

**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 January 2015 TO 31 DECEMBER 2015



Photo Credit: National Ocean Service

Submitted to:

National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Permits, Conservation and Education Division
Office of Protected Resources
1315 East-West Highway
Silver Spring, MD 20910

Submitted by:

United States Air Force
30th Space Wing
30 CES/CEIA
1028 Iceland Avenue
Vandenberg Air Force Base, CA 93437

26 January 2016

Table of Contents

Executive Summary.....	iii
1.0 Introduction	1
2.0 VAFB Operations.....	1
2.1 Space Vehicle Launches	1
2.2 Missile Launches	2
2.3 Fixed-wing Aircraft and Helicopter Operations	2
3.0 Methods.....	5
3.1 Sonic Boom Modeling	5
3.2 Launch Monitoring.....	5
3.3 Acoustic Measurements	6
3.4 Launch Mitigation Requirements Overview	6
3.5 Monthly Surveys	7
3.6 Fixed-wing Aircraft and Helicopter Operations	7
4.0 Results.....	7
4.1 Sonic Boom Modeling	7
4.2 Launch Monitoring.....	7
4.2.1. Atlas V NROL-55	7
4.2.2. MM III GT-214 and MM III GT-215GM.....	Error! Bookmark not defined.
4.2.3. MM III GT-212GM	9
4.3 Monthly Marine Mammal Surveys	10
4.4 Fixed-wing Aircraft and Helicopter Operations	11
5.0 Discussion.....	12
5.1 Effects of Natural Factors	12
5.2 Effects of VAFB Operations.....	12
6.0 Conclusions and Recommendations.....	12
7.0 Literature Cited	13

Tables

Table 1. Space Vehicle Launches.....	2
Table 2. Missile Launches.....	2
Table 3. Launch Mitigation Requirements during the 2015 reporting period.	6
Table 4. Sonic Boom Modeling Results.....	7

Figures

Figure 1. Launch Sites and Pinniped Haul-out Areas on South VAFB.....	3
Figure 2. Launch Sites and Pinniped Haul-out Areas on North VAFB.....	4
Figure 3. Pinniped Population Dynamics During 2014 and 2015 on VAFB.....	11

Executive Summary

This report is prepared in accordance with a National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS; also called NOAA Fisheries Service) five-year permit for the incidental harassment of marine mammals (NOAA 2014a), and with a Letter of Authorization (LOA) issued by NOAA to the U.S. Air Force, Vandenberg Air Force Base (VAFB), 30th Space Wing (NOAA 2014b). This report describes pinniped monitoring conducted in association with space vehicle and missile launches, together with fixed-wing aircraft and helicopter operations. Species of concern at VAFB listed in the LOA include Pacific harbor seals (*Phoca vitulina richardsi*), California sea lions (*Zalophus californianus*), northern elephant seals (*Mirounga angustirostris*), and Steller sea lions (*Eumetopias jubatus*). At San Miguel Island (SMI), which is occasionally impacted by sonic booms from space vehicles, the northern fur seal (*Callorhinus ursinus*) and Guadalupe fur seal (*Arctocephalus townsendi*) are considered species of concern in addition to the four species mentioned for VAFB.

During the reporting period (1 January 2015 to 31 December 2015) there were two space vehicles launched from VAFB. Pinniped monitoring was not required on VAFB for these two launches since they fell outside of the harbor seal pupping season (1 March through 30 June). Sonic booms that would trigger monitoring requirements were not predicted to impact the NCI (Northern Channel Islands) for the Delta II Soil Moisture Active Passive (SMAP) launch (31 January), therefore monitoring on the NCI was not required (R. Evans, pers. comm., 2015). Sonic boom modeling of the Atlas V NROL-55 launch (8 October 2015) indicated that pressures in excess of 2 pounds per square foot (psf) could impact the NCI, including a sonic boom estimated at 5.0 psf along the southwest portion (Point Bennett) of SMI (ManTech SRS Technologies, Inc. [MSRS] 2015d). In accordance with the NOAA Fisheries Service LOA, biological monitoring of select pinniped species at SMI was conducted, as was acoustic monitoring to quantify the sound levels to which the pinnipeds could be exposed. A sonic boom was recorded at the monitoring location, with peak overpressure measured at 1.956 psf and 133.423 decibels (dB) (MSRS 2015d). The monitors did not observe indications of disturbances, abnormal behavior, injury or mortality as a result of the Atlas V NROL-55 launch (MSRS 2015d). The Atlas V NROL-55 launch caused temporary disturbance, but no discernible effect to daily count numbers, which were similar during the pre- and post-launch monitoring periods, and no injury or mortality (MSRS 2015d). Auditory Brainstem Response (ABR) testing was not required for any launches during the reporting period.

Five missile launches occurred from Launch Facilities (LF) 04, 09, and 10 on North VAFB during the reporting period. The westward trajectory of these launches did not necessitate sonic boom modeling for the NCI so biological monitoring on the NCI was not required (ManTech 2015b, 2015c, SRS 1999). Of these five unarmed Minuteman III (MM III) missile launches, three launches occurred within the harbor seal pupping season, requiring pinniped monitoring on VAFB. There were no indications of disturbances, abnormal behavior, injury or mortality as a result of any of these three launches (MSRS 2015b, 2015c). Neither ABR studies nor acoustic monitoring was required for the missile launches because such testing had already been performed for this type of vehicle (SRS 1999). Video monitoring was not conducted because the launches occurred during hours of darkness (MSRS 2015b, 2015c).

During the reporting period, 8,075 operations were conducted from the VAFB airfield. No indications of significant disturbances, abnormal pinniped behavior, injury or mortality were reported as a result of these operations (R. Evans, pers. comm., 2015).

1.0 Introduction

This report is prepared in accordance with a National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS; also called NOAA Fisheries Service) five-year permit for the incidental taking of marine mammals (NOAA 2014a). This rule was issued on 24 February 2014 and is valid through March 26, 2019. This report is also in accordance with a Letter of Authorization (LOA) issued by NMFS to the United States Air Force, Vandenberg Air Force Base (VAFB), 30th Space Wing. The LOA covers the period from 26 March 2014 through 26 March 2019 (NOAA 2014b).

In accordance with a new condition in the LOA (NOAA 2014, page 1, item #4), instead of notifying NMFS "at least two (2) weeks prior to conducting any launch activities that may result in taking marine mammals by harassment," VAFB has agreed to send quarterly advisories and updates to NOAA. These quarterly advisories were submitted in January, April, July, and October 2015 and January 2016.

Harbor seals (*Phoca vitulina*) are the most abundant pinnipeds on VAFB. California sea lions (*Zalophus californianus*), Northern elephant seals (*Mirounga angustirostris*) and Steller sea lions (*Eumetopias jubatus*) are also present, with the latter two species increasing in recent years (MSRS 2014b). Potential impacts to these species on VAFB include harassment from rocket or missile launch or aircraft noise, particularly sonic booms, which may result in a startle response. In some cases, sudden disturbances from a variety of causes have resulted in the trampling of pups by adult animals, resulting in injuries or mortalities. Other potential noise impacts include temporary [hearing] threshold shift (TTS), in which an animal's hearing is temporarily diminished over part or all of its hearing range. Severe cases can involve permanent [hearing] threshold shift (PTS), in which the animal's hearing is permanently diminished over part or all of its hearing range.

During this reporting period, monitoring was required at SMI during the Atlas V NROL-55 launch. Pinniped monitoring was also required on VAFB for three MMIII launches (GT-214GM, GT-215GM, and GT-212GM) since they fell within harbor seal pupping season (1 March through 30 June). ABR testing was not required for any launches during the reporting period. This report describes the methods and results of the marine mammal mitigation efforts and discusses the impacts of Air Force operations.

2.0 VAFB Operations

2.1 Space Vehicle Launches

Two space vehicle launches occurred during the reporting period, from Space Launch Complexes (SLC) 2 and SLC-3E on VAFB (Table 1). The locations of these sites in relation to pinniped haul-out areas on VAFB are shown in Figures 1 and 2.

Table 1. Space Vehicle Launches

Vehicle Type	Facility	Launch Date
Delta II SMAP	SLC-2	31 January 2015
Atlas V NROL-55	SLC-3E	8 October 2015

2.2 Missile Launches

Five missile launches occurred during the reporting period from Launch Facilities (LF) on north VAFB from LF-04, LF-09, and LF-10 (Table 2; Figure 2). All five launches were unarmed MM III Intercontinental Ballistic Missiles (ICBMs).

Table 2. Missile Launches

Missile Type	Facility	Launch Date
MM III GT-214GM	LF-10	23 March 2015
MM III GT-215GM	LF-04	27 March 2015
MM III GT-212GM	LF-09	20 May 2015
MM III GT-213GM	LF-10	19 August 2015
MM III GT-216GM	LF-04	21 October 2015

2.3 Fixed-wing Aircraft and Helicopter Operations

Various types of fixed-wing aircraft fly from VAFB. All aircraft are required to maintain a 1000-foot buffer, or “bubble,” around pinniped haul-out and rookery sites; in other words, they must stay 1000 feet above or around any pinniped site. Exceptions can be made if an emergency search and rescue operation, a security breach or an aircraft emergency occurs.

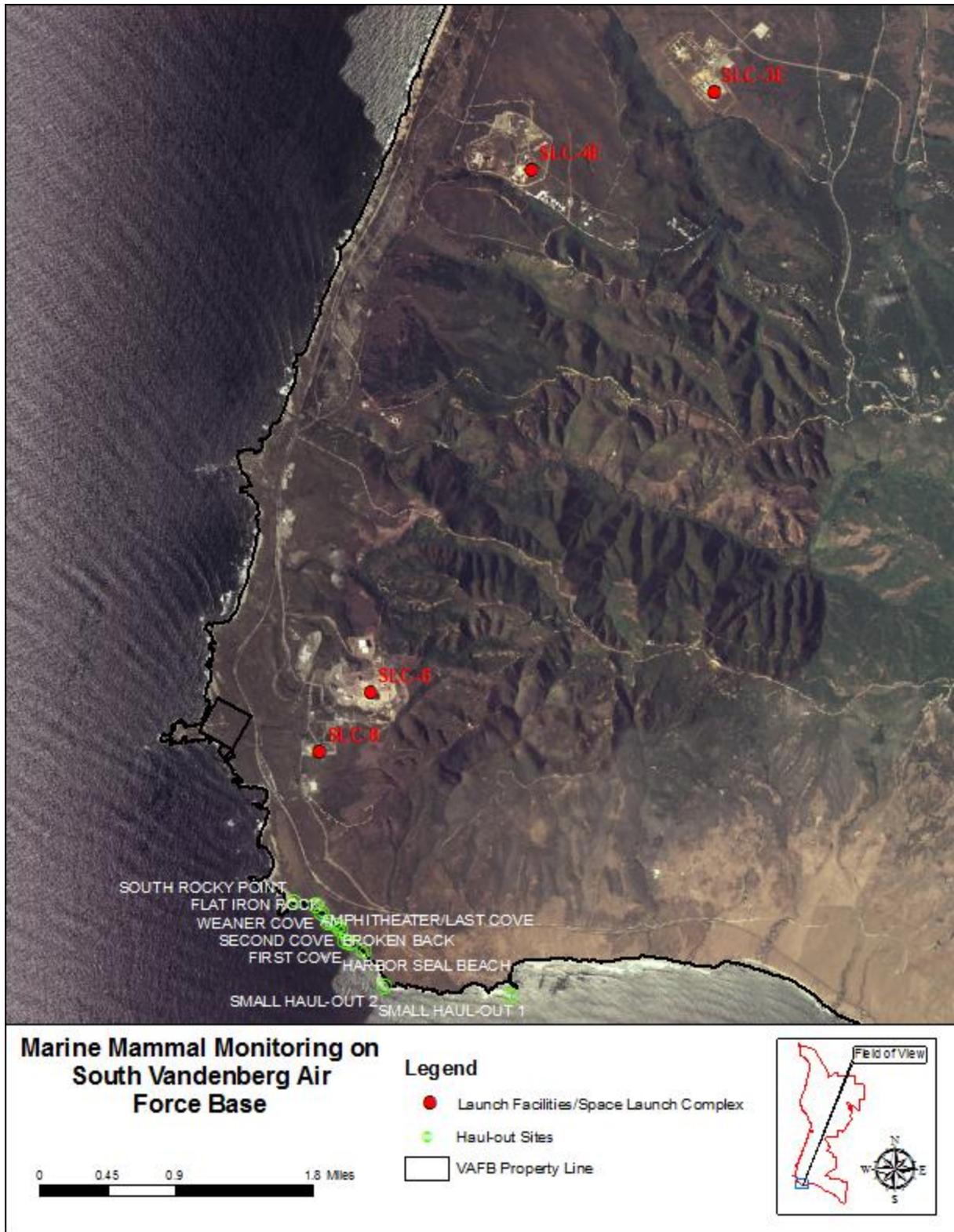


Figure 1. Launch Sites and Pinniped Haul-out Areas on South VAFB.

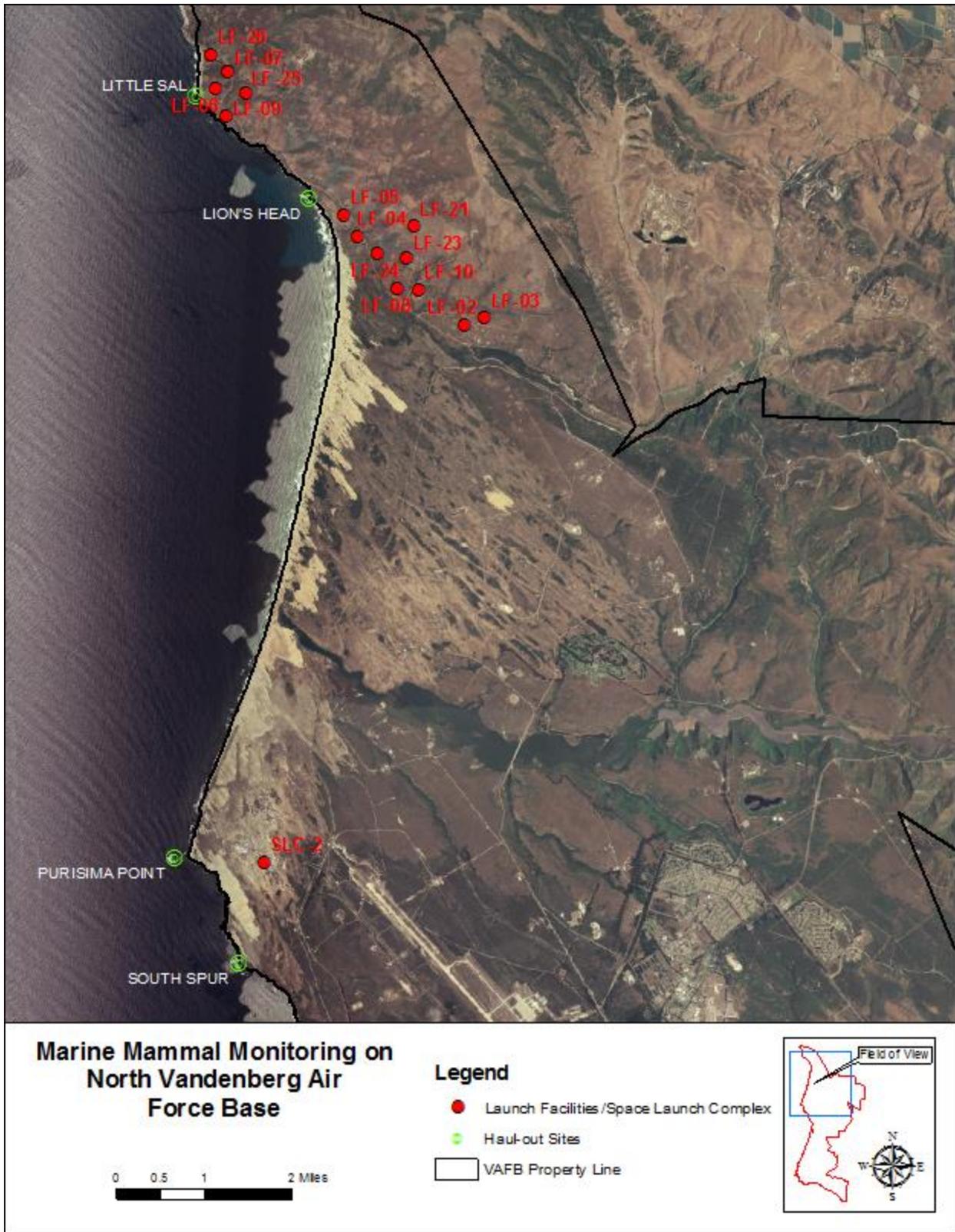


Figure 2. Launch Sites and Pinniped Haul-out Areas on North VAFB.

3.0 Methods

3.1 Sonic Boom Modeling

As required in the LOA, sonic boom modeling was performed prior to both space vehicle launches. Modeling was not necessary for the missile launches because GT vehicles are launched with a westward trajectory and their sonic booms do not impact marine mammal haul-outs on the NCI (MSRS 2015b, 2015c). The modeling programs incorporated nominal flight trajectory information, rocket weight, length, engine thrust, engine plume drag, and meteorological conditions to predict the peak amplitude and impact location of potential booms. Among other factors, meteorological conditions included the presence or absence of the jet stream, and if present, its direction, altitude, and velocity. The type, altitude, and density of clouds were also considered. From these data, the models predicted peak amplitudes and impact locations.

3.2 Launch Monitoring

Per the 2014 LOA, monitoring on the NCI is required if sonic boom modeling predicts a sonic boom greater than 1 psf is likely to impact one of the NCI between 1 March and 30 June, greater than 1.5 psf between 1 July and 30 September, and greater than 2 psf between 1 October and 28 February. Pinniped monitoring is required on VAFB if a launch occurs during harbor seal pupping season (1 March through 30 June). Monitoring must begin at least 72 hours prior to each launch and continue to 48 hours after the launch. During pupping season, follow-up monitoring must be conducted on VAFB two weeks after each launch. Monitoring must be conducted as close to the launch window as possible. During the 2014-2015 reporting period, monitoring on the NCI was required only for the Atlas V NROL-55 launch. Monitoring was required on VAFB for three of the five MM III launches.

Harbor seals preferentially haul out during the afternoon at low tide. Therefore, the early morning counts at high tide are likely to correlate with low pinniped counts. All monitoring days encompassed tide heights which exposed rocks suitable for hauling out, although low tides tended to correlate with higher numbers of harbor seals hauled out on the rocks. Both tide height and time of day account for patterns of harbor seal numbers observed during the monitoring period and during follow-up counts.

On VAFB, monitoring sites are selected based on the proximity of the launch location to the nearest active haul-out sites. For the MM III GT-214GM, GT-215GM, and GT-212GM launches from LF-10, LF-04, and LF-09, respectively, monitoring of pinnipeds was performed at Lion's Head haul-out location on North VAFB (Figure 2). Only harbor seals were present during the monitoring periods.

On the NCI, the monitoring location is selected based on the density and level of predicted sonic boom impacts and the nearest active haul-out of pupping pinnipeds. For the Atlas V NROL-55 launch, modeling runs predicted sonic booms impacting the western portion of SMI, with the highest impact on the southwestern end of the island (MSRS 2015d).

Monitors used high quality binoculars and spotting scopes to make hourly counts and recorded numbers of each species by sex and age class and behavior within a predefined focal area.

Several counts are conducted each day. If monitoring occurs during hours of darkness, monitors may choose to use night vision goggles (Exelis AN/PVS-7D (F5001)), such as during the monitoring activities that took place during the Atlas V launch on SMI. Remarks were recorded, including the nature and cause of any natural or human-related disturbance, such as low-flying aircraft or boat traffic. Incidental information was recorded on other wildlife. Environmental data recorded included time and level of tides, visibility, percentage and type of cloud cover, air temperature, wind direction and velocity, and swell direction and height. On VAFB, direct observations during launch events are usually not conducted due to safety concerns; therefore video is utilized during day time launches on VAFB to record the reactions of the animals to the launch. When video recording is conducted, the recording is reviewed and responses such as alert or flushing into the water are noted. Alert is usually considered insignificant, whereas flushing results in analysis, when possible due to recording length, of how much time it takes for the number of hauled-out animals to return to the pre-launch count.

3.3 Acoustic Measurements

Acoustic monitoring was only conducted for the Atlas V NROL-55 launch on SMI. Acoustic monitoring for the MM III launches and Delta II SMAP launch was not performed at VAFB, as the noise from these vehicles has been well quantified by measurements performed during previous launches from VAFB, and the effects of that noise was expected to be less than that of those previous launches (NOAA NMFS 2014) . In order to record and analyze the level of the sonic boom that impacts the NCI as a result of the launch, monitors utilize a TEAC model RD-120T digital audio tape (DAT) recorder and a high quality Bruel and Kjaer type 4193 microphone, with a type UC0211 low frequency adapter, type 2669 pre-amplifier and type 5935 power supply. This system is specially tailored for recording the low frequency sound associated with rocket launches and sonic booms. This DAT system records the launch noise and sonic booms digitally to tape, which allows for detailed analysis of the frequency content, and the calculation of other acoustical metrics. Using Maxell DAT tapes, the DAT system recorded for just less than 40 minutes, providing ample time to record the ambient noise and sonic boom. Prior to and after the audible sonic boom, the DAT recorder was calibrated with a Bruel & Kjaer sound level calibrator type 4220.

3.4 Launch Mitigation Requirements Overview

Table 3. Launch Mitigation Requirements during the 2015 reporting period

Vehicle or Missile	Launch Date	NCI Monitoring	VAFB Monitoring	ABR Testing	Boom Model	Acoustics	Video
Delta II SMAP	31 January 2015	N/R	N/R	N/R	Required	N/R	N/R
MM III GT-214GM	23 March, 2015	N/R	Required	N/R	N/R	N/R	N/R
MM III GT-215GM	27 March, 2015	N/R	Required	N/R	N/R	N/R	N/R
MM III GT-212GM	20 May, 2015	N/R	Required	N/R	N/R	N/R	N/R
MM III GT-213GM	19 August, 2015	N/R	N/R	N/R	N/R	N/R	N/R
Atlas V NROL-55	8 October, 2015	Required	N/R	N/R	Required	Required	N/R
MM III GT-216GM	21 October, 2015	N/R	N/R	N/R	N/R	N/R	N/R

N/R = "not required"

3.5 Monthly Surveys

Monthly pinniped surveys were performed at all significant haul-out sites on north and south VAFB (Figures 1 and 2) during the reporting period, except for Purisima Point and South Rocky Point. Purisima Point was omitted because the Center for Environmental Management of Military Lands (CEMML) and 30 CES biologists conducting the surveys were not permitted plover monitors and not authorized to enter snowy plover breeding habitat during breeding season (1 March to 30 September) (FWS, 2014). The site was not included in the remaining months in order to keep data consistent throughout the year. On north VAFB, observations were made from the cliff overlooking the Lion’s Head and Little Sal haul-outs and from the sand dunes adjacent to the haul-out site at Spur Road. On south VAFB, observations at each haul-out site were made from several vantage points on the cliffs overlooking the site. Observers kept a low profile near all haul-out sites to reduce disturbances to the animals. To the extent possible, surveys were timed to coincide with the lowest monthly afternoon low tides (time of day with highest number of animals hauled out). The location, species, number of individuals, age class, and sex (when possible) was recorded. Ocean and weather conditions were also recorded.

3.6 Fixed-wing Aircraft and Helicopter Operations

Records were obtained from the VAFB Airfield (30 OSS/OSAB) by the CEI Staff to determine the number and nature of flights performed during the reporting period (R. Evans, pers. comm., 2015).

4.0 Results

4.1 Sonic Boom Modeling

Sonic boom modeling was conducted for the two space vehicle launches that occurred during the 2015 reporting period. The following table summarizes the results of the modeling effort.

Table 4. Sonic Boom Modeling Results

Vehicle	Sonic Boom Modeling Results
Delta II SMAP	No booms impacting NCI
Atlas V NROL-55	>2 psf impacting SMI

4.2 Launch Monitoring

4.2.1. Atlas V NROL-55

Full details of the following summary for monitoring of the Atlas V NROL-55 launch on 8 October 2015 from SLC-3E can be found in the launch monitoring report (MSRS 2015d; sent to NMFS 20 November 2015). Monitoring was performed at East Adams Cove of Point Bennett, on SMI because it supports large numbers of hauled out pinnipeds and coincided with the highest predicted sonic boom impact (>5.0 psf). Poor visibility, low cloud ceiling and weather

prevented Channel Islands Aviation from being able to deploy the biological monitors on the island for three days (72 hours) prior to the launch; therefore monitoring was only conducted for two days prior. A sonic boom was recorded at the monitoring location, with peak overpressure measured at 1.956 psf (133.423 dB).

Several counts are conducted daily. Total pre-launch counts for California sea lions at the SMI monitoring location ranged from 42 to 166. Post-launch sea lion totals ranged from 84 to 201. Between 40 and 136 pups were observed prior to the launch and 60 to 166 pups were observed after the launch. During the launch, approximately 60% of the California sea lions within the count block alerted and raised their heads. None flushed. Within three minutes, 100% of all sea lions resumed normal behavior.

Total pre-launch counts for northern elephant seals at the SMI monitoring location ranged from 107 to 159 (Figure 12, 13). Post launch northern elephant seals ranged from 110 to 148. Between 103 and 158 pups were observed prior to the launch and 109 to 146 pups were observed after the launch (Figure 12, 13). Northern elephant seals had no visible response to the sonic boom and maintained normal behavior. None flushed.

Total pre-launch counts for northern fur seals at the SMI monitoring location ranged from 129 to 262 (Figure 14, 15). Post launch northern fur seals ranged from 154 to 311. Between 100 and 244 pups were observed prior to the launch and 113 to 258 pups were observed after the launch (Figure 14, 15). During the launch, approximately 60% of northern fur seals within the count block alerted and raised their heads. None flushed. Within three minutes, 100% of all northern fur seals resumed normal behavior.

In summary, northern elephant seals showed no visible response to the launch, whereas California sea lions and northern fur seals exhibited an "alert reaction" (head raise, startle, then back to sleep). No Guadalupe fur seals were observed or monitored. Overall, the launch appeared to have no significant effect on pre- and post-launch count totals at East Adam's Cove on SMI and caused only temporary behavioral disturbance.

4.2.2. MM III GT-214GM and MM III GT-215GM

Further details of the following summary for the MM III GT-214GM launch on 23 March 2015 and MM III GT-215GM on 27 March 2015 can be found in the launch monitoring report (MSRS 2015b). Monitoring on VAFB was required and was performed at Lion's Head (Figure 2) between 19 March 2015 and 28 March 2015. Four days of counts were performed prior to the GT-214GM launch rather than the usual three days because the launch was delayed by one day. Because the GT-214GM launch and the GT-215GM launch occurred within five days of each other, continuous monitoring was performed during the time between the launches because the post-launch count period of the first launch overlapped with the pre-launch count period of the second launch. A follow-up count was performed one week after the GT-215GM launch on 3 April 2015. During pre-launch monitoring, between 0 and 4 harbor seals were counted. Between the GT-214GM and GT-215GM launches harbor seal numbers ranged from 0 to 13. Forty-eight hours

following the GT-215GM launch, harbor seal totals ranged from 0 to 11. On the follow-up monitoring day, 3 April, the 07:00 a.m. to 11:00 a.m. monitoring period encompassed the high tide and no harbor seals were present; an additional count was made at 4:08 p.m. (at low tide), at which time 21 harbor seals were present. No pups were observed pre- or post-launch.

Overall, the launches appeared to have no significant effect on long term count totals at Lion's Head haul-out; count totals during the follow up survey were higher than those observed during the count period. Harbor seals preferentially haul out during the afternoon at low tide. Therefore, the early morning counts at high tide are likely to correlate with low pinniped counts. This relationship between environmental factors and harbor seal counts held true in all cases, except for 26 March. The GT-214GM and GT-215GM launches did not appear to affect harbor seal numbers at the Lion's Head haul-out on North VAFB. Activity patterns observed are adequately explained by environmental conditions. No evidence of injury or mortality was observed during launch monitoring. Therefore, there is no evidence of adverse effects to harbor seals using the Lion's Head haul-out or to VAFB pinniped populations as a result of the GT-214GM and GT-215GM launches. The launch did not appear to have caused long term effects on harbor seals, as the highest number of harbor seals hauled out (21) was observed one week post-launch.

4.2.3. MM III GT-212GM

Further details of the following summary for the MM III GT-212GM launch on 20 May 2015 can be found in the launch monitoring report (MSRS 2015c). MSRS performed quantitative monitoring of pinnipeds at the Lion's Head haul-out location on North VAFB (Figure 2) for three days (72 hours) prior to the GT-212GM launch on 20 May 2015 through two days (48 hours) following the launch. A follow-up count was conducted one week after the launch on 27 May 2015. In summary, the counts occurred from 17 May through 21 May, and a follow-up count occurred on 27 May.

Total harbor seals at the Lion's Head haul-out prior to the GT-212GM launch ranged from 0 to 12. During the 48 hours following the GT-212GM launch, harbor seal totals ranged from 0 to 10. On the post-launch monitoring day one week after the launch, 27 May, MSRS counted 6 to 20 harbor seals during each count from 06:00 a.m. to 10:00 a.m.; biologists conducted an additional count at 12:19 p.m. (at low tide), at which time biologists counted 21 harbor seals. Biologists did not observe any pups pre-launch or post-launch.

The launch may have caused a temporary disturbance due to noise, but there were no long-term effects, as the one week post-launch monitoring recorded higher numbers of harbor seals than pre-launch monitoring. A small brush fire (0.21 acres) was ignited by the launch, but it was quickly extinguished with no observed effect to harbor seals. The GT-212GM launch did not appear to affect harbor seal numbers at the Lion's Head haul out on North VAFB. Activity patterns observed are adequately explained by environmental conditions. There was no evidence of injury or mortality at the monitored haul-out as a result of the launch.

4.3 Monthly Marine Mammal Surveys

The results of monthly marine mammal surveys on VAFB are reported to NOAA Fisheries annually in a separate report. Further details of the following summary can be found in the marine mammal annual report [CEMML] *in prep*). None of the monthly surveys suggested any changes in haul-out patterns as a result of the launches (MSRS 2015b, 2015c, 2015d). Figure 3 indicates the population dynamics of select pinniped species on VAFB. Surveyors in 2011-2012 noted a decline in harbor seal numbers from historic levels (MMCG & SAIC 2012b); however, count totals have been increasing over the past three years and potentially show an overall increasing trend (MSRS 2014a, MSRS 2015a, CEMML *in prep*). In surveys conducted in 2013 and 2014, there were no harbor seals recorded at South Rocky Point and very few recorded at Purisima Point (a total of 16 in 2013 and 3 in 2014). Even though South Rocky Point and Purisima Point were not included in the 2015 surveys, there is an overall increase in the VAFB harbor seal population from 2014 to 2015 (Figure 3, red line).

In 2013, the number of northern elephant seals hauled out on VAFB observed increased substantially from previous years. Up to 191 individuals were observed at South Rocky Point (MSRS, 2015a) and up to 163 individuals, were observed at South Rocky Point during monitoring for the Falcon 9 Cassiope launch (URS Group, Inc. 2013). These observations have been almost entirely juvenile animals, which commonly haul out in large numbers during late summer and early fall throughout their range in California (MSRS 2015a). Greater than average numbers were again reported in 2014, with a total of 239 northern elephant seal observations (MSRS 2015a). Compared to the total of 10 northern elephant seals observed on monthly counts between 2007 and 2010, this is a significant increase in northern elephant seal numbers on VAFB (MSRS 2015a). Elephant seal numbers were lower during the 2015 survey period because South Rocky Point was not included in all of the surveys. Anecdotal sightings were recorded at South Rocky Point during seabird surveys, and as many as 55 elephant seals were present at one time in early May 2015 (CEMML *in prep*). These surveys were conducted in the morning, and were not dependent upon the tide schedule; therefore the elephant seal population could have been higher than recorded because pinnipeds are more likely to haul out in the afternoon and at low tide.

In addition to harbor seals and elephant seals, routine observations of California sea lions were recorded throughout the 2015 reporting period at North Rocky Point and various other haul-out sites scattered along the VAFB coastline (CEMML *in prep*). Anecdotal sightings of sea lions at East Islet were regularly reported from April 2015 through June 2015 during seabird surveys (CEMML *in prep*). Once again, these anecdotal sightings took place in the morning and were not planned around the tide schedule, so it can be assumed that higher numbers are present in the afternoon at low tide, the preferred haul-out conditions for pinnipeds. In addition, 135 California sea lions were recorded at East Islet in May 2014. It is clear that East Islet is a popular haul-out location in recent years and should be considered as a regularly surveyed haul-out in future years. California sea lion counts were exceptionally lower this year than in 2014. Since there was no significant increase in disturbances caused by launches (a total of 8 launches in 2014 and 7 launches in 2015), it can be inferred that the decline in California sea lions is not caused by launch activity. Sea lion populations declined drastically in 2015 due to a combination of starvation and domoic acid poisoning over the course of the year (The Marine Mammal Center 2015).

Low numbers of Steller sea lions were recorded at North Rocky Point during the 2015 reporting period; however, there was an increase in the number of sightings from 2014. In addition to the regular monthly surveys, there was an anecdotal sighting of two Steller sea lions hauled out on East Islet in June 2015. It is the only location other than North Rocky Point where Steller sea lions have been recorded on VAFB. A total of 14 Steller sea lions were recorded in the 2014 monthly surveys, while a total of 30 sightings were recorded during the 2015 monthly surveys (CEMML *in prep.*). It is unlikely that launch activity on VAFB negatively affected Steller sea lion populations, as North Rocky Point has become an increasingly popular haul-out location over the past two years (MSRS 2015a, CEMML *in prep.*)

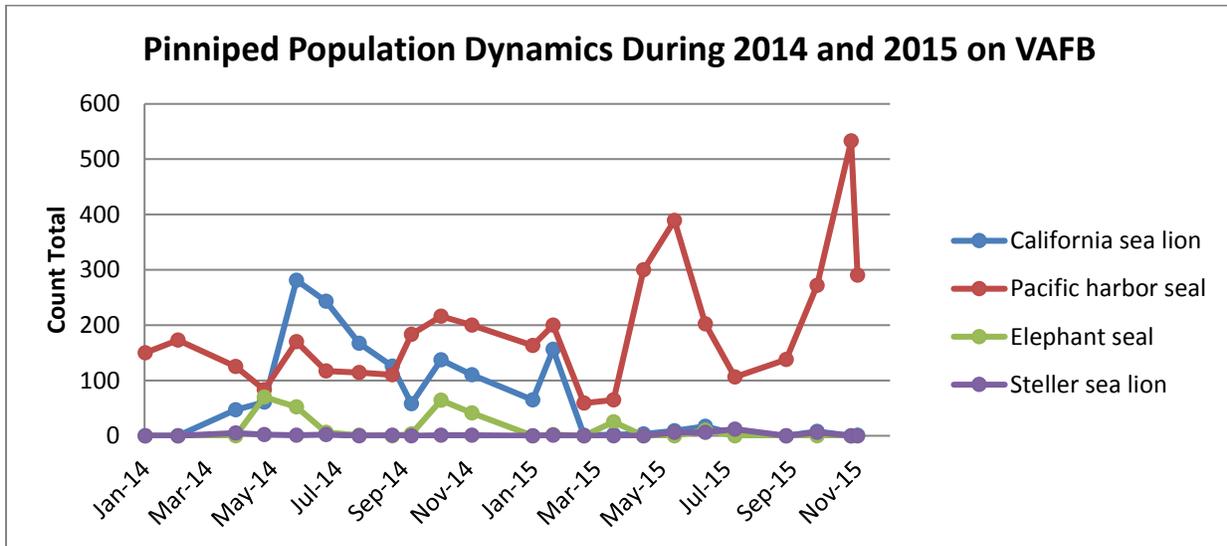


Figure 3. Monthly pinniped survey count totals for harbor seals, California sea lions, northern elephant seals, and Steller sea lions from March 2014 through November 2015 (MSRS 2014a, 2015a, CEMML *in prep.*). Full base surveys were not conducted in December due to poor weather conditions on the late December date that was selected.

4.4 Fixed-wing Aircraft and Helicopter Operations

During the reporting period, 8,075 operations were conducted from the VAFB airfield. Most of these consisted of overflights or training and proficiency flights involving practice approaches and “touch and goes.” Some were logistics flights involving the transfer of supplies, equipment and personnel. Many were also overflights, which were below 2,500 feet in altitude. The total number of take-offs and landings (including touch and goes) was 3,115. The total number of low altitude flights that did not use our airfield was 4,960. No indications of significant disturbances, abnormal pinniped behavior, injury or mortality were reported as a result of these operations (R. Evans, pers. comm. 2015).

5.0 Discussion

5.1 Effects of Natural Factors

Both seasonal and cyclic effects have been discussed in previous documents with haul-out numbers being affected by high tides, strong surf, pupping, breeding, and molting seasons (MMCG & SAIC 2012a and 2012b). Landslides also affect available haul-out locations, such as the continued landslide at Weaner Cove (MMCG & SAIC 2012b), which continues to be monitored (MSRS 2014a, 2015a). Predation risk from coyotes (*Canis latrans*) can make harbor seals wary of hauling out (Gearin *et al.* 1990; MMCG & SAIC 2012a), causing them to haul out in fewer numbers and quickly react to any movement from shore or from the bluffs. Some evidence suggests that there may be an increase in white shark (*Carcharodon carcharias*) predation on harbor seals in the region, which may be a contributing factor in the declining number of harbor seals observed on VAFB (MMCG & SAIC 2011 and 2012b); however, more study would be required to determine if sharks are having a significant impact on this population. In 2015, VAFB Natural Resources staff reported 12 southern sea otter (*Enhydra lutris nereis*) mortalities to our regulators.

5.2 Effects of VAFB Operations

There was no evidence of injury, mortality, or abnormal behavior as a result of the Atlas V NROL-55 or three MM III missile launches on VAFB or the NCI (MSRS 2015b, 2015c, 2015d). For each launch, pre-launch counts were similar to post-launch counts suggesting that if the launch had any effect on the seals, these effects were negligible and temporary. Activities associated with airfield operations did not cause any significant effects on pinniped counts, nor cause injury, mortality, or significant abnormal behavior.

6.0 Conclusions and Recommendations

The launch monitoring and monthly surveys were effective at assessing the effects of launch operations on pinniped populations at VAFB. Consistent results were obtained showing no indications of significant disturbances, abnormal behavior, injury, or mortality as a result of launch or aircraft operations. Responses to launches, when they did occur, were short-lived and of no significance. Fluctuations in counts were mostly due to environmental conditions, such as changing tides, rather than the disturbances associated with the launches. Monthly pinniped counts across VAFB show a cyclical, but stable population of harbor seals hauled out on VAFB (Figure 3).

There are ongoing discussions between VAFB and NMFS regarding possibly decreasing or eliminating all pinniped monitoring during and after ballistic missile test launches. We hope these discussions will continue. Additionally, further discussion between those parties is required in regards to monitoring possible impacts of VAFB space launches to Guadalupe fur seals on SMI.

7.0 Literature Cited

- Center for Environmental Management of Military Lands (CEMML) *in prep.* Marine Mammal Surveys 2015 Annual Report, Vandenberg Air Force Base, California. 19 pp.
- FWS, 2014. Reinitiation of the Biological Opinion Beach Management Plan on Vandenberg Air Force Base during the Western Snowy Plover Breeding Season (2014-2018) (8-8-12-F-11R)
- Gearin, P., M. Johnson, J. Calambokidis, and G. Steiger. 1990. Coyote (*Canis latrans*) Predation and scavenging on Harbor Seal (*Phoca vitulina*) pups. Cascadia Research Collective, Olympia, Washington. Unpublished manuscript.
- The Marine Mammal Center. (2015). Another Sea Lion Crisis Underway as Toxic Algal Bloom Grows. Retrieved December 1, 2015, from <http://www.marinemammalcenter.org/about-us/News-Room/2015-news-archives/toxic-algal-bloom.html>
- MMCG and SAIC. 2011. Annual Report, Monthly Marine Mammal Surveys Vandenberg Air Force Base, California. 1 February 2011 through 31 January 2012.
- MMCG and SAIC. 2012a. Annual Report, Monthly Marine Mammal Surveys Vandenberg Air Force Base, California. 1 February 2012 through 31 January 2013.
- MMCG and SAIC. 2012b. Technical Report: Population Trends and Current Population Status of Harbor Seals at Vandenberg Air Force Base, California. 1993-2012. September 2012. MMCG and SAIC.
- MSRS. 2014a. Marine Mammal Surveys 2013 Annual Report Vandenberg Air Force Base California. 1 March 2013 through 28 February 2014. 17 pp.
- MSRS. 2014b. Biological Marine Mammal Surveys, September 2014 – October 2014 Quarterly Report, Vandenberg Air Force Base, California. 17 November 2014.
- MSRS. 2015a. Marine Mammal Surveys 2014 Annual Report, Vandenberg Air Force Base, California. 17 pp.
- MSRS. 2015b. Biological Monitoring of the GT-214GM and GT-215GM Launches, Vandenberg Air Force Base, California. 4 May 2015.
- MSRS. 2015c. Biological Monitoring of the GT-212GM Launch, Vandenberg Air Force Base, California. 17 June 2015.
- MSRS. 2015d. Biological Monitoring of Pinnipeds on San Miguel Island for the 8 October 2015 Atlas V NROL-55 Launch, Vandenberg Air Force Base, California. 20 November 2015. 17 pp.
- NOAA, NMFS. 2014a. Taking Marine Mammals Incidental to U.S. Air Force Launches, Aircraft and Helicopter Operations, and Harbor Activities Related to Launch Vehicles From Vandenberg Air Force Base (VAFB), California; Federal Register Vol. 79, No. 36; 24 February 2014.
- NOAA, NMFS. 2014b. Letter of Authorization issued to U.S. Air Force, VAFB, 30th Space Wing, 26 March 2014.

SRS Technologies. 1999. Acoustic Measurement of the 16 September 1997 Peacekeeper and 13 November 1999 Minuteman III Ballistic Missile launches from Vandenberg Air Force Base. SRS Technologies System Development Division, Manhattan Beach, California. 34pp.

URS Group, Inc. 2013. Marine Mammal Monitoring for the 29 September 2013 Falcon 9 Cassiope Launch from SLC-4 East, Vandenberg Air Force Base, California.