

**Final Comprehensive Report for the 5-Year
Programmatic Permit
for Taking Marine Mammals Incidental to
Space Vehicle and Test Flight Activities from
Vandenberg Air Force Base, California
7 February 2009 through 6 February 2014**

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EXECUTIVE SUMMARY

This report provides the National Oceanic and Atmospheric Administration - National Marine Fisheries Service (NOAA Fisheries) information relating to biological and acoustic monitoring conducted on Vandenberg Air Force Base (VAFB) and the northern Channel Islands (NCI). This monitoring was performed under a NOAA Fisheries 5-year Programmatic Permit allowing the unintentional take of small numbers of marine mammals incidental to space vehicle and test flight activities, hereinafter referred to as the "Programmatic Permit." With the Programmatic Permit, NOAA Fisheries issued VAFB multiple 1-year Letters of Authorization, which allowed specified launch programs, aircraft flight test operations, and helicopter operations to unintentionally take small numbers of marine mammals. VAFB has submitted four annual reports (VAFB 2009, VAFB 2010, VAFB 2011, VAFB 2012), with a fifth report due in December of 2013. This report draws heavily upon and references those four annual reports.

During the period covered under the Programmatic Permit, 7 February 2009 through 6 February 2014, a total of thirty-four launches occurred from VAFB, including eleven missile launches and twenty-three space launch vehicle launches. An additional five launches are scheduled to occur between the date of this report being prepared and the conclusion of the 5-year permit, specifically three missile launches and three space launches. Of the eleven missile launches described above (and the three scheduled), eight launches were monitored; six missile launches were not monitored, as they fell or will fall outside of the VAFB Pacific harbor seal (*Phoca vitulina richardii*) pupping season (March through June). Seventeen of the twenty-three space vehicle launches were monitored in some capacity, while six were not monitored as they fell outside of the pupping season and had sonic boom prediction models that did not result in impacts to the NCI greater than one pound per square foot (psf).

Concerning potential impacts to harbor seals, night-time launches could be less likely to cause impacts than launches that occur during daylight hours

because fewer seals use the haul-out sites during night-time. Similarly, launches occurring during or near peak high tides clearly impact a smaller number of seals, as fewer individuals are hauled-out during high tides.

Monitoring for the eight missile launches was performed at the north VAFB Lion's Head haul-out site. Most missile launches occurred during hours of darkness. During all monitoring at this haul-out site, there were no observations of mortalities, injuries, or unusual behavior of the monitored seals. Given that the Lion's Head haul-out site continues to be used regularly, we do not think that launches from the northern VAFB launch facilities result in adverse impacts, or adverse cumulative impacts, to pinnipeds using the site.

Eight space vehicle launches during the reporting period occurred from north VAFB, near the Spur Road and Purisima Point haul-out sites. Of these eight Delta II and Taurus launches, only three occurred during the pupping season, and all three occurred during daylight. The continued use of the Spur Road and Purisima Point haul-out sites indicates that it is unlikely that launches of Delta II and Taurus vehicles result in long-term disturbances of marine mammals using the haul-out sites. Moreover, adverse cumulative impacts from launches were not observed at this site.

Twelve space vehicle launches occurred from South VAFB (with two more scheduled in the next four months). Of these twelve, seven occurred during the pupping season. The continued use of haul-outs near Rocky Point indicates that it is unlikely that launches of Delta IV, Atlas V and smaller vehicles result in long-term disturbances of the marine mammals using the haul-out sites.

One launch from Space Launch Complex 6 in January of 2011 required Auditory Brainstem Response (ABR) testing, and VAFB attempted but was unable to complete this testing in late August of 2013. ABR testing was performed under Scientific Research Permit No. 859-1680-00, to determine if harbor seals exposed to rocket launch noise from Delta IV launches had a resulting change in their hearing sensitivity.

To conduct ABR testing in 2011, three juvenile harbor seals (approximately six months to two years old) were captured for hearing tests.

They were held for a total of twenty-eight hours, and were ABR tested prior to and after the launch. Each seal was fitted with a plastic numbered tag in the hind flipper prior to release.

There was no evidence that the launch noise from the Delta IV Heavy NROL-49 caused a loss in hearing acuity. However, because “after” testing did not begin until two hours post-launch, it is possible that the seals may have had a mild temporary threshold shift that had fully recovered by the time their hearing was tested. Even so, no permanent threshold shift in hearing from the Delta IV Heavy NROL-49 launch noise was found.

Modeling led us to conclude that the majority of space launches from both north and south VAFB did not result in sonic booms greater than 1 psf over the NCIs. In addition, actual on-island monitoring and digital sound recordings demonstrated that “modeled booms” did not actually materialize over NCIs during VAFB launches. Of the actual booms over the NCIs none were greater than 1.5 psf.

Observational monitoring showed that northern elephant seals and northern fur seals failed to respond during sonic boom events. Based on lack of significant sonic boom events over San Miguel Island (SMI) (only four of nineteen launches resulted in booms), and lack of adverse reactions seen during direct observations we conclude there are no launch related adverse effects, or adverse cumulative impacts, to these species on SMI.

California sea lions and harbor seals on SMI were found to be more responsive to sonic booms. Although California sea lions did react to sonic booms on SMI, most disturbances were minor and temporary in nature.

There was no evidence that the noise resulting from aircraft operations detrimentally affected individual pinnipeds or their population. Aircraft movements remain a relatively minor component of operations, especially since the relocation of an Air Force helicopter squadron from Vandenberg to three other bases in 2007. Aircraft maintain a minimum 1000 foot altitude over the coastline of VAFB, and 1900 feet over key rookeries including Purisima Point (this minimum altitude does not apply to law enforcement, security operations,

search and rescue and other emergency situations).

Monthly marine mammal surveys of the VAFB coastline have detected an increase in utilization of beaches by Elephant seals (*Mirounga angustirostris*), although no breeding or pupping has been observed to date. Additionally, Steller sea lions (*Eumetopias jubatus*) were documented at one South VAFB location (north Rocky Point) from May-June 2012 and again January-March 2013). Both of these findings have been reported independently to NOAA Fisheries. Steller sea lions are currently listed as “threatened” under the Endangered Species Act of 1973; however NOAA Fisheries is reviewing a petition to delist this species.

For approximately 28 months, VAFB has been closely monitoring natural landslide activity south of Rocky Point at a haul-out informally referred to as “Weaner Cove,” where female harbor seals have historically weaned their young. Due to massive landslide activity (photographs available upon request, also see Appendix 1), Weaner Cove and at least three nearby areas previously used as haul-outs have been at least partially covered in sandy material from the cliff face. This slide activity made these haul-outs more accessible to coyotes and other terrestrial predators. Consequently, a significant number of seals have left the area and are now hauling out at other locations, most of which are unknown. Numbers have increased slightly on north VAFB, but not enough to compensate for the decreases on south VAFB. A few informal pinniped surveys at nearby Point Conception, a portion of the coast currently managed by the United States Coast Guard, have shown (with detailed statistical analysis not yet available) a major increase in harbor seal haul-out numbers at that location.

1 INTRODUCTION

Under the Marine Mammal Protection Act of 1972, the 30th Space Wing at Vandenberg Air Force Base (VAFB) was issued a 5-year Programmatic Permit for unintentional take of small numbers of marine mammals incidental to space vehicle and test flight activities (Department of Commerce, National Oceanic and Atmospheric Administration [NOAA] 2009a), hereinafter referred to as the Programmatic Permit. In addition, VAFB was issued multiple 1-year Letters of Authorization in association with the Programmatic Permit (NOAA - National Marine Fisheries Service [Fisheries Service] 2009b, 2010, 2011, 2012, 2013), hereafter referred to as the Letters of Authorization (LOAs). These LOAs allowed specified launch programs, aircraft flight test operations, and helicopter operations to unintentionally take small numbers of marine mammals. VAFB was required to comply with the conditions listed in these LOAs and address NOAA Fisheries concerns regarding marine mammals at VAFB and the northern Channel Islands (NCI).

Pacific harbor seals (*Phoca vitulina richardii*) haul out on the remote sandy beaches and rocky ledges along the shore of VAFB. The main haul-out sites are near south Rocky Point on south VAFB (Figure 1), with smaller groups found at the Spur Road, Purisima Point, and Lion's Head areas on north VAFB (Figure 2).

Space launches from VAFB have the potential to cause impacts on the NCI, including San Miguel, Santa Rosa, and Santa Cruz islands, located to the southeast of VAFB (Figure 3, inset). The Point Bennett area of San Miguel Island (SMI; Figure 3) is one of the most important pinniped areas on the west coast of the United States (U.S.). On SMI, the main species of pinnipeds commonly found are California sea lions (*Zalophus californianus*), northern elephant seals (*Mirounga angustirostris*), northern fur seals (*Callorhinus ursinus*), and Pacific harbor seals. Guadalupe fur seals (*Arctocephalus townsendi*) and Steller sea lions (*Eumetopias jubatus*) have bred in the past on SMI, but sightings have been rare since the mid-1980s (Forney et al. 2000).



Figure 1. Map of the south VAFB harbor seal haul-out sites, and south VAFB Space Launch Complexes.



Figure 2. Map of the north VAFB harbor seal haul-out sites, and the north VAFB launch sites and facilities.

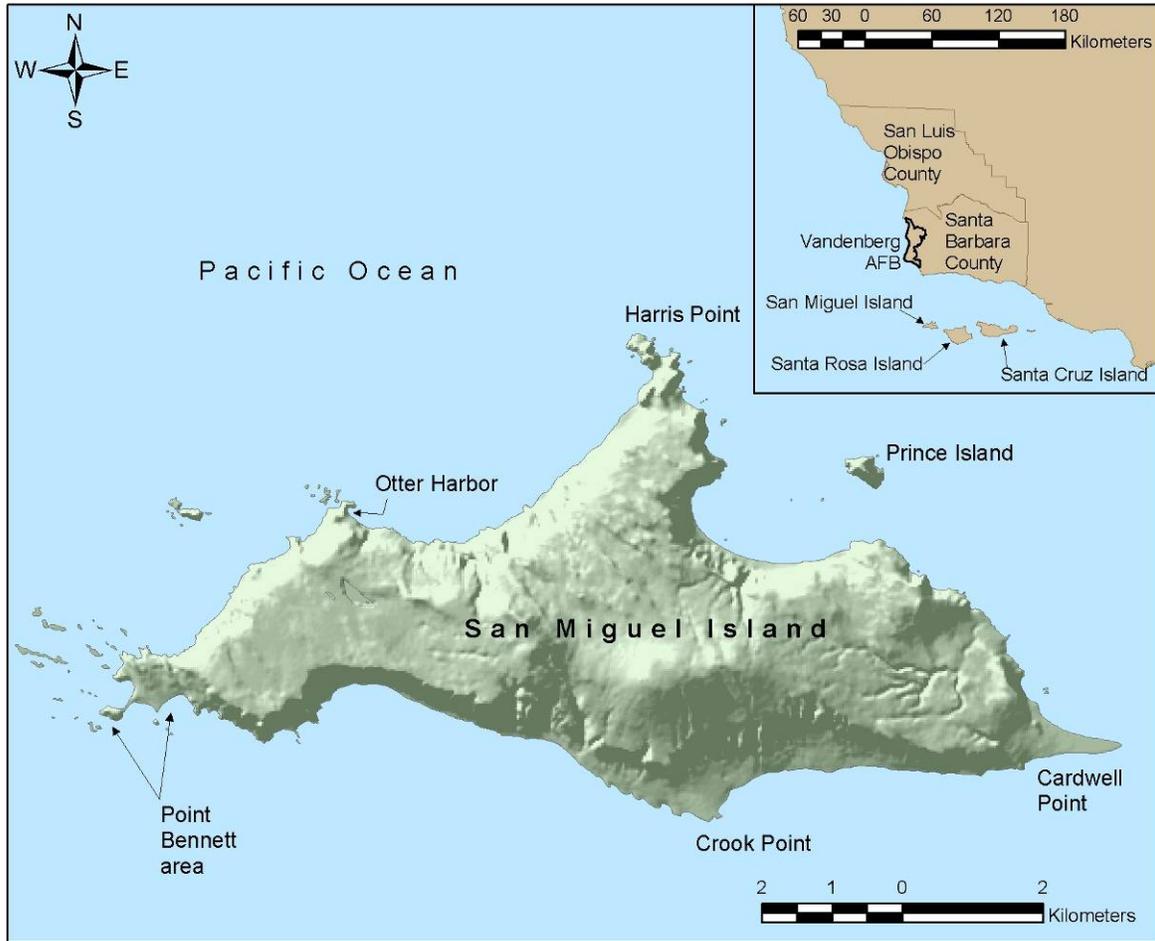


Figure 3. SMI and its monitoring sites. Inset shows the NCI in relation to VAFB.

The main rookeries of sea lions, elephant seals, and fur seals on SMI are found at Point Bennett, on the west end of the island, although sea lions and elephant seals also breed on the east end. There are approximately 23,000 California sea lion pups (Sharon Melin, NOAA Fisheries/National Marine Mammal Laboratory [NMML], personal communication), over 10,000 elephant seal pups (Lowry 2002), and several hundred northern fur seals pups (Forney et al. 2000) typically born on SMI each year. Pacific harbor seals pup on the north and east end of SMI, and several hundred northern elephant seals and sea lions also pup on the east end of SMI at Cardwell Point (Figure 3). Most sea lions and elephant seals on the south and east end of SMI are non-breeding (juvenile or molting) animals.

At VAFB, to determine whether harbor seals exposed to rocket launch noise had a resulting change in their hearing sensitivity, Air Force contractors used a technique known as auditory brainstem response (ABR) testing. ABR testing was performed under Scientific Research Permit No. 14197. ABRs are electrical potentials generated by the discharge of neurons in major cell groups in the brainstem, when the ear is stimulated by sound (Hall 1992). The sound stimulus may be a click, used to measure broadband hearing sensitivity; a tone burst, used to measure frequency-specific sensitivity; or more complex stimuli. The electrical potentials are measured as voltage differences between electrodes located on an animal's head. These electrical potentials are averaged for several hundred or thousand stimuli presentations, thereby increasing the signal-to-noise ratio and clarity of the waveform. ABR waveforms typically consist of a series of peaks and troughs that are measured in amplitude and latency.

A loss in hearing sensitivity causes measurable changes in the ABR waveform and the amount of hearing loss can be quantified. If hearing impairment has occurred after noise exposure, the latency of the peaks and troughs of the waveform increases and the amplitude of the peaks and troughs is reduced when compared to the pre-exposure waveforms. That is, ABR waveforms collected from identical stimuli will differ in amplitude and latency if there has been a change in hearing sensitivity.

2 METHODS

During the period covered under the Programmatic Permit, 7 February 2009 through 6 February 2014, a total of thirty-four launches occurred from VAFB, including eleven missile launches and twenty-three space launch vehicle launches. An additional five launches are scheduled to occur between the date of this report being prepared and the conclusion of the 5-year permit, specifically three missile launches and two space launches.

2.1 SONIC BOOM MODELING

Approximately one month prior to a scheduled launch, PCBoom (versions 3 or 4), a sonic boom prediction model, was used to perform pre-launch sonic boom modeling for all southern trajectory space launch vehicle launches, which have the potential to cause a sonic boom that could impact the NCI. Because of their westward trajectory, north VAFB missile launches were excluded.

The modeling program incorporated nominal flight trajectory information from each launch vehicle, and used numerous samples of daily meteorological conditions appropriate for the date of the launch to predict the sonic boom peak amplitudes and impact locations.

Sonic booms models showing expected impacts to the Northern Channel Islands in excess of one pound per square foot required on-island monitoring of pinnipeds during the launch.

2.2 BIOLOGICAL MONITORING

2.2.1 Vandenberg Air Force Base

The LOAs require monitoring of pinnipeds at VAFB (primarily harbor seals) to begin at least 72 hours prior to launch and continue through 48 hours after launch. To meet those requirements, pre-launch and post-launch counts were conducted for each monitored launch. For launches that occurred during the pupping season (March through June), an additional follow-up survey was performed within two weeks of the launch. A time-lapse video recorder was also set up at the haul-out site for daylight launches during pupping season (on one occasion, a still camera programmed to capture an image every 30 seconds was tested, but this method failed to show the immediate impacts of launches, so it was discontinued). Direct observations during launches could not be made due to safety concerns that required personnel to evacuate the area prior to launch.

Counts were usually made over several hours, and were scheduled to occur as close to the launch window as possible or later in the reporting period.

We also considered tide charts to monitor pinnipeds during tides roughly equivalent to those predicted at the time of the launch. The monitored haul-out site was selected based on which launch facility (LF) or space launch complex (SLC) was to be utilized for the launch (Table 1). Figures 1 and 2 depict the locations of the haul-out sites on south and north VAFB, respectively. Within the south VAFB haul-out area, specific sites were selected, and multiple sites were often monitored, based on the time of year and stage within the pupping season. Monitored sites within the south VAFB haul-out area included Small Haul-out 1, Small Haul-out 2, Harbor Seal Beach, First Ledge, First Cove, Second Cove, Broken Back, Flat Iron Rock, Weaner Cove, Amphitheatre, and South Rocky Point (Figure 4).

Table 1. Types of launch vehicles, launch sites, and monitored VAFB haul-out sites for launches between 7 February 2009 and 1 October 2013.

Type of Launch Vehicle	Launch Facility or Complex	Monitored VAFB Haul-Out Site
Atlas V	SLC-3E	South VAFB
Delta II	SLC-2W	Spur Road
Delta IV	SLC-6	South VAFB
Falcon 9	SLC-4E	South Rocky Point
Minotaur	SLC-8	South VAFB
Minuteman III	LF-04, LF-09, LF-10, LF-26	Lion's Head
Taurus	576E	Spur Road
MDA - BVT and FTG	LF-23, LF-24	Lion's Head

Counts at all haul-outs were usually made from a vantage point on the cliffs above the haul-out site with high powered binoculars and/or a power variable zoom spotting scope. By keeping a low profile, harbor seals could be seen clearly without disturbing them.

Counts included all seals hauled out at the site when the count was made, and did not include those animals present in the water. In addition to count data, which included species, number of animals, age class, and gender when possible, data on natural (e.g., waves, rock slides, birds) or human-caused disturbances (e.g., trains, boats, aircraft, beach-goers), as well as any unusual pinniped behavior, was recorded. Environmental conditions, including wind speed, tide, air temperature and swell height were also noted. A handheld

Kestrel 3000 or similar wind gauge with a built-in thermometer was used to obtain wind speed and air temperature. Marine mammal counts during the 5-year reporting period are summarized in Appendix 2. Additional environmental data, used in data analysis, was obtained from nearby weather stations (Point Arguello Station 46023 and Station PTGC1 at Point Arguello, CA). Tide data was obtained from a various sources.

2.2.2 Northern Channel Islands

The LOAs required observations of pinnipeds take place on the NCI, beginning at least 72 hours prior to launch and continuing through 48 hours after launch, when a sonic boom of over one psf was predicted to impact the islands. Per the LOAs, observations of selected pinnipeds were made at various locations on SMI, depending on the location of the predicted boom. Monitoring sites were generally selected where higher psf levels of a boom were predicted, as well as considering pinniped numbers



Figure 4. South VAFB haul-out area and specific monitoring sites.

Pre- and post-launch counts were completed if a sonic boom impacted the

island. Daily observations were made over several hours, and, as on VAFB, counts were made during the closest observable time periods to the launch windows. Observations were made using high power binoculars and a power zoom spotting scope. Counts included animals in the water, those in the wash zone, and those hauled out on the beach or on the rocks. Unusual behavior and environmental conditions were noted.

Monitoring was also performed immediately prior to and during the launches, using a night vision scope for night launches. Observations were made from immediately prior to the launch window, through the launch and sonic boom, and continued for approximately 20 minutes after a sonic boom was heard by the observers.

2.3 ACOUSTIC MONITORING

As stipulated in the LOAs, acoustic monitoring was performed at VAFB (Figure 5) for new vehicles that were launched during the reporting period. The first three Delta IV launches were specifically called out for monitoring in the LOAs, one of these were monitored in the previous reporting period and one is detailed in this report. The remaining VAFB launches during the reporting period were not acoustically monitored because required acoustic monitoring for on-going programs was completed under the previous programmatic permit (the September 29, 2013 launch of a Falcon 9 from SLC-4 was recorded).

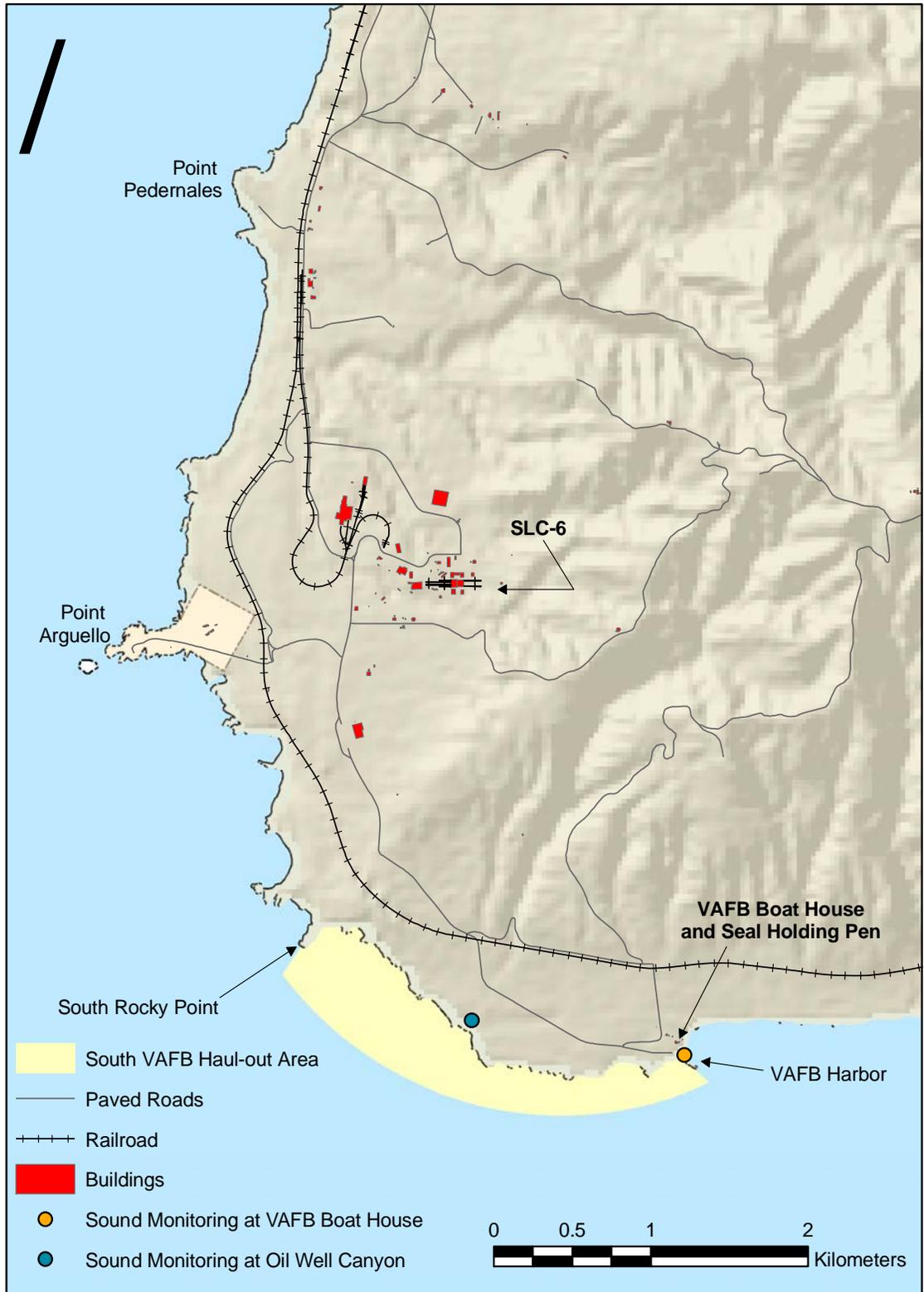


Figure 5. Location of the acoustic monitoring sites at Oil Well Canyon and the VAFB Boat House.

2.4 AUDITORY BRAINSTEM RESPONSE TESTING

Three juvenile harbor seals (approximately 7 to 8 months old) were captured on 19 January 2011 at the Point Conception haul-out area, 20 kilometers (km) south of VAFB, in support of the 20 January 2011 Delta IV NROL-49 launch. The seals were captured using custom-made hoop nets (1.0 m diameter by 1.2 m deep). Only seals that appeared healthy and at least 20 kilograms (kg) in mass were held and tested. The seals were maintained in a fenced enclosure (4.5 m in diameter) over a sand substrate with tarps to provide shade, and a small salt-water pool (1.0 m diameter and 25 cm deep). Immediately prior to their release, each seal was tagged with a plastic numbered tag in the webbing of the hind flipper. The seals were held for a total of 28 hours (the VAFB Scientific Research Permit #14197 allows for seals to be held for up to five days [120 hours]) and released after the post-launch ABR tests were completed. Post-launch ABR testing began approximately three hours after the launch. Refer to Table 2 for a summary of data on the seals used for ABR testing. An additional ABR testing iteration was attempted in August of 2013, but it was unsuccessful. We attempted to capture seals for testing in association with a launch of “Delta IV Heavy,” but high tides and lower than expected afternoon temperatures prevented seals from “hauling out.”

For the ABR testing in 2011, seals were placed on a custom-made restraint board. Upon restraint, the seals were for the most part calm and often fell asleep during the testing; therefore it was unnecessary to use sedatives. Two different sound stimuli were presented through standard audiometric headphones (Telephonics type TDH-39P). The headphones were placed in custom-made neoprene covers to ensure consistent sound levels were presented into the animal's ear. The first stimuli presented were broadband clicks, which measure general hearing function in the frequency range of 1.0 to 4.0 kilohertz (kHz). The second stimuli used were 8.0 kHz tone bursts, which measure hearing function in the 8.0 kHz region. The tone bursts had a 0.5 millisecond (ms) rise and fall time with a 0.25 ms plateau (standard 2-1-2 ratio). A Blackman ramping window was used to enhance the spectral characteristics of the tones (Hall 1992).

Table 2. Summary information on seals used for ABR tests in 2011.

Seal ID	Tag #	Gender	Age	Standard Length (cm)	Axillary Girth (cm)	Calculated Mass* (kg)	Capture Time (PST)	Release Time (PST)	Time Held (hrs)
PV1	Brown 21 left	Male	>1 Year	102	81	46.3	19 Jan 11 14:30	20 Jan 11 18:30	28
PV2	Brown 23 left	Male	>1 Year	100	74	41.4	19 Jan 11 14:30	20 Jan 11 18:30	28
PV3	Brown 22 right	Female	>2 years	107	83	49.7	19 Jan 11 14:30	20 Jan 11 18:30	28

*Mass was calculated based on regression equations for the standard length and axillary girth measurements. Regression lines were derived from data collected from previous captures of harbor seals at VAFB and Point Conception.

Initially the stimuli were presented at sound pressure levels (SPL) loud enough to obtain clean reliable waveforms, and then decreased in 10 dB steps until the response was no longer reliably observed. At this point in the testing, the stimuli were then increased in 10 dB steps to the original SPL. By obtaining two ABR waveforms at each SPL, the variability of the measurements can be quantified to verify the presence or absence of standard peaks and troughs in the waveforms.

The sound stimuli were delivered at a rate of 31.1 stimuli per second. A Bio-logic Systems Corporation evoked-potential computer produced the stimuli, and collected and averaged the ABR evoked potentials from the animals. Following standard ABR testing protocols, the evoked responses from the click were bandpass filtered from 100 to 3,000 Hz, and the evoked responses from the tone bursts were filtered from 30 to 3,000 Hz (Hall 1992). All responses had an analysis time window of 10 ms. The ABR was measured from the right ear of each seal using sterile, sub-dermal, stainless steel electrodes (10 millimeters length). A conventional electrode array was used (Hall 1992) and low-level white noise (25 dB) was presented to the non-tested ear to reduce any electrical potentials generated by that ear.

Analysis of the pre-launch data was then performed by marking standard identifiable ABR peaks (I, III, and V) on the waveforms and tracking those peaks as the stimulus level was decreased.

3 RESULTS

A total of 34 launches occurred from VAFB, including eleven missile launches and twenty-three space launch vehicle launches. An additional five launches are currently scheduled to occur between the date of this report being prepared and the conclusion of the 5-year permit, specifically three missile launches and three space launches. Of the 14 missile launches described above, eight launches were monitored; six missile launches were not monitored, as they fell, or will fall, outside of the VAFB Pacific harbor seal (*Phoca vitulina richardii*) pupping season (March through June). Results of routine, monthly marine mammal monitoring are summarized in Appendix 2.

Monitoring for eight missile launches was performed at the north VAFB Lion's Head haul-out site. Most missile launches occurred during hours of darkness. During all monitoring at this haul-out site, there were no observations of mortalities, injuries, or unusual behavior of the monitored seals.

Seventeen of the twenty-three space vehicle launches were monitored in some capacity, while six were not monitored as they fell outside of the pupping season and had sonic boom prediction models that did not result in impacts to the NCI greater than one psf.

For one launch event, three juvenile harbor seals (approximately months to two years old) were captured for hearing tests using the ABR technique in January of 2011 (in support of mission Delta IV Heavy NROL-49). They were held for a total of twenty-eight hours, and were ABR tested prior to and after the launch. Each seal was fitted with a plastic numbered tag in the hind flipper prior to release.

There was no evidence that the launch noise from the Delta IV Heavy NROL-49 caused a loss in hearing acuity. However, because testing did not begin until two hours post-launch, it is possible that the seals may have had a mild temporary threshold shift that had fully recovered by the time their hearing was re-tested. Even so, no permanent threshold shift in hearing from the Delta IV Heavy NROL-49 launch noise was found. An additional iteration of ABR was

attempted in late August, 2013 but we were unable to complete this testing.

There was no evidence that noise from aircraft operations detrimentally affected individual pinnipeds, or their populations. Aircraft movements remain a relatively minor component of operations, especially since the relocation of an Air Force helicopter squadron from Vandenberg to three other bases in 2007. Aircraft maintain a minimum 1,000 foot altitude over the coastline of VAFB, and 1,900 feet over key rookeries, including Purisima Point (this minimum altitude does not apply to law enforcement, security operations, search and rescue and other emergency situations).

4 DISCUSSION

An application for renewal of the 5-year programmatic permit has been submitted. Within the application, the Air Force is consolidating actions formerly covered by an Incidental Harassment Authorization issued to the United Launch Alliance (ULA), a VAFB tenant Unit. This consolidation will also support the actions of a new tenant unit, Space Exploration Technologies, Inc. (SpaceX). Under new guidance from NOAA Fisheries, a 5-year LOA is anticipated.

A total of thirty-four launches occurred from VAFB, including eleven missile launches and twenty-three space launch vehicle launches. An additional five launches are currently scheduled to occur between the date of this report being prepared and the conclusion of the 5-year permit, specifically three missile launches and two space launches.

The continued use of the Lion's Head, Spur Road, and Purisima Point haul-out sites on north VAFB in addition to a number of haul-outs near Rocky Point on south VAFB indicates that it is unlikely that launches of Taurus, Atlas, Delta II and Delta IV space vehicles or Minuteman III and similar missiles result in long-term disturbances of marine mammals using the haul-out sites. Adverse cumulative impacts from launches were not observed at any site.

Concerning potential impacts to harbor seals, night-time launches could be less likely to cause impacts than launches that occur during daylight hours

because fewer seals use the haul-out sites during night-time. Similarly, launches occurring during or near peak high tides clearly impact a smaller number of seals, as fewer individuals are hauled-out during high tides.

The Air Force has requested the initiation of discussions with NOAA Fisheries to reduce or remove requirements to monitor future missile launches, because more than twenty missile launches have been monitored in the past twelve years, and none of them have been demonstrated to cause any detrimental effects to pinnipeds other than short-term entry into the water.

The Air Force believes that it also would be prudent to discuss and consider reduction of monitoring requirements for pinnipeds on the Northern Channel Islands. After monitoring more than twenty space launches in approximately eighteen years, no adverse effects to “booms” less than 1.5 psf have been detected. We recommend increasing the monitoring threshold to 1.5 psf or higher, perhaps also considering seasonal factors such as pupping and molting.

In summary, the biological and acoustic launch monitoring data collected for all space and missile launches occurring during the reporting period at VAFB and the NCI under the Programmatic Permit provided the following information on pinniped populations at monitored sites:

- No adverse effects to any individual pinnipeds, or their populations were noted.
- No adverse impacts to any major rookery or haul-outs were noted resulting from VAFB activities. Naturally occurring landslides at “Weaner Cove” have significantly reduced pinniped utilization of that and other nearby haul-out sites.
- No cumulative impacts on pinnipeds, or other marine mammals were noted resulting from VAFB activities
- Date(s), location(s) and findings of research activities are discussed in a summary form within this report, and specific details are provided in the annual reports as well as specific reports on individual launch actions previously provided to NOAA Fisheries.

Due to a number of factors, including but not limited to reduced personnel, limited budgets and data collected to date, the Air Force is interested in convening discussions with NOAA Fisheries to:

- i.) Eliminate the requirement for monitoring all missile launches; and
- ii.) Increase the sonic boom level requiring monitoring of pinnipeds on the Northern Channel Islands (this level should probably vary depending upon time of year and presence of young)

5 LITERATURE CITED

Department of Commerce, NOAA. 2009. 50 CFR Part 216. Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Space Vehicle and Test Flight Activities From Vandenberg Air Force Base (VAFB), CA. Federal Register / Vol. 74, No. 24 / Friday, February 6, 2009, pages 6236-6244..

Department of Commerce, NOAA Fisheries Service. 2009b. Letter of Authorization. Issued to the 30th Space Wing, U.S. Air Force. Dated February 6, 2009.

Department of Commerce, NOAA Fisheries Service. 2010. Letter of Authorization. Issued to the 30th Space Wing, U.S. Air Force. Dated January 25, 2010.

Department of Commerce, NOAA Fisheries Service. 2011. Letter of Authorization. Issued to the 30th Space Wing, U.S. Air Force. Dated January 31, 2011.

Department of Commerce, NOAA Fisheries Service. 2012. Letter of Authorization. Issued to the 30th Space Wing, U.S. Air Force. Dated February 1, 2012.

Department of Commerce, NOAA Fisheries Service. 2013. Letter of Authorization. Issued to the 30th Space Wing, U.S. Air Force. Dated January 31, 2013.

Forney, K.A., J. Barlow, M.M. Muto, M. Lowry, J. Baker, G. Cameron, J. Mobley, C. Stinchcomb, and J.V. Carretta. 2000. Pacific Stock Assessment Report. National Marine Fisheries Service Stock Assessment Report, NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-300.

Hall, J.W. 1992. HandBook of Auditory Evoked Responses. Alley and Bacon, Needham Heights, Massachusetts, USA.

Lowry, M.S. 2002. Counts of northern elephant seals at rookeries in the Southern California Bight: 1981-2001. NOAA Technical Memorandum NMFS. NOAA-TM-NMFS-SWFSC-345. 63 pp.

VAFB, 2010. FINAL ANNUAL REPORT, LETTERS OF AUTHORIZATION: Taking Marine Mammals Incidental to Space Vehicle and Missile Launches, and Aircraft Test Flight and Helicopter Operations, at Vandenberg Air Force Base, California, 1 December 2009 to 30 November 2010

VAFB, 2011. FINAL ANNUAL REPORT, LETTERS OF AUTHORIZATION: Taking Marine Mammals Incidental to Space Vehicle and Missile Launches, and Aircraft Test Flight and Helicopter Operations, at Vandenberg Air Force Base, California, 1 December 2010 to 30 November 2011

VAFB, 2012. FINAL ANNUAL REPORT, LETTERS OF AUTHORIZATION: Taking Marine Mammals Incidental to Space Vehicle and Missile Launches, and Aircraft Test Flight and Helicopter Operations, at Vandenberg Air Force Base, California, 1 December 2011 to 30 November 2012

VAFB, 2013. (*in prep*) FINAL ANNUAL REPORT, LETTERS OF AUTHORIZATION: Taking Marine Mammals Incidental to Space Vehicle and Missile Launches, and Aircraft Test Flight and Helicopter Operations, at Vandenberg Air Force Base, California, 1 December 2012 to 30 November 2013

APPENDIX 1:

Photos of natural landslide activity at “Weaner Cove” on South Vandenberg Air Force Base.

Soil from this closely monitored landslide activity is being deposited on several former haul-out sites in the immediate area (primarily to the south). As a result, many of these former haul-outs are now accessible to terrestrial predators such as coyotes; seal counts at those haul-outs have declined significantly, but commensurate increases have been recorded elsewhere, with perhaps the most significant increases being noted at Point Conception (currently managed by the United States Coast Guard), however no statistically rigorous counts have been completed at that location. (Additional photos of landslide activity are available upon request).



August 2011



January 2012



July 2013

APPENDIX 2:

Summary of routine, monthly marine mammal surveys.

Year	Month	Pacific Harbor Seal	California sea lion ¹	Northern Elephant seal ¹	Steller sea lion
2009	Jan	279			
	Feb	145			
	Mar	197		1	
	Apr	149			
	May	271		3	
	Jun	354	36		
	Jul	253	23	1	
	Aug	217	25		
	Sep	223	15		
	Oct	160			
	Nov	238	63		
	Dec	383			
2010	Jan				
	Feb				
	Mar	184			
	Apr	171			
	May	199	18		
	Jun	249			
	Jul	175		1	
	Aug	116			
	Sep	207			
	Oct	250			
	Nov	118			
	Dec	146			
2011	Jan	166		2	
	Feb	178			
	Mar	188			
	Apr	102			
	May	150			
	Jun	259			
	Jul	121	21		
	Aug	23 ²			
	Sep	170	21		
	Oct	165			
	Nov	139			
	Dec	167		1	

APPENDIX 2:

Summary of routine, monthly marine mammal surveys.

2012	Jan	178		2	
	Feb	146			
	Mar	19			
	Apr	134			
	May	44			<16³
	Jun	59			<16
	Jul	83			
	Aug	47	<100		
	Sep	149			
	Oct	159	<100		
	Nov	34			
	Dec	158			
2013	Jan	142			
	Feb				
	Mar	81	6		
	Apr	180	2		1
	May	124		18	
	Jun	92		22	
	Jul	119			
	Aug	173		17	

Notes:

¹ California sea lion and Northern elephant seal sightings, in some reports, are shown as incidental or anecdotal findings; all survey work prior to 2013 focused solely on Pacific harbor seals. After the first documented sightings of Steller sea lions in 2012, an independent survey effort for just that species was initiated in 2013.

² In August 2011, a major landslide occurred (refer to Appendix 1); this has been closely monitored since then. From this date onward, a notable trend toward lower numbers on “South Base” is obvious. Anecdotal reports of increased Pacific Harbor Seal numbers at nearby Point Conception (United States Coast Guard property) have been received; additionally, more animals have been observed on “North Base” and at other haul-outs. While one report (MMCG 2012) suggests that landslide-related pinniped fatalities may have occurred, we have not observed any population-level impact.

³ Steller sea lions, and to a slightly lesser extent California sea lions are most often seen at “South Rocky Point.” This site is difficult to access, and much of the apparent haul-out cannot be seen without disturbing the sea lions and seabirds’ therefore survey numbers are never considered especially accurate.

⁴ Blank cells usually mean zero animals observed during monitoring. In a few instances, it means that no animals were observed because no monitoring was conducted at that time.