from this monitoring period will be analyzed and included in the Draft Comprehensive Technical Report due to NMFS on 2 December 2013.

1.1.2 Visual Monitoring of Pinnipeds during Missile Launches

Video and visual monitoring provide data on focal groups of pinnipeds hauled out on SNI during launches (See Chapter 2 for details). The accumulation of such data across numerous launches helps provide data required to characterize the extent and nature of disturbance effects. In particular, it provides the information needed to document the nature, frequency, occurrence, and duration of any changes in pinniped behavior resulting from the missile launches, including the occurrence of stampedes from haul-out sites if they occur. A detailed description of the methods for the visual monitoring can be found in Section 3.2 of Chapter 3.

The video records were to be used to document pinniped responses to the launches. The objectives included the following:

1. Identify and document any change in behavior or movements that occurred at the time of the launch;
2. Quantify the interval required for pinniped numbers and behavior to return to normal if there was a change as a result of launch activities;
3. Compare received levels of launch sound with pinniped responses, based on acoustic and behavioral data from monitoring sites at different distances from the launch site and flightline during each launch; from the data accumulated across a series of launches, establish the "dose-response" relationship[3] for missile sounds under different launch conditions[4];
4. Ascertain periods or launch conditions when pinnipeds are most and least responsive to launch activities[4], and
5. Document numbers of pinnipeds affected by missile launches and, although unlikely, any mortality or injury.

1.2 Estimating Numbers of Pinnipeds Affected

The monitoring program for the missile launches on SNI was designed, in part, to provide the data needed to estimate the numbers of pinnipeds affected by the launches and the manner in which they were affected. Pinnipeds are assumed to be 'taken by harassment' if there is a reason to believe that auditory impairment (TTS) might have occurred as a result of a launch, or if biologically significant behavioral patterns of pinnipeds are disrupted. NMFS (2000) defined a biologically significant behavioral response as one "…that affects biologically important behavior[s], such as survival, breeding, feeding and migration, which have the potential to affect the reproductive success of the animal". As a corollary of

[3] This is equivalent to estimating behavioral zones of influence by comparing pinnipeds' reactions to varying received levels of launch sounds.

[4] Determination of the dose-response relationship (objective 3, above) and conditions when pinnipeds were most or least responsive to launch sounds (objective 4) requires consideration of additional data, including data from the previous years of monitoring (Holst et al. 2008) and data from planned future monitoring. Therefore, objectives (3) and (4) are not addressed in the present report. However, an analysis using data from all previous monitoring years can be found in Holst et al. (2008).

that, NMFS (2002) stated that "…one or more pinnipeds blinking its eyes, lifting or turning its head, or moving a few feet along the beach as a result of a human activity are not considered a 'take' under the MMPA definition of harassment".

In this report, consistent with previous related reports, it is assumed that only those animals that met the following criteria would be counted as affected by launches:

1. Pinnipeds that were injured or killed during launches, if any (e.g., by stampedes);
2. Pinnipeds exposed to launch sounds strong enough to cause permanent or temporary auditory impairment (permanent threshold shift [PTS] or TTS);
3. Pinnipeds that left the haul-out site, or exhibited prolonged movement or behavioral changes (such as pups separated from mothers) relative to their behavior immediately prior to the launch.

In practice, no pinnipeds are known to have been injured or killed during launches monitored since August 2001, and few are believed to have received sounds strong enough to elicit TTS (Holst et al. 2011). Thus, the number of pinnipeds counted as potentially affected during the current monitoring period was primarily based on criterion 3 above - the number that left the haul-out site, or exhibited prolonged movement or other behavioral changes.

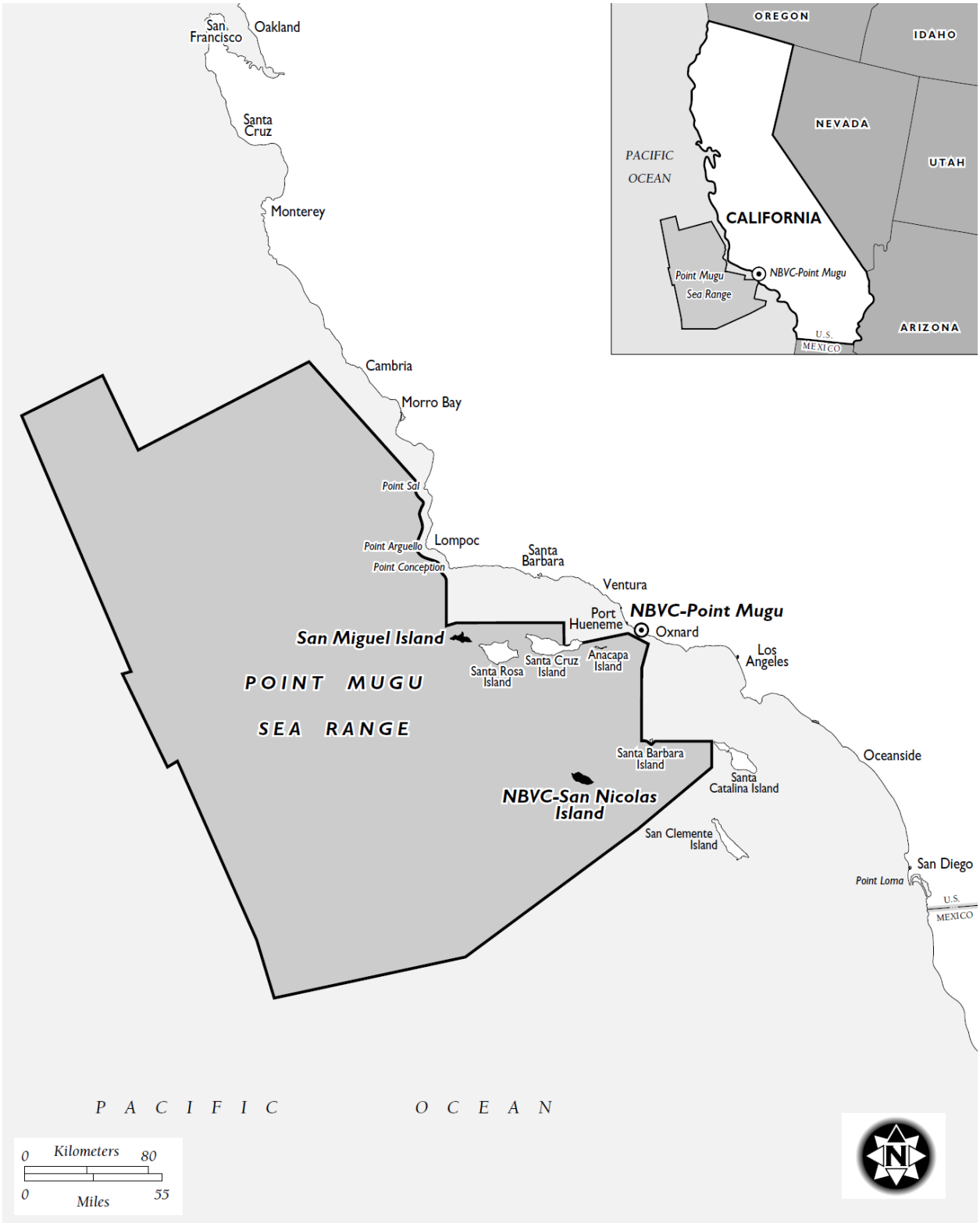


FIGURE 1.1. Regional site map of the Point Mugu Sea Range and San Nicolas Island, California (map by TEC, Inc.).

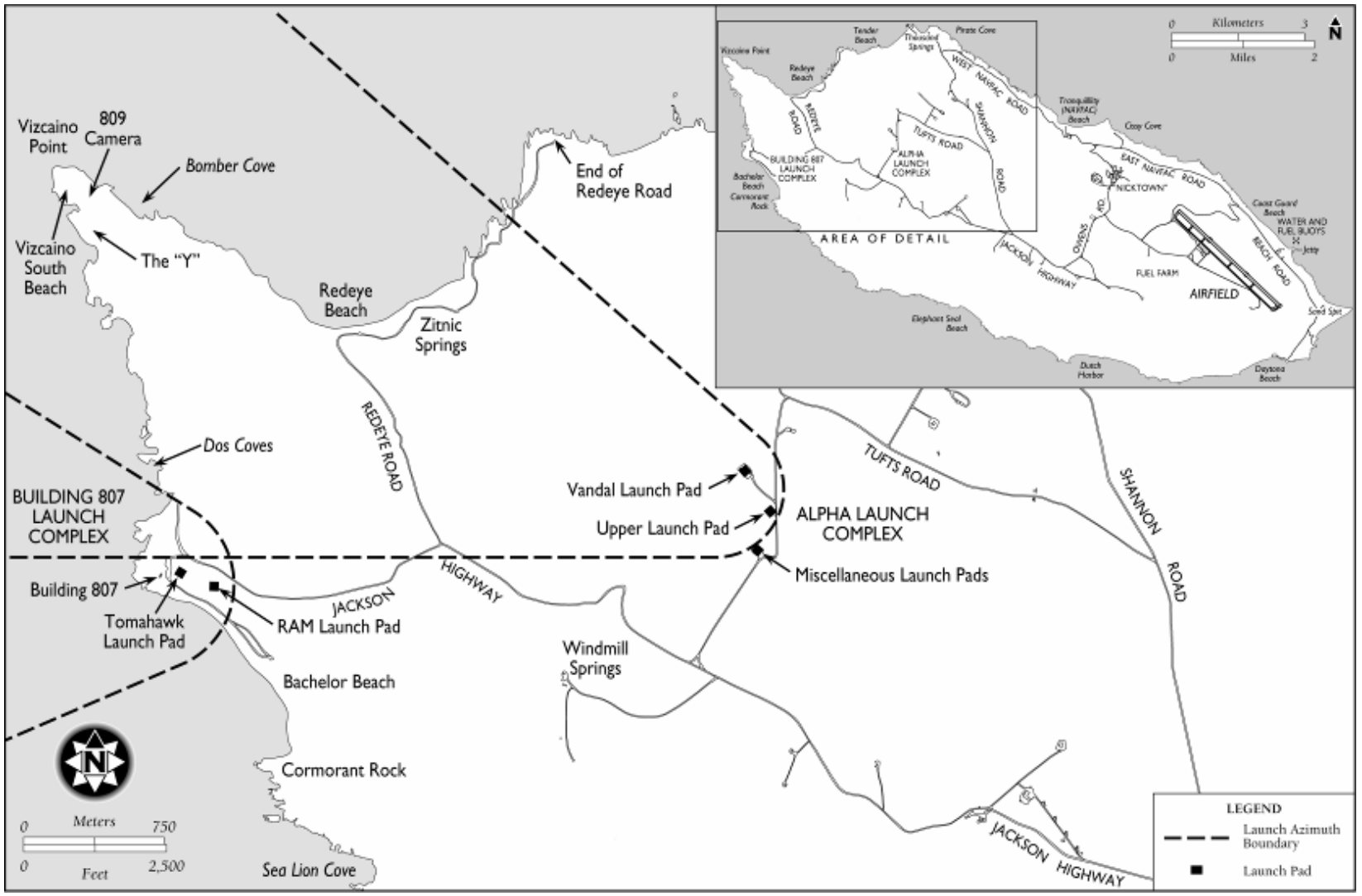


FIGURE 1.2. Map of San Nicolas Island, California, showing the Alpha Launch Complex, B807 Launch Complex, and the names of adjacent beaches on which pinnipeds are known to haul out. Also shown are the anticipated launch azimuths (dashed lines) for each launch complex. These launch azimuths are typical, although occasionally launch paths could pass outside these boundaries.

1.3 Missile Types Launched During the Monitoring Period

GQM-163A "Coyote" Supersonic Sea-Skimming Target

The Navy/Orbital Sciences Corp. GQM-163A "Coyote" missile is an expendable target powered by a ducted-rocket ramjet. It is capable of flying at low altitudes (13 ft or 4 m cruise altitude) and supersonic speeds (Mach 2.5) over a flight range of 45 nautical miles (nm, 83 km) (Fig. 1.3). This missile is designed to provide a ground launched aerial target system to simulate a supersonic, sea-skimming Anti-Ship Cruise Missile threat. The GQM was developed to replace the Vandal missile target.

The GQM missile assembly consists of two primary subsystems: MK 12 or MK 70 solid propellant booster, and the GQM-163A target missile. The solid-rocket booster is about 18 inches (in) (46 centimeters [cm]) in diameter and is of the type used to launch the Navy's Standard surface-to-air missile. The GQM-163A target missile is 18 ft (5.5 m) long and 14 in (36 cm) in diameter, exclusive of its air intakes. It consists of a solid-fuel Ducted Rocket ramjet subsystem, Control and Fairing Subassemblies, and the Front End Subsystem (FES). Included in the FES is an explosive destruct system to terminate flight if required.

Active Protection Interceptor Munition (APIM)

The APIM is APIM is a precision munition based system which incorporates an Interferometric radar for threat detection, a mission fire control computer, a high speed slewed launcher and a ballistic interceptor with on board precision proximity fuzing and mass-focused warhead. The rocket consists of a 4 in (10 cm) diameter round propelled by at rocket motor with a total length of 25 in (63.5 cm).

1.4 Launch Dates and Information

Between September 2012 and September 2013 there were 8 launches from SNI on 7 separate days (Table 1.1). The temperature during launches ranged from 57° to 79° Fahrenheit (F) at the control room, with winds varying from calm to and 15 knots (kts) (Table 1.1).

GQM-163A

Daytime launches of single GQM missiles occurred on February 27, April 3, May 10, and June 12, 2013. Daytime launches of two separate GQM missiles occurred on May 12, 2013. These launches were separated by more than three hours and thus not considered to be a dual launch. The GQMs were launched from the Alpha Launch Complex located 625 feet (190.5 m) ASL on the west-central part of SNI. The GQMs were launched elevation angles of between 14º and 25º above horizontal and crossed the west end of SNI at altitudes between approximately 1,600 and 2,700 feet (518 and 823 m). Elevation angle does not necessarily translate to a straight line for altitude change, as missiles may actively alter the rate of climb achieving a higher than expected altitude for a given distance from the launcher. Reported altitudes are based on the programed altitude/distance function of the missile.

Active Protection Interceptor Munition (APIM)

APIM missiles were launched during daytime hours on August 7 and 8, 2013. The APIMs were launched from the Building 807 Launch Complex located at sea level on the west end of SNI. The APIMs were launched at an elevation angle of 10º and intercepted incoming targets directly above the shoreline at an approximate altitude of approximately 100 ft (30 m) ASL.

TABLE 1.1. Launch data for the September 2012 – September 2013 report period.

Launch Date	Launch Time (local)	Missile Type	Launch Complex	Launch Azimuth (true)	Elevation Angle / Altitude Over Beach (Feet)	Weather at Control Room (Wind speed in knots)[1]	Video Quality	Audio Quality
2/27/2013	11:05	GQM	Alpha	280°	20° / 5,100	6 NW / 64°	Good	Good
4/3/2013	11:57	GQM	Alpha	253°	25° / 1,600	9 NW / 57°	OK*	Good
5/10/2013	9:54	GQM	Alpha	253°	25° / 1,600	<5 NW / 59°	Good	Good
5/12/2013	11:34	GQM	Alpha	253°	25° / 1,600	Calm / 77°	Good	Good
5/12/2013	14:40	GQM	Alpha	335°	14° / 1,000	Calm / 79°	Good	Good
6/12/2013	11:28	GQM	Alpha	220°	20° / 2,700	2 NW / 57°	Good	Good
8/7/2013	14:50	APIM	B807	172°	10° / 100	15 NW / 60°	OK^	Good
8/8/2013	13:57	APIM	B807	172°	10° / 100	15 NW / 57°	Good	Good

[1] The weather data were collected at the launch control room located between 2 and 5 kilometers from the missiles' closest point of approach to the shoreline; therefore weather conditions at pinniped haul-out sites near the closest point of approach may have differed.

* One of three cameras failed due to battery issues.

^ One of three cameras fogged but reactions still minimally visible.

2. ACOUSTICAL MEASUREMENTS OF MISSILE LAUNCHES

2.1 Introduction

The acoustic measurement program for the monitoring period was consistent in approach and methodology with that used during the preceding years (Holst et al. 2011). Recordings of each missile's sound, as well as background sounds, were attempted at up to four sites during each missile flight. ATARs, described in Holst et al. 2011, were developed for this purpose by the Navy's acoustical contractor, Greeneridge Sciences Inc. (Greeneridge) of Santa Barbara, California. Maps of the launch azimuths and monitoring locations can be found in Chapter 3 (Fig. 3.1). Thirty recordings were obtained during the monitoring period (Table 2.1).

2.2 Field Methods

2.2.1 Deployment of ATARs

Prior to each launch, ATARs were positioned at the launch pad and near pinniped haul out sites at varying distances from the planned launch azimuth, specifically at locations where pinniped responses were monitored (see Chapter 3). The recordings were planned to be suitable for quantitative analysis of the levels and characteristics of the received flight sounds. In addition to providing information on the magnitude, characteristics, and duration of sounds to which pinnipeds were exposed, these acoustic data and associated pinniped behavioral data will contribute to a longer-term dataset, analysis of which has determined at least a minimal "dose-response" relationship between received sound levels and pinniped behavioral reactions, especially for sea lions (Holst, et al., 2011.).

Measured sound levels at various microphone locations can be used to characterize sound exposure vs. distance downrange and laterally from the launch azimuth. Analyses of this type for acoustic data collected for the period August 2001 through October 2008 were reported by Holst et al. (2011). In those analyses, factors that were considered included missile type, launch azimuth, launch characteristics (e.g., low- vs. high-angle launch), as well as weather, which is expected to have important effects on the received sounds. Given the limited number of launches during the present monitoring period, no corresponding analysis of acoustic data will be completed for these launches.

ATARs were set up at the recording locations up to several hours prior to the launch and were retrieved following the launch. The ATAR units were deployed by Navy biologists at sites as close as practical to as many as three pinniped haul-out sites at various distances from the launch site and launch trajectory. Total number of sites monitored depended upon the presence of pinnipeds on beaches in the potentially impacted area. Over the entire monitoring period (since August 2001), the Navy has distributed the ATARs such that, for types of missiles that are commonly launched at SNI, recordings have been made at a variety of different distances and locations relative to the flight trajectories and the launch pad.

TABLE 2.1. Missile launches and ATAR recording sites (also see Fig. 3.1).

Launch Date	Missile	Elevation Angle (°)	ATAR Locations	Recording Status
2/27/2013	GQM	20	Alpha Pad, Dos Coves, Pirate's Cove	3 OK
4/3/2013	GQM	25	Alpha Pad, Dos Coves, Pirate's Cove, West Balloon	4 OK
5/10/2013	GQM	25	Alpha Pad, Dos Coves, Pirate's Cove, East Pirate's Reef	4 OK
5/12/2013	GQM	25	Alpha Pad, Dos Coves, Pirate's Cove, Phoca Reef	4 OK
5/12/2013	GQM	14	Alpha Pad, Dos Coves, Pirate's Cove, Phoca Reef	4 OK
6/12/2013	GQM	20	Alpha Pad, Dos Coves, Pirate's Cove, Phoca Reef	4 OK
8/7/2013	APIM	10	B807, Bachelor, Dos Coves, B809	4 OK
8/8/2013	APIM	10	B807, Bachelor, Dos Coves	3 OK

2.3 Audio Data Analysis Methods

While audio recordings of launch sounds were taken during this monitoring period, due to contracting delays caused by the Federal Sequestration analyzed data on the sound levels recorded are not yet available. Audio data from this monitoring period will be analyzed and included in the Draft Comprehensive Technical Report due to NMFS on 2 December 2013. Based upon the types of missiles launched, pinniped reactions noted and previous audio monitoring results it is highly unlikely that any were exposed to launch sounds that could cause TTS.

3. PINNIPED BEHAVIOR DURING MISSILE LAUNCHES

3.1 Introduction

Three species of pinnipeds are common on SNI beaches – California sea lion, Pacific harbor seal, and northern elephant seal. Northern elephant seals have shown little reaction to previous missile launches and monitoring for elephant seals is not required by the current LOA. Therefore this report only includes reactions of Pacific harbor seals and California sea lions. Elephant seals were present on some of the monitored haul-outs along the other species and were included in the camera's FOV. On these occasions, reactions were similar to those in the past (generally no movement or very minor movement down the beach) reconfirming their lack of reaction to missile launches. No other pinniped species were recorded during this or previous monitoring since August 2001 (Holst et al. 2011).

California sea lions often show startle responses to launches and movement along the beach. In most cases, sea lion behavior returns to pre-launch levels within seconds or minutes following the launches (e.g., Holst et al. 2011). Behavior as well as numbers of sea lions hauled-out several hours after launches appears similar to the behavior and numbers observed before a launch. In contrast, when Pacific harbor seals react to launches, they commonly leave their haul-out sites to enter the water and do not return for several hours or until the next tide cycle (Holst et al. 2011). Nonetheless, Holst and Lawson (2002) noted that the behavior and numbers of Pacific harbor seals hauled out on the day following a launch were similar to those on the day of the launch.

Due to operational needs, launches in June 2013 occurred during California sea lion pupping/breeding season, launches in February 2013 occurred during northern elephant seal pupping/breeding season, and launches in February, March and April 2013 occurred during Pacific harbor seal pupping season. No evidence of injury, mortality, or pup abandonment was observed on the day of any launch during the monitoring period, nor was any launch-related injury or mortality expected based on prior monitoring results.

3.2 Field Methods

The launch monitoring program is based primarily on remote video recordings and later analysis. Remote cameras are essential because, during missile launches, safety requirements prevent personnel from being present in many of the areas of interest. Video data were obtained via portable cameras that were temporarily set up at monitoring locations. In addition, trained biologists made notes on the status of pinnipeds on monitored beaches as well as other locations around the island prior to and following launches.

During the launches described in this report, use of video methods theoretically allowed observations of up to three pinniped species during the same launch. The actual number of species observed depended on the number of video systems deployed during each launch and on the number of species hauled out at those sampling sites (Table 3.1). During the monitoring period, only California sea lions and Pacific harbor seals were targeted for monitoring, though northern elephant seals were present at some monitored locations.

Navy biologists usually placed three cameras at locations overlooking haul-out sites prior to each launch. However, on two occasions only two cameras were used due to an absence of animals in the areas of potential impact. Cameras were placed in a manner to minimize disturbance to pinnipeds. The entire haul-out aggregation at a given site cannot be recorded, as the wide-angle view necessary to encompass

an entire beach will not allow detailed behavioral observations. Thus, cameras are set to record a focal subgroup within the haul-out aggregation. Prior to selecting a focal subgroup, however, video pans of the entire area are made to allow computation of total animals in the area. Video pans were repeated after the launch to provide information on changes in total numbers of animals present. Figure 3.1 shows the monitoring locations relative to the launch azimuths for September 2012 – September 2013.

TABLE 3.1. Video monitoring locations.

	Launch Date / Vehicle Type							
Video Recording Location by Species*	27 February 2013 GQM	03 April 2013 GQM	10 May 2013 GQM	12 May 2013 GQM	12 May 2013 GQM	12 Jun 2013 GQM	07 Aug 2013 APIM	08 Aug 2013 APIM
California Sea Lion								
Dos Coves	X	X	X	X	X	X	X^	X
Building 809 (West End)							X	
Bachelor Beach							X	X
Pacific Harbor Seal								
Phoca Reef				X	X	X		
Pirates Cove	X	X^	X	X	X	X†		
East Pirates Reef			X					
W. Balloon Launch		X						

*Multiple Species may be monitored on the same camera at one location.
X = recording attempted
^ Camera failed (Camera battery died on 3 April and Camera partially fogged on 7 August)
† No pinnipeds present in field of view at time of launch

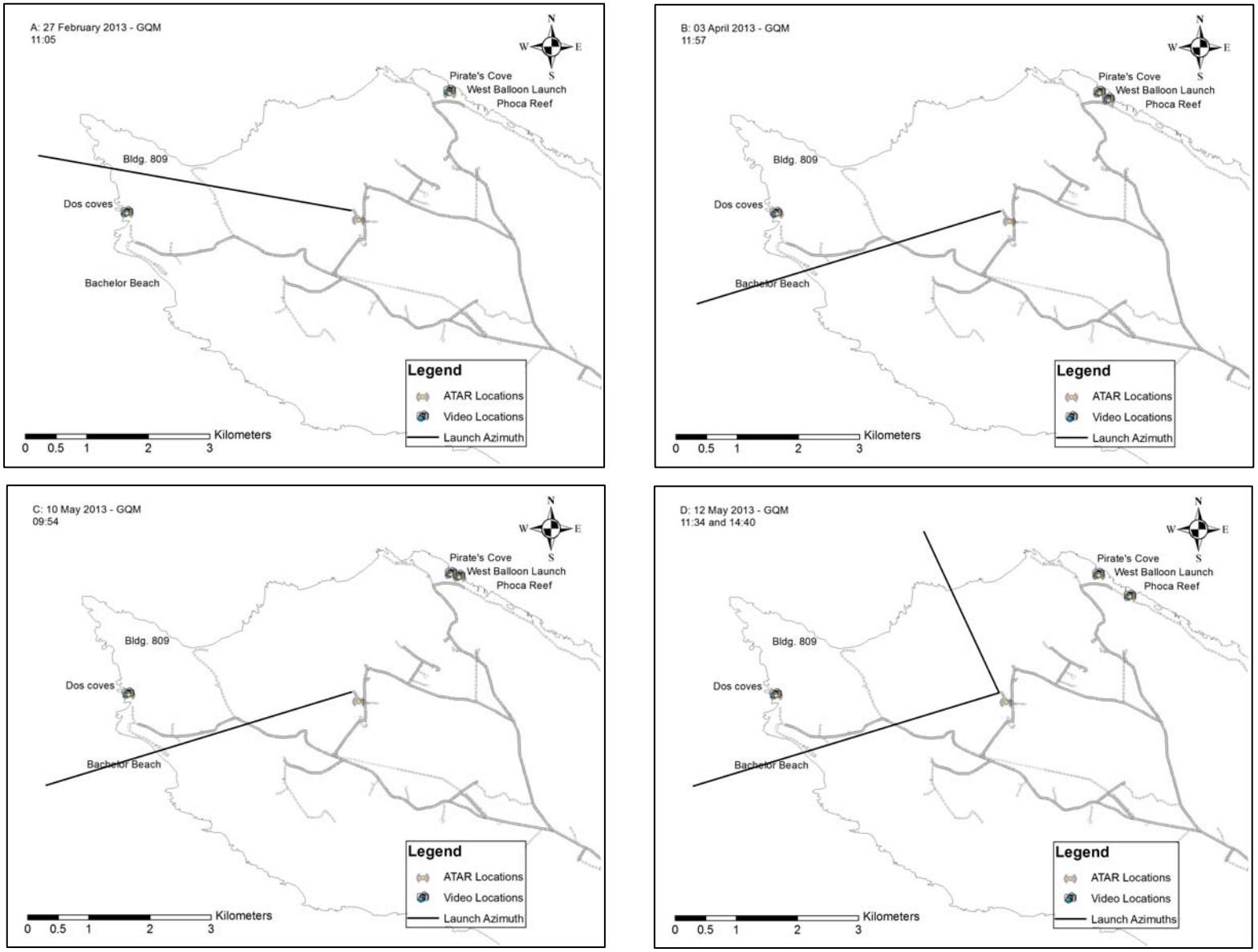
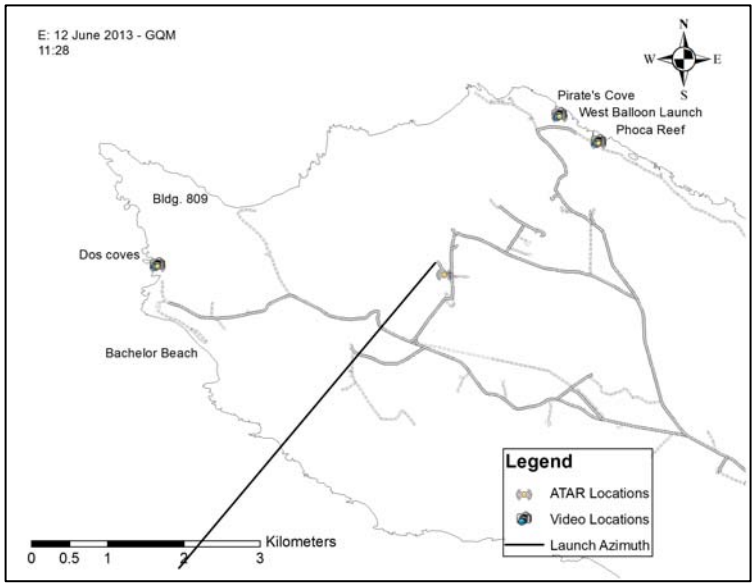
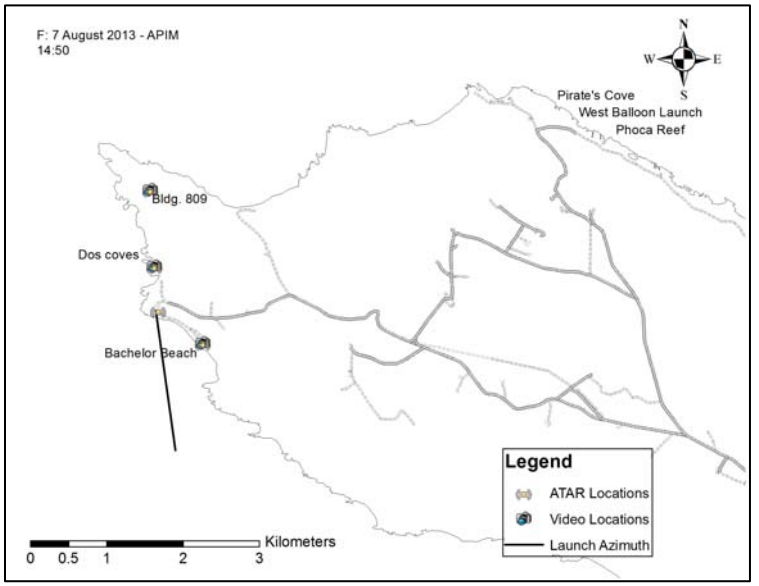


FIGURE 3.1. Launch azimuths, acoustic recording sites (ATARs), and video recording sites.





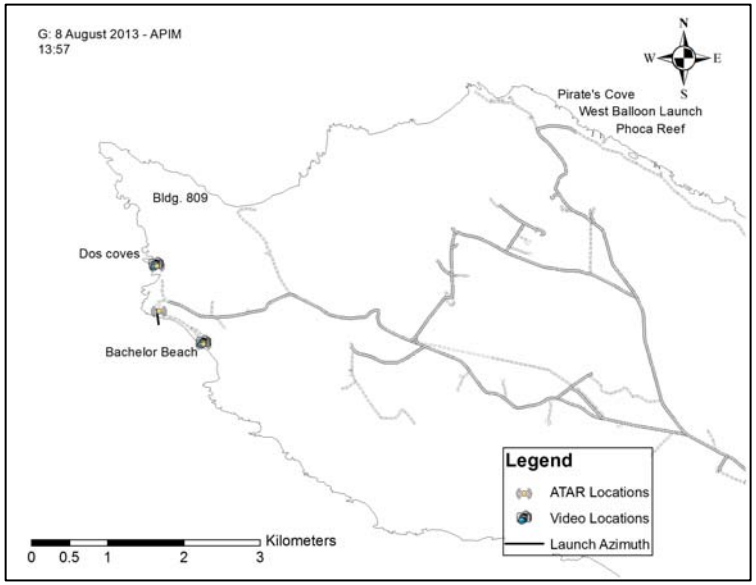


FIGURE 3.1 (Cont.)

3.2.1 Visual Observations

Video observations are obtained before, during, and after each missile launch. Navy biologists also make direct visual observations of the pinniped groups prior to deployment of the cameras and ATARs and after the launch when collecting equipment. Records from these visual observations include the local weather conditions, the type of launch activity planned, types and locations of any pinnipeds hauled out and notable impacts if any, as well as notes on tidal changes or other confounding factors.

Video recordings continue for approximately 15–60 min or more after the launch. If any reactions to the launch occur, post-launch recordings are used to determine how quickly animals returned to pre-launch behaviors. These recordings also help determine whether the relative numbers of pinnipeds at the haul-out site had changed and if there was obvious evidence of recent injury or mortality. In addition, Navy biologists perform visual scans while retrieving video equipment to determine the relative number of hauled-out pinnipeds compared to pre-launch numbers.

3.2.2 Digital Video Cameras

To monitor daytime launches, Navy biologists place up to three portable Sony high definition digital video cameras (HDR-CX160) on tripods overlooking haul-out sites. Missile and other sounds detected by the microphones built into these cameras are also recorded. The audio data are used during behavioral analyses to confirm the exact time when the missile passed and if launch noises were audible in a given location, but are not calibrated and not of sufficient quality to support launch sound analyses.

3.3 Video Monitoring Analysis

Digital video data are reviewed by an experienced biologist on a high-resolution color monitor. The data several hours before, during, and up to 60 min after each launch were reviewed in order to document the types and numbers of pinnipeds present, the nature of any overt responses to the launch, and the number of pinnipeds that responded overtly. The number, proportion and (where determinable) age class (adult or juvenile) of the individuals that responded in various ways were determined from the video, along with comparable data for those that did not respond. Following NMFS [2002], subtle behavioral reactions that persisted for only a few minutes were considered unlikely to have biologically significant consequences for the pinnipeds. To relate pinniped behavior to the proximity of the missile launch, the 3-D distance from the recording site to the closest point of approach (CPA) of the missile was calculated

The following variables were determined from the videotape or from direct observations at the site:

1. Study location;
2. Local time;
3. Weather, including an estimate of wind strength and direction, and presence of precipitation; and
4. Tide state - exact time for local high tide was determined from relevant tide tables.

3.4 Descriptions of Pinniped Behavior during Specific Launches

The following subsections provide overall descriptions of pinniped responses and notable reactions during each launch during the monitoring period. Video recordings of pinniped behavior during launches from September 2012 to September 2013 were successfully collected on seven dates for California sea lions and on five dates for Pacific harbor seals (Table 3.1). California sea lions were monitored at three different haul-out beaches in the potential area of impact during launch events. Pacific harbor seals were

monitored at four different haul-outs. The video recordings generally provided data on the responses of a sample of the total pinnipeds present on a given beach, though on some occasions all animals in the area were recorded.

3.4.1 GQM Launch, 27 February 2013

The GQM missile was launched at approximately 11:05 Pacific time from the Alpha Launch Complex, with a 20º elevation angle and an azimuth of 280º (Fig. 3.1a). A video recording of California sea lions was made at Dos Coves Cliff (CPA ≈ 1.7 km) (Table 3.1). A video recording of Pacific harbor seals was made at Phoca Reef (CPA ≈ 2.4).

ATARs were deployed at the sites where video recordings of pinnipeds were attempted, as well as near the launcher (Fig. 3.1a; Table 2.1). The sounds from the launch were audible on the audio channel of video recordings at Dos Coves, and they were barely audible at Phoca Reef.

California sea lions. Approximately 200 sea lions were present in the general area and approximately 100 were monitored on the beach. During the launch, 65 monitored animals startled and moved into the water. In addition, 75 animals entered and left the FOV of the camera and moved into the water. All sea lions were starting to settle down after 2 - 5 min. Given that the most likely path for animals not in the focal group was through FOV, the total estimated impact was increased by the 75 animals seen entering the FOV. Therefore, it is estimated that 205 California Sea Lions [([65/75]*200)+75] were affected in total.

Pacific harbor seals. At the time of launch, only one harbor seal was present on the monitored beach. This animal startled and moved into the water in response to the launch. A single harbor seal returned to the beach approximately one minute after the launch, but did not appear to be the same individual and could have been coming in from sea. During camera setup, no other hauled out harbor seals were seen. Therefore, it is estimated that one harbor seal was affected.

3.4.2 GQM Launch, 3 April 2013

The GQM missile was launched at approximately 11:57 Pacific time from the Alpha Launch Complex with a 25º elevation angle and an azimuth of 253º (Fig. 3.1b). A video recording of California sea lions was made at Dos Coves (CPA ≈ 1.1 km) (Table 3.1). Video recordings of Pacific harbor seals were attempted at Pirates Cove (CPA ≈ 2.4 km) and West Balloon Launch (CPA ≈ 2.4 km) (Table 3.1). The camera at Pirates Cove failed just prior to the launch, and impacts were estimated based upon direct visual observations prior to the launch and when retrieving the camera shortly afterwards.

ATARs were deployed at the sites where video recordings of pinnipeds were attempted, as well as near the launcher (Fig. 3.1b; Table 2.1). The event was audible on all recordings.

California sea lions. Approximately 90 sea lions were present in the general area and approximately 75 were monitored on the beach. During the launch all animals startled, but only 57 monitored animals moved and only 19 of those entered the water. Most sea lions were starting to settle down in a few minutes after the launch. Therefore, it is estimated that 23 California Sea Lions ([19/75]*90) were affected in total.

Pacific harbor seals. At Pirate's Cove, 15 harbor seals were present prior to the launch and 11 just afterward. Two mother-pup pairs had moved off the beach. Therefore, it is assumed that 4 of the animals were affected and left the beach in response to the launch but that no pups were abandoned. At West Balloon Launch, 4 animals were present on the beach and all in the camera's FOV consisting of two

mother-pup pairs. All of these animals left the beach in response to the launch and no pups were abandoned. Therefore, it is estimated that 8 harbor seals were affected.

3.4.3 GQM Launch, 10 May 2013

The GQM missile was launched at approximately 09:54 Pacific time from the Alpha Launch Complex with a 25º elevation angle and an azimuth of 253º (Fig. 3.1c). A video recording of California sea lions was made at Dos Coves (CPA ≈ 1.1 km) (Table 3.1). Video recordings of Pacific harbor seals were made at Pirates Cove (CPA ≈ 2.4 km) and East Pirate's Reef (CPA ≈ 2.4 km) (Table 3.1). In addition, visual observations were made at Phoca Reef (CPA ≈ 2.4 km).

ATARs were deployed at the sites where video recordings of pinnipeds were attempted, as well as near the launcher (Fig. 3.1c; Table 2.1). The event was audible on all recordings.

California sea lions. Approximately 150 sea lions were present in the general area and approximately 100 were monitored on the beach. During the launch very few animals startled and only 27 monitored animals moved, all of those entering the water. Most sea lions were starting to settle down in a few minutes after the launch. Therefore, it is estimated that 41 California Sea Lions ([27/100]*150) were affected in total.

Pacific harbor seals. At Pirate's Cove, 20 harbor seals were present prior to the launch and 8 in the camera's FOV on the beach with two more (a mother-pup pair) in the water just off the beach. 4 of the 8 seals entered the water in response to the launch, an additional 4 entered the FOV and continued into the water (including one mother-pup pair) and the pair in the water swam off and out of view. After the launch, the remaining 16 animals were still present on the beach. Therefore, it is assumed that 10 of the animals were affected. At East Pirate's Reef one harbor seal was present just prior to the launch and did not react. No harbor seals were hauled out at Phoca Reef prior to the launch and 43 were hauled out approximately 1 hour afterwards. Therefore, it is estimated that only 10 harbor seals were affected.

3.4.4 Two GQM Launches, 12 May 2013

The two GQMs were launched at approximately 11:34 and 14:40 Pacific time from the Alpha Launch Complex. The missiles were launched with elevation angles of 25º and 14º and azimuths of 253º and 335º respectively (Fig. 3.1d). Video recordings of California sea lions were made at Dos Coves (CPAs ≈ 1.1 km and 2.9 km respectively) (Table 3.1). Video recordings of Pacific harbor seals were made at Pirate's Cove (CPA ≈ 2.4 km and 1.98 km respectively) and Phoca Reef (CPA ≈ 2.4 km and 2.3 km respectively) (Table 3.1)

ATARs were deployed at the sites where video recordings of pinnipeds were attempted, as well as near the launcher (Fig. 3.1d; Table 2.1). The event was audible on all recordings.

California sea lions. Approximately 175 sea lions were in the vicinity of Dos Coves during the launches and 100 were in the camera's FOV. During the first launch, approximately 75 animals reacted and 37 of those moved into the water. Many of these animals began returning to the beach immediately. During the second launch, 55 animals reacted and 48 of those moved into the water. Sea lions began moving back towards their original locations after less than 5 minutes. A very conservative estimate of impact, assuming that all affected animals were different during each launch, yields a total of 149 California [((37/100)*175) + ((48/100)*175)] sea lions affected.

Pacific harbor seals. At Pirate's Cove, 9 harbor seals were present and in the camera's FOV prior to the first launch and 18 prior to the second. During the first launch, all animals startled and a few moved short distances but none entered the water and none were considered affected. During the second launch,

all of the animals reacted and 14 of the 18 seals entered the water and were considered affected and no pups were abandoned. Six of these seals returned and hauled out again within a few minutes.

At Phoca Reef 17 seals were present and 3 in the camera's FOV during the first launch and 40 present with 29 in the FOV during the second. During the first launch, 2 of 3 animals reacted and entered the water. A conservative assumption that 2/3 of all animals reacted in the same way yielded an estimate of 11 animals affected by the launch. During the second launch, 19 of the 29 visible animals reacted and entered the water and no pups were abandoned. Five of these returned after about 5 minutes. It is estimated that 21 animals were affected [(19/29)*40] Therefore, a very conservative estimate of impact, assuming that all affected animals were different during each launch, yields a total of 46 Pacific harbor seals affected.

3.4.5 GQM Launch, 12 June 2013

The GQM missile was launched at approximately 11:28 Pacific time from the Alpha Launch Complex with a 20º elevation angle and an azimuth of 220º (Fig. 3.1e). A video recording of California sea lions was made at Dos Coves (CPA ≈ 2.6 km) (Table 3.1). Video recordings of Pacific harbor seals were made at Pirates Cove (CPA ≈ 2.4 km) and Phoca Reef (CPA ≈ 2.4 km) (Table 3.1).

ATARs were deployed at the sites where video recordings of pinnipeds were attempted, as well as near the launcher (Fig. 3.1e; Table 2.1). The event was audible on all recordings.

California sea lions. Approximately 150 sea lions were in the vicinity of Dos Coves during the launch and all were in the camera's FOV. Most of the sea lions reacted by sitting up and becoming more active, though only 34 moved into the water and were considered impacted. Normal behavior resumed within a few minutes. An additional 25 animals were disturbed during camera setup and are included in the impact estimate. Based on this, 59 California sea lions were estimated to have been affected.

Pacific harbor seals. At Pirate's Cove 4 harbor seals were present prior to the launch, but moved off the beach due to the incoming tide before the launch occurred. At Phoca Reef, 41 seals were present with 17 in the camera's FOV. Nine harbor seals moved and entered the water in response to the launch and were considered affected. After the launch, normal behavior resumed almost immediately and more harbor seals were hauled out on the reef when retrieving the equipment than had been prior to the launch. Therefore, it is estimated that 22 harbor seals [(9/17)*41] were affected.

3.4.6 APIM Launch, 07 August 2013

The APIM missile was launched at approximately 14:50 Pacific time from Building 807. The missile was launched with a 10º elevation angle and an azimuth of 172º (Fig. 3.1f). Video recordings of California sea lions were made at Dos Coves (CPA ≈ 0.6 km), Bachelor Beach (CPA ≈ 0.4 km) and B809 (CPA ≈ 1.6 km) (Table 3.1).

ATARs were deployed at all three sites where video recording of pinnipeds were made and near the launcher (Fig. 3.1f; Table 2.1). Launch sounds were not audible at B809 and barely audible at Dos Coves.

California sea lions. Approximately 250 sea lions were in the vicinity of Dos Coves during the launch with 50 in the camera's FOV. While the camera partially fogged prior to the launch event, animals were still visible and none reacted to the launch. Approximately 10 sea lions were in the vicinity of Bachelor Beach with 4 visible in the camera's FOV at the time of launch. None of these animals reacted to the launch. At B809 approximately 250 sea lions were in the vicinity and 50 in the camera's FOV.

None of the animals reacted to the launch. Therefore, it is estimated that no sea lions were affected by the launch.

Pacific harbor seals. Harbor seals were not present in the potential area of impact and therefore were not monitored.

3.4.6 APIM Launch, 08 August 2013

The APIM missile was launched at approximately 13:57 Pacific time from Building 807. The missile was launched with a 10º elevation angle and an azimuth of 172º (Fig. 3.1g). Video recordings of California sea lions were made at Dos Coves (CPA ≈ 0.6 km) and Bachelor Beach (CPA ≈ 0.4 km) due to lack of launch sounds or reactions at B809 the previous day, video was not attempted at this site (Table 3.1).

ATARs were deployed at both sites where video recording of pinnipeds were made and near the launcher (Fig. 3.1g; Table 2.1). Launch sounds were not audible at both sites.

California sea lions. Approximately 250 sea lions were in the vicinity of Dos Coves during the launch with 28 in the camera's FOV. Seventeen of the sea lions in the FOV startled in response to the launch, but only 1 entered the water. Based on this, a very conservative estimate of 9 animals affected [(1/28)*250] was made. Approximately 10 sea lions were in the vicinity of Bachelor Beach with 1 visible in the camera's FOV at the time of launch. This 1 sea lion reacted and ran out of the camera's FOV and was considered to be affected. It was also assumed that the 9 other sea lions in the area but not visible were affected, with a conservative estimate of all 10 animals in the area affected by the launch. Therefore, it is estimated that 19 California sea lions were affected by the launch.

Pacific harbor seals. Harbor seals were not present in the potential area of impact and therefore were not monitored.

3.5 Implementation of Mitigation Measures

Table 3.2 shows a summary of the mitigation measures that were specified by NMFS in the LOA, and how they were implemented during the June 2010–November 2011 monitoring period.

TABLE 3.2. Implementation of mitigation measures.

Mitigation Measure	Implementation
No personnel at haul-out sites 2 hr before launch	Personnel were prohibited from accessing the haul-out sites at least 2 hr before all launches.
Avoid launches during Pacific harbor seal pupping season	Two launches occurred during Pacific Harbor Seal pupping season (February 27 and March 3, 2013). These launches had to occur at this time due to operational need. No harbor seal pups were abandoned and no pinniped injury or mortality occurred.
Limit launch activities during other pinniped pupping season	One launch occurred at the start of California sea lion pupping season, and two launches occurred at very end of sea lion pupping season (June 12, and August 7/8, 20130. These launches had to occur at this time due to operational need. No sea lion pups were abandoned and no pinniped injury or mortality occurred.
No launches of missiles at low elevation from Alpha Launch Complex	All missiles that were launched successfully passed over haul-out beaches at altitudes of approximately greater than 1,000 feet or, in the case of APIM, did not cross over occupied beaches.
Avoid multiple launches in quick succession, especially when pups present	No multiple launches occurred. On May 12, two launches occurred separated by more than 3 hours.
Limit launches during nighttime	No night launches occurred.
Ensure aircraft maintain an altitude of 1000 ft from haul outs	No large aircraft were flown near haul-out areas. A small UAV was flown near Redeye Beach during the APIM launches on August 7 and 8. There were no visible reactions of pinnipeds to this UAV.
Review launch procedure and monitoring methods with NMFS if pinniped injury or mortality are discovered.	No injured or dead pinnipeds were seen during the monitoring period.

4. ESTIMATED NUMBERS OF PINNIPEDS AFFECTED

4.1 Pinniped Behavioral Reactions to Noise and Disturbance

Some of the pinnipeds on the beaches at SNI showed disturbance reactions to missile launches, but others do not. The levels, frequencies, and types of noise that elicit a response are known or expected to vary between and within species, individuals, locations, and seasons. Also, it is possible that pinnipeds hauled out on land may react to the sight (light at night), or the combined sight plus sound, of a missile launch. Furthermore, pinnipeds may, at times, react to the sight and sound of seabirds reacting to a launch. Thus, responses are not expected to be a direct function of received sound level. However, some correlation between pinniped responses and received sound level has been shown, at least for California sea lions and elephant seals, based on data from previous monitoring periods (Holst et al. 2011).

For pinnipeds hauled out on land, behavioral changes range from a momentary alert reaction or an upright posture to movement – either deliberate or abrupt – into the water. Previous studies indicate that the reaction threshold and degree of response are related to the activity of the pinniped at the time of the disturbance. In general, there is much variability and pinnipeds often show considerable tolerance of noise and other forms of human-induced disturbance, though at other times certain pinnipeds can be quite responsive (Richardson et al. 1995; Reeves et al. 1996; Lawson et al. 1998).

Although it is possible that pinnipeds exposed to launch noise might "stampede" from the haul-out sites in a manner that causes injury or mortality, this was judged unlikely prior to the monitoring program. Review of video records of pinnipeds during launches at SNI indicates that this assumption was generally correct. However, monitoring conducted during 2002 - 2003 showed that, in some cases, several Pacific harbor seal pups were knocked over by adult seals as both pups and adults moved toward the water in response to the launch (Holst 2004a) though no injuries were observed. Similarly, during the 2004 - 2005 monitoring period, several California sea lion pups were knocked over by adult sea lions as the adults moved along the beach in response to a launch (Holst and Greene 2006b). The pups were momentarily startled, but did not appear to be injured. No such cases have been observed since 2005.

Since no injuries or deaths were observed during the monitored launches in either this monitoring period or earlier monitoring dating back to August 2001, determining disturbance level, rather than injury or mortality, is the primary monitoring objective. The numbers of pinnipeds on the monitored beaches that might have been affected significantly by the launches were estimated. Estimates were always conservative, assuming the highest possible level of impact. The Navy, consistent with NMFS (2002), assumes that a pinniped blinking its eyes, lifting or turning its head, or moving a few feet along the beach as a result of a human activity is not significantly affected (i.e., not harassed).

In this report, consistent with previous related reports (Ugoretz and Greene, 2012, Holst et al. 2005, 2008; 2011 and Holst and Greene 2006a, b), it is assumed that only those animals meeting the following criteria are affected by launches:

1. Pinnipeds that were injured or killed during launches (e.g., by stampedes);
2. Pinnipeds exposed to launch sounds strong enough to cause TTS; and
3. Pinnipeds that left the haul-out site, or exhibited prolonged movement or prolonged behavioral changes (such as pups separated from mothers) relative to their behavior immediately prior to the launch.

In practice, no pinnipeds are known or suspected to have been injured or killed during the monitored launches since August 2001, no pups have been separated from mothers, and few if any are

believed to have received sounds strong enough to elicit TTS (see §4.2, below). Thus, the number of pinnipeds counted as potentially affected during the monitoring period was based on criterion (3) – the number that left the haul-out site, or exhibited prolonged movement.

The numbers of such affected pinnipeds were calculated for the 8 launches on 7 separate days occurring between September 2012 and September 2013. Disturbance reactions were short-lived for California sea lions and did not appear to extend into subsequent days. Some Pacific harbor seals left their haul-out site during the launches, but the same sites held similar numbers of animals on subsequent days.

4.2 Possible Effects on Pinniped Hearing Sensitivity

While audio recordings of launch sounds were taken during this monitoring period, due to contracting delays caused by the Federal Sequestration analyzed data on the sound levels recorded are not yet available. Audio data from this monitoring period will be analyzed and included in the Draft Comprehensive Technical Report due to NMFS on 2 December 2013.

Overall, the results to date indicate that there is little potential for appreciable TTS or especially PTS in pinnipeds hauled out on SNI near the missile launch paths during the launch operations. This conclusion is necessarily speculative given the limited TTS data (and lack of PTS data) for pinnipeds in air exposed to strong sounds for brief periods. In the event that levels are occasionally sufficiently high to cause TTS, these levels probably would be only slightly above the presumed thresholds for mild TTS. Thus, in the event that TTS did occur, it would typically be mild and reversible (i.e., no PTS). Given the relatively infrequent launches from SNI, the low probability of TTS during any one launch, and the fact that a given pinniped is not always present on land, there appears to be no likelihood of PTS from the cumulative effects of multiple launches.

If there is any reason to be concerned about auditory effects, it would be during either of two types of launches: (1) When artillery shots occur at beach locations and pinnipeds are present nearby, should this ever occur, and (2) When a large missile travels at supersonic speed over a pinniped beach at relatively low altitude. These types of events did not occur during the current monitoring period. Based upon the types of missiles launched, pinniped reactions noted and previous audio monitoring results it is highly unlikely that any were exposed to launch sounds that could cause TTS.

4.3 Estimated Numbers of Pinnipeds Affected by Launches

The approach to estimating the numbers of pinnipeds affected by launches between September 2012 and September 2013 was based on video observations of pinnipeds, combined with estimates of the numbers of hauled out pinnipeds in the same general vicinity not videotaped but exposed to the same launches. The latter animals are presumed to have reacted in the same manner as those whose responses were videotaped. For pinniped groups that extended farther along the beach than encompassed by the FOV of the video camera, an estimate of the total number of individuals that were hauled out was made based on a pre-launch video pan of the area.

The proportions of animals in the focal subgroups that were affected during each launch (based on the disturbance criteria listed in §4.1) were then extrapolated to the estimated total number of individuals hauled out in this area (Table 4.1). It was not possible to extrapolate the proportions of animals affected on the monitored beaches to the entire island as not all beaches could be observed on the day of a launch. However, whenever possible surveys of surrounding beaches were conducted during monitoring set up to determine if additional pinniped were in the area. Additionally, individual pinnipeds may have been

affected on more than one occasion, but are counted here as separate individuals. Thus, the overall estimate of pinnipeds affected may be over- or underestimated.

Navy biologists did not observe any northern fur seals (*Callorhinus ursinus*) or Guadalupe fur seals (*Arctocephalus townsendi*) on SNI during the 2012–2013 monitoring period in areas of potential impact, and none were evident in the video segments that were analyzed.

Observations from the 2001–2002 monitoring period showed that all of the haul-out sites continued to be occupied on subsequent days following the launches (Holst and Lawson 2002).

There was no evidence of injury or mortality during any of the launches.

TABLE 4.1. Estimated numbers of pinnipeds harassed by launches from the Navy's SNI missile launch program between September 2012 and September 2013.

Launch Date	Missile Type	Monitoring Site	# of Focal Animals Potentially Affected	Total # Potentially Affected in Area
Number of California sea lions potentially harassed				
27 February 2013	GQM	Dos Coves	65	*205*
3 April 2013	GQM	Dos Coves	19	*23*
10 May 2013	GQM	Dos Coves	27	*41*
12 May 2013	Two GQMs	Dos Coves	85 (37+48)*	*149**
12 June 2013	GQM	Dos Coves	59	59
07 August 2013	APIM	Dos Coves	0	0
07 August 2013	APIM	B809	0	0
07 August 2013	APIM	Bachelor Beach	0	0
08 August 2013	APIM	Dos Coves	1	*9*
08 August 2013	APIM	Bachelor Beach	1	*10*
Total number of sea lions potentially affected				**496**
Number of Pacific harbor seals potentially affected				
27 February 2013	GQM	Pirate's Cove	1	1
3 April 2013	GQM	Pirate's Cove	4	4
3 April 2013	GQM	West Balloon	4	4
10 May 2013	GQM	Pirate's Cove	10	10
10 May 2013	GQM	East Pirate's Reef	0	0
12 May 2013	Two GQMs	Pirate's Cove	14	14
12 May 2013	Two GQMs	East Pirate's Reef	16 (14+2)*	*32**
12 June 2013	GQM	Pirate's Cove	0	0
12 June 2013	GQM	Phoca Reef	9	*22*
Total number of Pacific harbor seals potentially affected				**87**

Note: Numbers in italics are estimates based upon the proportion of pinnipeds affected within a focal group and expanded to the entire number of animals present in the area.

* It is likely that these numbers overestimate individuals affected as it is highly likely that some of the same individuals were hauled out in the FOV during both launches.

4.4 Summary

No evidence of pinniped injuries or fatalities related to launch noises or other launch operations was evident, nor was it expected. Approximately 496 California sea lions, 87 Pacific harbor seals, and no northern elephant seals were estimated to have been affected during the monitoring period. These figures are very approximate, because they (a) include extrapolations for pinnipeds on beaches that were not monitored on any given launch day, (b) very likely count some of the same individuals more than once, and (c) also exclude pinnipeds on some beaches that were not monitored. The pinnipeds included in these estimates left the haul-out site in response to the launch, or exhibited prolonged movement or behavioral changes relative to their behavior immediately prior to the launch.

The results from the 2012 - 2013 monitoring period (and those from previous monitoring periods) suggest that any effects of the launch operations were minor, short-term, and localized, at least for northern elephant seals and California sea lions. Some Pacific harbor seals may have left their haul-out site until the following low tide, but numbers occupying haul-out sites shortly after a launch or the next day, are generally similar to pre-launch levels. It is not likely that any of the pinnipeds on SNI were adversely impacted by such behavioral reactions.

5. ACKNOWLEDGEMENTS

Lisa Thomas-Barnett and Grace Smith provided critical support collecting the audio and video recordings from SNI along with ancillary visual observations, weather data, and other information. Grace Smith provided comments on the draft monitoring report.

Bob Norman and Clay Rushing, consultants to Greeneridge, were largely responsible for the design of the ATARs, and continue to improve their operation. Bob Norman and others at Greeneridge analyzed the recordings and prepared the figures of launch-by-launch acoustic results.

Previous video monitoring analyses and report preparation was completed by Meike Holst and staff of LGL Ltd., environmental research associates. LGL's long-term assistance in the Navy's SNI pinniped monitoring program is greatly appreciated.

We are grateful to all concerned.

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APPENDIX A:
LETTER OF AUTHORIZATION
1 DECEMBER 2012 – 30 NOVEMBER 2013

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

OCT 24 2012

Mr. Tony Parisi
Naval Air Warfare Center Weapons Division
Code 5090 Ser 52F00ME/
575 "I" Avenue, Suite 1
Point Mugu, California 93042-5049

Dear Mr. Parisi:

Enclosed is a Letter of Authorization (LOA), issued to the Naval Air Warfare Center Weapons Division, U.S. Navy, under the authority of Section 101(a)(5)(A) of the Marine Mammal Protection Act (16 U.S.C. 1361 *et seq.*), to harass Pacific harbor seals, California sea lions, and northern elephant seals incidental to missile launch activities from San Nicolas Island. This LOA is valid from December 1, 2012 through November 30, 2013.

The Naval Air Warfare Center Weapons Division, U.S. Navy, is required to comply with the conditions contained in the LOA and implementing regulations. In addition, the Naval Air Warfare Center Weapons Division, U.S. Navy, must submit an annual report to the National Marine Fisheries Service (NMFS) Office of Protected Resources (PR) and NMFS' Southwest Regional Office (SWRO) no later than 60 days prior to the expiration of this LOA. Along with other mitigation measures to be incorporated, the LOA requires monitoring the presence of Pacific harbor seals and California sea lions; reporting any behavioral modifications resulting from this activity as observed by a qualified individual; and the collection of acoustic measurements from missile launch activities. Modifications and future issuance of an LOA for this activity will be determined according to the outcomes documented under the current authorization and based on (a) regular monitoring of pinniped reactions from missile launches, (b) degree of implementation of mitigation requirements, and (c) marine mammal impacts associated with this action.

If you have any questions concerning the LOA or its requirements, please contact Michelle Magliocca, NMFS/PR at 301-427-8426 or Monica DeAngelis, NMFS/SWRO at 562-980-3232.

Sincerely,

Helen M. Golde, Acting Director
Office of Protected Resources

Enclosure

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

Letter of Authorization

The Department of the Navy, Naval Air Warfare Center Weapons Division, Point Mugu, 1 Administration Circle, China Lake, California 93555 is hereby authorized to take marine mammals incidental to missile launch activities from San Nicolas Island, California, in accordance with 50 CFR 216, Subpart N – Taking of Marine Mammals Incidental to Missile Launch Activities from San Nicolas Island, CA, subject to the provisions of the Marine Mammal Protection Act (16 U.S.C. 1361 *et seq.*) and the following conditions:

1. This Authorization is valid from December 1, 2012, through November 30, 2013.

2. This Authorization is valid only for activities associated with the launching of a maximum of 40 Coyote (or similar sized and smaller) missiles per year from San Nicolas Island, California.

3. General Conditions:

(a). The taking, by Level B harassment only, is limited to the species listed under condition 5 below. The taking by Level A harassment, serious injury (injury that is likely to lead to mortality) or death of these species and the taking by harassment, injury or death of any other species of marine mammal is prohibited and may result in the modification, suspension, or revocation of this Authorization.

(b). The taking of any marine mammal in a manner prohibited under this Authorization must be reported immediately to the Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service (NMFS) at 301-427-8401 and to the Southwest Regional Office, NMFS at 562-980-3232.

(c). If a freshly dead or seriously injured pinniped is found during post-launch monitoring, it must be reported immediately to the parties listed above in 3(b). Additionally, the National Stranding Network must be notified immediately (526-980-4017). Every attempt will be made to collect pinniped carcasses discovered within 48 hours following a launch, provided that the collection does not result in the disturbance (flushing) of other animals on the site. Any carcasses collected will be transferred to Long Marine Laboratory in Santa Cruz, California for complete necropsy.

4. Cooperation:

The holder of this Authorization is required to cooperate with NMFS and any other Federal, state or local agency monitoring the impacts of the activity on marine mammals. The holder must notify the Administrator, Southwest Regional Office, NMFS, by letter, e-mail, or telephone (562-980-3232) at least one (1) week prior to launches (unless constrained by the date of issuance of this Authorization).

5. The marine mammal species authorized for taking by incidental harassment are: 467 Pacific harbor seals (*Phoca vitulina*); 474 northern elephant seals (*Mirounga angustirostris*); and 1606 California sea lions (*Zalophus californianus*).

6. Mitigation Requirements: The Holder of this Authorization must ensure the least practicable adverse impacts on Pacific harbor seals, northern elephant seals, and California sea lions, by:

(a). Prohibiting personnel from entering pinniped haul-out sites below the missile's predicted flight path for two (2) hours prior to planned missile launches.

(b). Avoiding launch activities during harbor seal pupping season (February through April), unless constrained by factors including, but not limited to, human safety, national security, or for launch trajectory necessary to meet mission objectives.

(c). Limiting launch activities during other pinniped pupping seasons, unless constrained by factors including, but not limited to, human safety, national security, or for launch trajectory necessary to meet mission objectives.

(d). Not launching missiles from the Alpha Complex at low elevation (less than 1,000 ft [305 m]) on launch azimuths that pass close to pinniped haul-out site(s) when occupied.

(e). Avoiding the launch of multiple missiles in quick succession over haul-out sites, especially when young pups are present, except when required by mission objectives.

(f). Limiting launch activities during nighttime hours, except when required by mission objectives.

(g). Ensuring that aircraft and helicopter flight paths maintain a minimum altitude of 1,000 ft (305 m) from pinniped haul-outs and rookeries, except in emergencies or for real-time security incidents (e.g., search-and-rescue, fire-fighting, adverse weather conditions), which may require approaching pinniped haul-outs and rookeries closer than 1,000 ft (305 m).

(h). Reviewing the launch procedure and monitoring methods, in cooperation with NMFS, if any incidents of injury or mortality of a pinniped discovered during post-launch surveys or indications of affects to the distribution, size, or productivity of the affected pinniped populations as a result of the authorized activities are thought to have occurred. If necessary, appropriate changes must be made through modification to this Authorization prior to conducting the next launch of the same vehicle.

7. Monitoring Requirements:

(a). General:

(1). The holder of this Authorization must designate biologically-trained, on-site individual(s), approved in advance by NMFS, to record the effects of the launch activities and the resulting noise on pinnipeds.

(2). NMFS must be informed immediately of any changes or deletions to any portions of the proposed monitoring plan.

(b). Visual Land-Based Monitoring:

(1). Prior to each missile launch, an observer(s) will place three (3) autonomous digital video cameras overlooking chosen haul-out sites located varying distances from the missile launch site. Each video camera will be set to record a focal subgroup within the larger haul-out aggregation for a maximum of four (4) hours or as permitted by the videotape capacity.

(2). Systematic visual observations, by those individuals described in condition 7(a)(1) above, on pinniped presence and activity will be conducted and recorded in a field logbook or recorded on digital video for subsequent analysis for no less than one (1) hour prior to the estimated launch time and for up to one (1) hour immediately following each missile launch.

(3). Documentation, both via autonomous video camera and human observer, will consist of:

(i). numbers and sexes of each age class in focal subgroups;
(ii). description and timing of launch activities or other disruptive event(s);
(iii). movements of pinnipeds, including number and proportion moving, direction and distance moved, and pace of movement;
(iv). description of reactions;
(v). minimum distances between interacting and reacting pinnipeds;
(vi). study location;
(vii). local time;
(viii). substratum type;
(ix). substratum slope;
(x). weather condition;
(xi). horizontal visibility; and
(xii). tide state.

(c). Acoustic Monitoring:

(1). During all missile launches, calibrated recordings of the levels and characteristics of the received launch sounds will be obtained from three (3) different locations of varying distances from the missile's flight path. To the extent practicable, these acoustic recording locations will correspond with the haul-out sites where video monitoring is done.

(2). Acoustic recordings will be supplemented by the use of radar and telemetry systems to obtain the trajectory of target missiles in three (3) dimensions, whenever data coverage allows.

(3). Acoustic equipment used to record launch sounds will be suitable for collecting a wide range of parameters, including the magnitude, characteristics, and duration of each missile.

8. Reporting:

(a). For each missile launch, the lead contractor or lead observer for the holder of this Authorization must provide a status report by telephone to the Southwest Regional Office, NMFS (562-980-3232), providing reporting items found under condition 8(b), unless other arrangements for monitoring are agreed in writing.

(b). An initial report must be submitted to the Office of Protected Resources, NMFS, and the Southwest Regional Office, NMFS, at least 60 days prior to the expiration of this Letter of Authorization. This report must contain the following information:

(1). Timing and nature of launch operations;

(2). Summary of pinniped behavioral observations;

(3). Estimate of the amount and nature of all takes by harassment or by other means; and

(4). Evidence of compliance with mitigation measures.

(c). A draft comprehensive technical report will be submitted to the Office of Protected Resources, NMFS, and the Southwest Regional Office, NMFS, 180 days prior to the expiration of the regulations providing full documentation of the methods, results, and interpretation of all monitoring tasks for launches to date plus preliminary information for missiles launches planned during the first six (6) months of the final Letter of Authorization.

(d). A revised final comprehensive technical report, including all monitoring results during the entire period of the Letters of Authorization will be due 90 days after the end of the period of effectiveness of the regulations contained in 50 CFR 216.150 through 216.159.

(e). The draft and final reports will be subject to review and comment by NMFS. Any recommendations made by NMFS must be addressed in the final comprehensive report prior to acceptance by NMFS.

(f). The draft final technical report must contain documentation on the effectiveness of the implementation of the mitigation measures described in condition 6 of this Authorization, including a description of launch activity during the harbor seal pupping season (February through April).

9. Activities related to the monitoring described in this Authorization and as described in the holders application, do not require a separate scientific research permit issued under section 104 of the Marine Mammal Protection Act.

10. Failure to comply with the terms and conditions contained in Subpart N – Taking of Marine Mammals Incidental to Missile Launch Operations from San Nicolas Island, CA (50 CFR 216.150-216.159) may result in the modification, suspension or revocation of this Authorization

11. A copy of this Authorization must be in the possession of each observer or group operating under the authority of this Letter of Authorization.

OCT 24 2012

Helen M. Golde
Acting Director
Office of Protected Resources
National Marine Fisheries Service

Date