

**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**

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Photo Credit: Tiffany Whitsitt-Odell

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Table of Contents

Executive Summary.....	iii
1.0 Introduction	1
2.0 Operations	2
2.1 Rocket Launches	2
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 Acoustic Monitoring.....	5
3.3 Launch Monitoring.....	5
3.4 Monthly Surveys	6
3.5 Fixed-wing Aircraft and Helicopter Operations	6
4.0 Results.....	7
4.1 Sonic Boom Modeling.....	7
4.2 Acoustic Measurements	7
4.3 Launch Monitoring.....	8
4.3.1. Atlas V NROL 79	8
4.3.2. Falcon 9 Iridium 2.....	9
4.4 Monthly Marine Mammal Surveys	9
4.5 Fixed-wing Aircraft and Helicopter Operations	12
5.0 Discussion.....	13
5.1 Effects of Natural Factors	13
5.2 Effects of VAFB Operations.....	13
6.0 Conclusions and Recommendations.....	13
7.0 Literature Cited	14

Tables

Table 1. Rocket Launches in 2017.....	2
Table 2. Missile Launches in 2017.....	2
Table 3. Launch Mitigation Requirements in 2017.....	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. Monthly Harbor Seal Survey Totals on VAFB (2014-2017).....	10
Figure 4. Monthly Pinniped Survey Totals on VAFB (2014-2017)	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) five-year Letter of Authorization (LOA) to the U.S. Air Force, Vandenberg Air Force Base (VAFB), 30th Space Wing (30 SW) for the incidental harassment of marine mammals related to missile, rocket, aircraft, and helicopter activities at Vandenberg Air Force Base (VAFB; NOAA 2014a). The LOA was originally issued on 26 March 2014, valid 26 March 2014 through 26 March 2019 (NOAA 2014a) after publication of the Federal Register Final Rule on 24 February 2014 (2014b) related to VAFB request for unintentional take of marine mammals pursuant to the Marine Mammal Protection Act (MMPA) regulation. The LOA was reissued on 20 December 2017 due to a new elephant seal rookery developing on VAFB and is valid from 01 January 2018 through 26 March 2019 (NOAA 2017).

This report describes pinniped monitoring conducted in association with space vehicle (rocket) 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*; harbor seals), California sea lions (*Zalophus californianus*), northern elephant seals (*Mirounga angustirostris*; elephant seals), and Steller sea lions (*Eumetopias jubatus*). At San Miguel Island (SMI), which is occasionally impacted by sonic booms from rockets, 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 to 31 December 2017) there were nine rockets and five missile or related vehicles launched from VAFB. Launches were avoided when possible during the harbor seal pupping season (1 March through 30 June) and if they would produce a sonic boom over the Northern Channel Island (NCI) during the harbor seal pupping season. For two launches, avoidance was not possible and pinniped monitoring was required. No Auditory Brainstem Response (ABR) studies were required for any rocket launches because such testing had already been performed for these vehicles (SRS 1999). During the reporting period, 6,727 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., 2018).

LOA monitoring requirements were followed during 2017 and no incidents of injury or mortality of a pinniped caused by VAFB operations were documented.

1.0 Introduction

This report presents information to satisfy the requirements of the LOA (NOAA 2014a) issued to VAFB by NMFS. In accordance with a new condition in the LOA (NOAA 2014a, 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 2017 (R. Evans, pers. comm., 2018).

Harbor seals are the most abundant pinnipeds on VAFB. California sea lions, elephant seals, and Steller sea lions are also present, with the latter two species increasing in recent years (MSRS 2014b, CEMML 2016a, CEMML 2016b, CEMML 2018). During the latter half of 2016 and throughout 2017, elephant seal numbers had a marked increase and they established a rookery at Amphitheatre Cove. Elephant seal pups were first documented in January 2017. The new LOA (NOAA 2017), effective 01 January 2018 requires launch monitoring of the elephant seal rookery beginning 01 January 2018.

Potential impacts to these pinniped 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 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 threshold shift (PTS), in which the animal's hearing is permanently diminished over part or all of its hearing range.

During the 2017 reporting period, monitoring on NCI and VAFB was required for the Atlas V NROL 79 launch and monitoring on VAFB was required for the Falcon 9 Iridium 2 launch. This report describes the methods and results of the marine mammal mitigation efforts and discusses the impacts of Air Force operations.

In July of 2016, informal consultation was conducted under the United States Endangered Species Act between the U.S. Air Force and NMFS. NMFS concurred that VAFB rocket launches are "not likely to adversely affect" the Guadalupe fur seal on the Northern Channel Islands.

2.0 Operations

Operations that occur on VAFB covered by the LOA include missile, rocket, aircraft, and helicopter activities. Operations activities occurring in 2017 are detailed below.

2.1 Rocket Launches

Nine rocket launches occurred during the reporting period from Space Launch Complexes (SLC) 2, SLC 3, SLC 4, SLC 6 and SLC 576-E on VAFB (Table 1). The locations of launch sites in relation to pinniped haul-out areas on VAFB are shown in Figures 1 and 2.

Table 1. Rocket Launches in 2017

Vehicle Type	Facility	Launch Date
Falcon 9 Iridium 1	SLC 4E	14 January
Atlas V NROL 79	SLC 3E	01 March
Falcon 9 Iridium 2	SLC 4E	25 June
Falcon 9 Formosat 5	SLC 4E	24 August
Atlas V NROL 42	SLC 3E	24 September
Falcon 9 Iridium 3	SLC 4E	09 October
Minotaur-C Skybox	576-E	31 October
Delta II JPSS 1	SLC 2	18 November
Falcon 9 Iridium 4	SLC 4E	23 December

2.2 Missile Launches

Four missile launches and one Ground-based Midcourse Defense (GMD) launch test occurred during the reporting period from Launch Facilities (LF) on north VAFB from LF-04, LF-09, LF-10, and LF-23 (Table 2). The locations of these sites in relation to pinniped haul-out areas on VAFB are shown in Figure 2. Four of the five launches were unarmed Minuteman III (MM-III) Intercontinental Ballistic Missiles (ICBMs) test launches. The GMD launch vehicle is of similar size and scope of a MM-III, and it produces approximately the same amount of noise/disturbance.

Table 2. Missile Launches in 2017

Missile Type	Facility	Launch Date
MM III GT-221GM	LF-10	09 February
MM III GT-220GM	LF-09	26 April
MM III GT-222GM	LF-04	03 May
GMD FTG-15	LF-23	30 May
MM III GT-223GM	LF-10	02 August

2.3 Fixed-wing Aircraft and Helicopter Operations

Various types of fixed-wing aircraft fly from VAFB. In accordance with the LOA, all aircraft and helicopter flight paths maintain a minimum distance of 1,000 feet from recognized pinniped haul outs and rookeries, except during emergencies or security incidents. Class 0-2 unmanned aerial systems may be flown within 200 feet of recognized pinniped haul outs and rookeries.

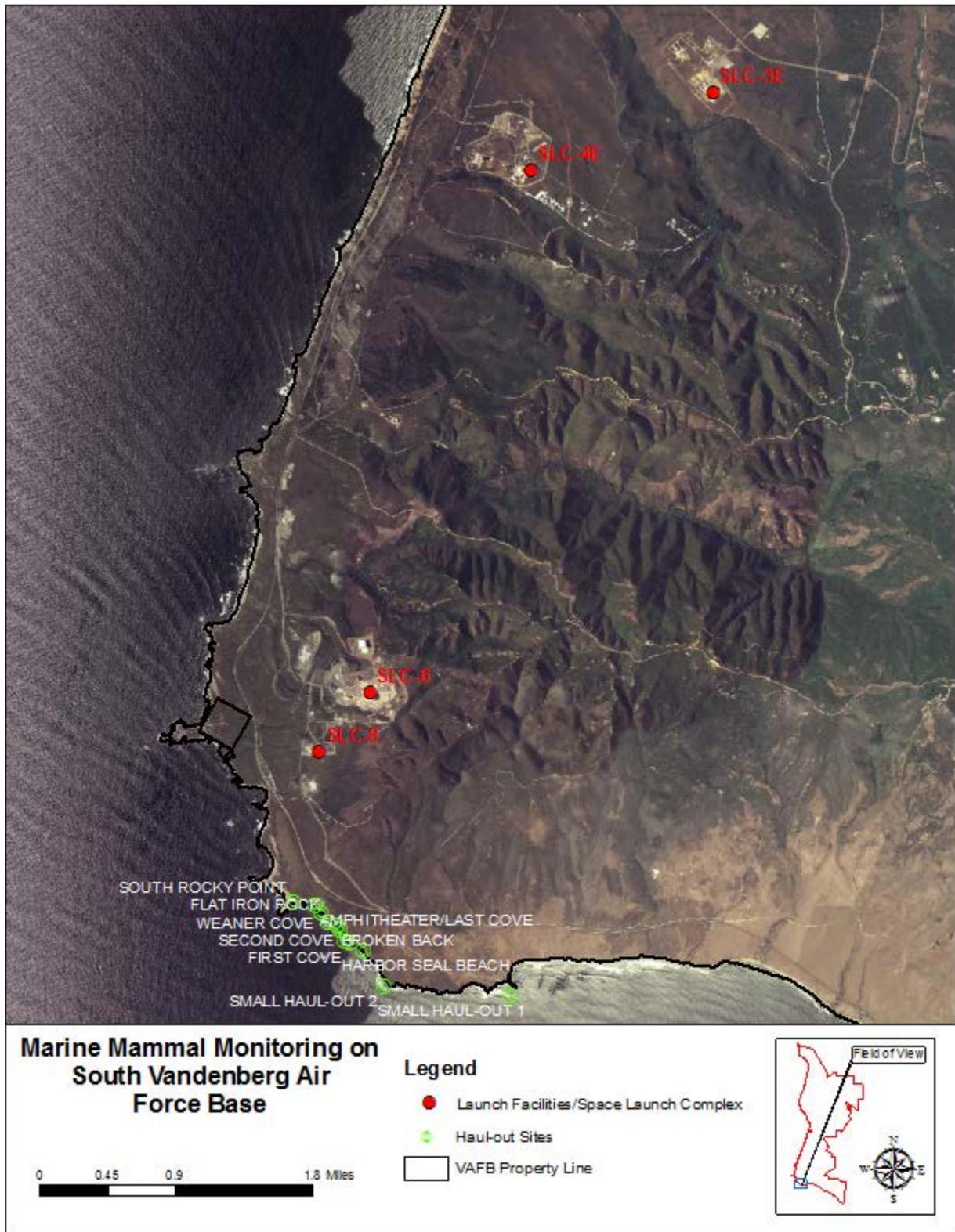


Figure 1. Launch Sites and Pinniped Haul-out Areas on South VAFB.

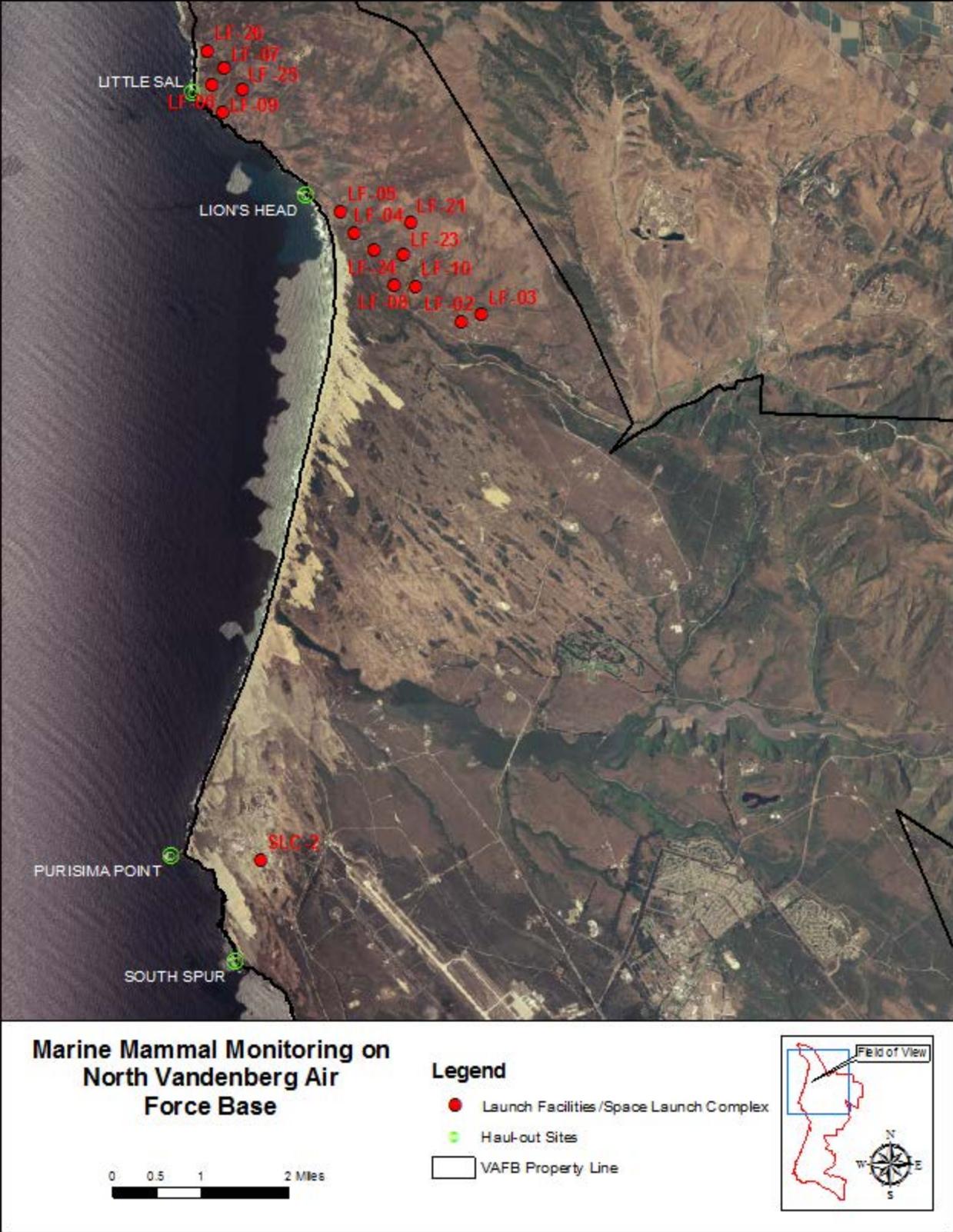


Figure 2. Launch Sites (several of which are inactive) and Pinniped Haul-out Areas on North VAFB.

3.0 Methods

3.1 Sonic Boom Modeling

As required in the LOA, sonic boom modeling is performed prior to all rocket launches. Modeling is not necessary for the missile launches because GT and GMD vehicles are launched with a westward trajectory and their sonic booms do not impact marine mammal haul-outs on VAFB or the NCI (NOAA 2014a). The modeling programs incorporate 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 include jet stream presence or absence, and if present, its direction, altitude, and velocity. Cloud type, altitude, and density are also considered. From these data, models predict peak amplitudes and impact locations.

3.2 Acoustic Monitoring

Acoustic monitoring is conducted on NCI when sonic boom modeling predicts impacts to the NCI in excess of the thresholds defined in the LOA. 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 calibrated sound level meter with all the necessary accessories. Measurements could be downloaded to a laptop and analyzed. A separate system with a calibrated digital audio tracking (DAT) recorder, preamplifier, and specialized microphone is used to obtain sonic boom measurements. The microphone is mounted on a tripod and fitted with a windscreen. The DAT tapes are analyzed in the laboratory to determine various acoustic properties of the rocket noise and sonic boom.

3.3 Launch Monitoring

Monitoring on the NCI is required if sonic boom modeling predicts a sonic boom greater than 1 psf is likely to impact one or more 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. Beginning 01 January 2018, pinniped monitoring is required on VAFB if a launch occurs during elephant seal pupping season (1 January through 28 February), this was not a requirement during the 2017 survey season. A continuing requirement is pinniped monitoring during the harbor seal pupping season (1 March through 30 June). Note that elephant seal weaners are expected to still be present at their rookery for the first few weeks of March, therefore harbor seal monitoring will also incorporate this species. 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, one day approximately two weeks after each launch. Monitoring must be conducted as close to the launch window as possible.

On VAFB, monitoring sites are selected based on the proximity of the launch location to the nearest active haul-out sites. The haul outs that are monitored for rocket launches from South VAFB include Amphitheatre Cove and may include North and South Rocky Point (Figure 1). Amphitheatre cove has historically been utilized as a harbor seal rookery and is now also utilized as an elephant seal rookery. 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.

Pinniped monitors used high quality binoculars and spotting scopes to make hourly counts and record species, number of individuals, sex, age class, and behavior within a predefined focal area. Several counts are conducted each day. Monitors may use night vision goggles (Exelis AN/PVS-7D (or similar) if monitoring occurs during hours of darkness. Remarks are recorded, including the nature and cause of any natural or human-related disturbance, such as low-flying aircraft or boat traffic. Incidental information may be recorded for other wildlife species. Environmental data collected includes tide level and time, 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 pinnipeds to the launch. Post-launch, the video equipment is collected and video reviewed with responses such as alert or flushing into the water noted. Alert is usually considered insignificant. When flushing is observed, the amount of time it takes for the number of hauled-out animals to return to the pre-launch count is determined if length of recording allows.

3.4 Monthly Surveys

The Center for Environmental Management of Military Lands (CEMML) and 30 SW, 30th Civil Engineer Squadron (30 CES) biologists surveyed marine mammal haul-out sites on North and South VAFB (Figures 1 and 2) monthly from January to December 2017. For each survey, high quality binoculars and a spotting scope are utilized depending on conditions. Monthly surveys are timed to coincide with the lowest weekday afternoon low tides. The location, species, number of individuals, age class, and sex (when possible) were recorded for each site and ocean and weather conditions are documented.

On VAFB, observations are made from cliffs overlooking haul-outs. Purisima Point has been omitted from all surveys throughout 2015-2017 because a permitted biologist must accompany anyone accessing Purisima Point during the California least tern and western snowy plover breeding season (1 March to 30 September). The site was not included in the remaining months (1 October to 28 February) in order to keep data consistent throughout the year.

In 2017 several haul outs on South VAFB (Harbor Seal Beach, First Cove, First Ledge, Second Cove, Broken Back, and Weaner Cove) were omitted from almost all surveys. This was due to significant decreased use of these sites in 2016, likely linked to increased cliff erosion in the area. This also allowed for adequate time to survey more heavily utilized haul outs (Amphitheatre Cove, South Rocky, and North Rocky) and potentially allow time to survey two new sites, East Islet and South Arguello Ridge. Additionally, three vantage points are now used to thoroughly survey North Rocky Point, which takes additional time.

3.5 Fixed-wing Aircraft and Helicopter Operations

The VAFB Airfield (30 OSS/OSAB) keeps records of number and nature of all fixed-wing aircraft and helicopter operations completed at VAFB.

4.0 Results

Based on modeling of launches and time of year, three monitoring efforts were required during 2017. Launch mitigation requirements are presented in Table 3 and discussed in detail in the following subsections.

Table 3. Launch Mitigation Requirements in 2017[^]

Vehicle or Missile	Launch Date	Monitoring				ABR Test	Boom Model
		NCI	VAFB	Acoustics	Video		
Falcon 9 Iridium 1	14 January						Required
MM III GT-221GM	09 February						
Atlas V NROL 79	01 March	Required	Required	Required	Required		Required
MM III GT-220GM	26 April						
MM III GT-222GM	03 May						
GMD FTG-15	30 May						
Falcon 9 Iridium 2	25 June		Required		Required		Required
MM III GT-223GM	02 August						
Falcon 9 Formosat 5	24 August						Required
Atlas V NROL 42	24 September						Required
Falcon 9 Iridium 3	09 October						Required
Minotaur-C Skybox	31 October						Required
Delta II JPSS 1	18 November						Required
Falcon 9 Iridium 4	23 December						Required

[^] Blank Cell = action not required

4.1 Sonic Boom Modeling

Sonic boom modeling was conducted for the nine rocket launches that occurred during the 2017 reporting period. The Atlas V NROL 42 launch was the only model that predicted sonic boom impacts to the NCI. Sonic boom modeling for the other eight launches predicted no boom impact on the NCI.

4.2 Acoustic Measurements

Acoustic monitoring was required for the Atlas V NROL 79 launch. Results of these surveys indicated that no significant acoustic impacts had occurred as a result of this launch. Acoustic measurements on SMI indicated that the peak boom at the pinniped monitoring site was about 2.2 psf, but this was in the infrasonic range and was very brief, so it could not be heard or detected by humans or animals. Within the audible frequency spectrum, the boom at the monitoring site likely measured about 0.8 psf.

4.3 Launch Monitoring

Two launches required monitoring during the 2017 reporting period. Monitoring on NCI and VAFB was required for the Atlas V NROL 79 launch and monitoring on VAFB was required for the Falcon 9 Iridium 2 launch. Full details of the following summary for the Atlas V NROL 79 launch on 01 March 2017 from SLC 3E can be found in the launch monitoring report sent to NMFS on 12 April 2017 (Leidos 2017). Full details of the following summary for Falcon 9 Iridium 2 launch on 25 June 2017 from SLC 4 can be found in the launch monitoring report sent to NMFS on 14 August 2017 (MSRS 2017).

4.3.1. Atlas V NROL 79

Monitoring at NCI was conducted at Cuyler Harbor on San Miguel Island (SMI) because it was determined to be the location supporting the largest amount of hauled out pinnipeds with elephant seal weaners, pups, and adults present that coincided with the highest predicted sonic boom impact (> 1 psf). Harbor seals and California sea lions appeared occasionally in the surf but were not observed hauled out. No harbor seal pups were present at the time of monitoring.

Several counts were conducted daily from 26 February – 03 March 2017. Monitoring occurred pre and post launch at the same tide cycle as what was present during the launch. On SMI harbor seals were not observed during the launch. One was observed approximately two hours post-launch and was exhibiting normal behavior. California sea lion were not seen on the day of the launch and only in low numbers (1 or 2 individuals) during monitoring on days pre and post launch. Total pre-launch counts for elephant seal adults ranged from 39-65, juveniles from 14-22, and pups from 182-265 individuals. Total post-launch counts for adults ranged from 37-67, juveniles from 31-42, and pups from 287-328 individuals. Five adult males and three adult females raised their heads in reaction to the booms, then returned to their prone resting positions within few seconds of the booms. Five pups raised their heads for about seven minutes following the booms, then returned to their resting positions. None of them moved toward the water.

Monitoring at VAFB was conducted at all haul-outs from Small Haul Out 1 north to Amphitheatre Cove on 26-28 Feb, 02-03 Mar, and 10 Mar. Surveys were conducted at the same days and times as the SMI surveys. The only haul outs to have pinnipeds were Small Haul Out 2 and Amphitheatre Cove. Small Haul Out 2 had harbor seals present every day with total pre-launch counts ranging from 4-9 individuals and total post-launch counts ranging from 9-20 individuals. At Amphitheatre Cove, two harbor seal pups were born in February which are anomalies as most harbor seal pups are born between 01 March and 31 May at VAFB. These pups remained on the beach throughout the pre and post launch monitoring. Total pre-launch counts for adults ranged from 20-26 and juveniles from 2-6 individuals. Total post-launch counts for adults ranged from 20-24 and juveniles from 6-11 individuals. On 10 March, fog at Amphitheatre Cove precluded visual survey, though individuals could be heard vocalizing. Overall no abnormal behavior, injuries, or mortalities were reported as a result of the launch.

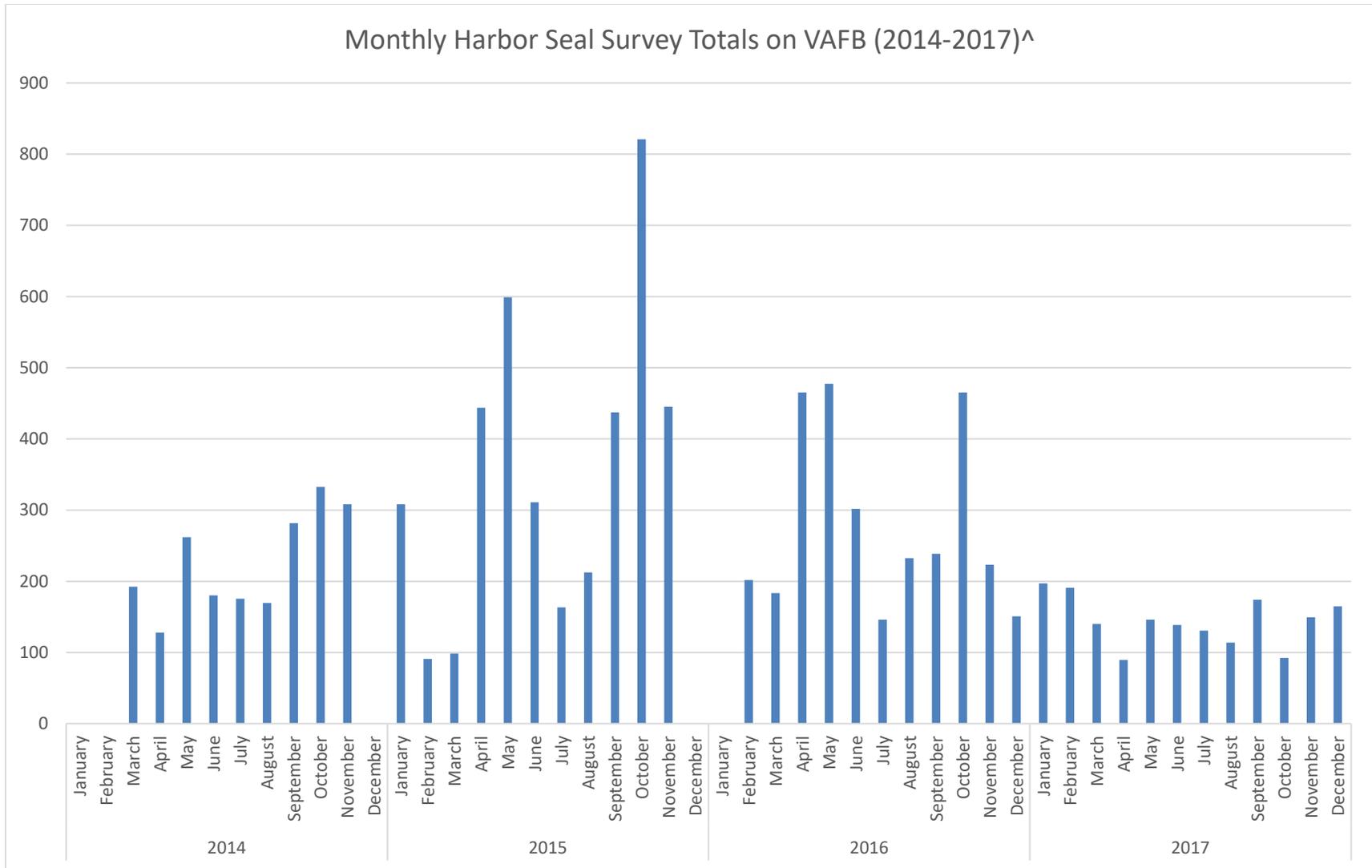
4.3.2. Falcon 9 Iridium 2

Monitoring at VAFB was conducted at all haul-outs between North Rocky Point and Weaner Cove on 22 - 27 June 2017. Pre-launch counts of adult and juvenile harbor seals ranged from 1 to 10 with no harbor seal pups observed. California sea lion pre-launch counts ranged from 1 to 28 for adults and juveniles, with 1 pup observed on one day. Elephant seal counts ranged from 4 to 12 adult and juveniles with no pups observed. Post-launch counts for harbor seals ranged from 1 to 5 adults and juveniles while no pups were observed. Post-launch counts for California sea lions ranged from 13 to 73 for adults and juveniles with no pups observed while elephant seal adults and juveniles ranged from 1 to 19 with one pup observed on South Rocky Point. Pinniped's response to the launch was documented via a video recorder, showing that all 14 juvenile California sea lions reacted by making movement toward the ocean but stopped before getting in the water and returned to the haul-out spot. Six of the nine juvenile elephant seals reacted by raising their heads but remained in place. Only one elephant seal weaner entered the water and did not return within the video recording window. During the following monitoring days, no pinnipeds were observed to have any injuries, mortality, or abnormal behavior. A follow-up count was performed two weeks after the launch on 9 July 2017, documenting similar numbers of pups and adults at the primary count locations. No evidence of injury, mortality, or abnormal behavior was observed during the follow-up count.

4.4 Monthly Marine Mammal Surveys

Monthly marine mammal survey results on VAFB are summarized here, with detailed results presented in a separate report to NOAA Fisheries annually (CEMML 2018). None of the monthly surveys suggested any changes in haul-out patterns as a result of launches. Figure 3 displays the monthly survey results of harbor seals and Figure 4 indicates the monthly survey results of elephant seals, California sea lions, and Steller sea lions on VAFB from 2015-2017.

Harbor seals are not all hauled out on shore at one time, thus a 1.54 correction factor is applied to the number of hauled out harbor seals observed to account for individuals in the water (Harvey and Goley 2011). All harbor seal counts in this document are calculated and reported based on this correction factor. Harbor seal totals in 2017 varied from a low of 89 in April to a high of 193 in January, with an average monthly count of 144 for the survey period. Pups were observed in all survey months except January, August, September, November, and December 2017, with a peak of 17 in May 2017. Two harbor seal mortalities were documented and reported to NMFS in May and June 2017 (R. Evans, pers. comm., 2017). Harbor seal totals were lower in 2017 compared to previous years. This may be a result of erosion causing several haul outs to become infrequently utilized or some other factor.



^Numbers reflect a 1.54 correction factor.

Figure 3. Monthly pinniped survey count totals for harbor seals from January 2014 through December 2017 (CEMML 2016a, 2016b, 2018 unpublished data).

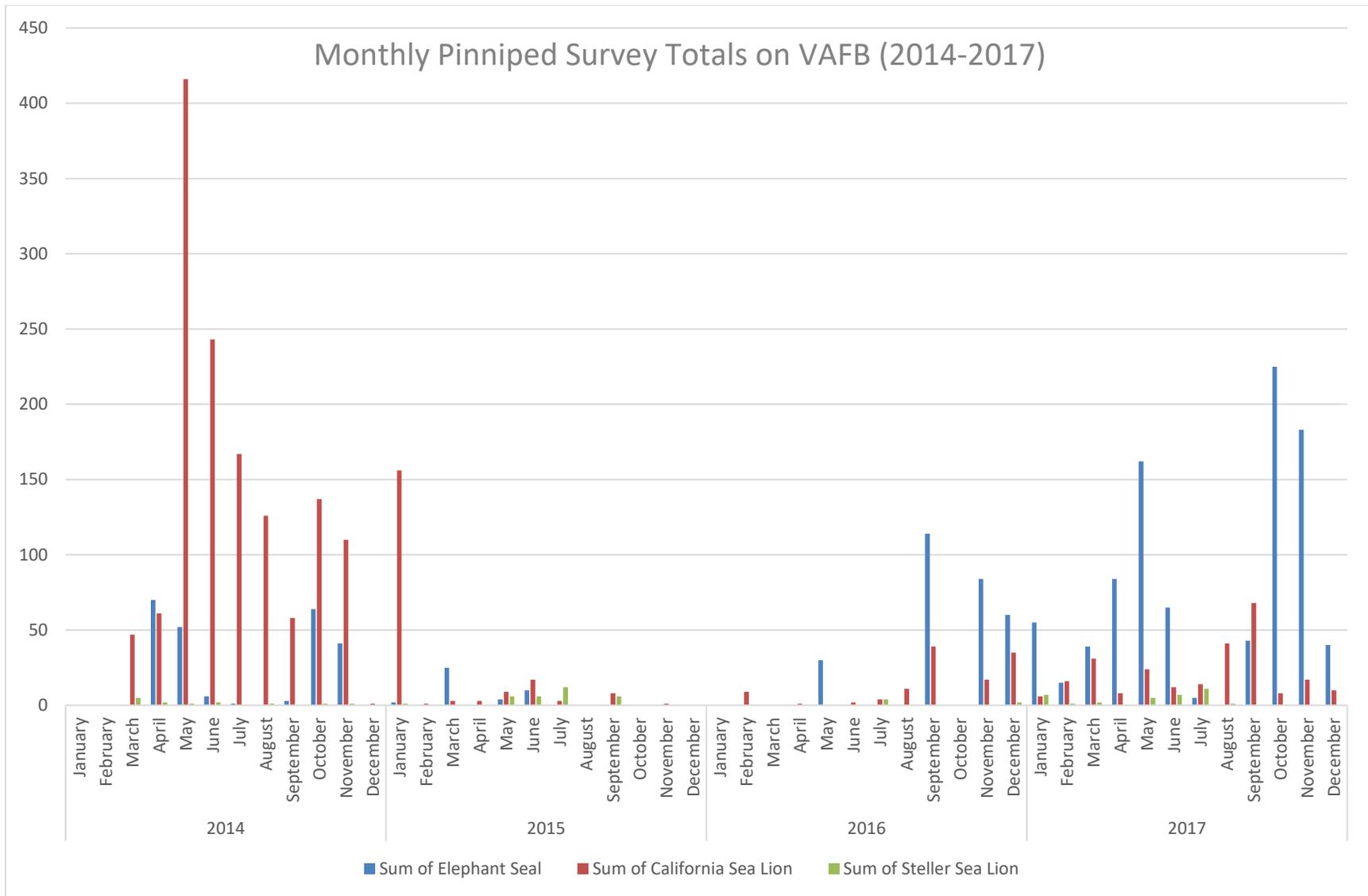


Figure 3. Monthly pinniped survey count totals for elephant seals, California sea lions, and Steller sea lions from January 2014 through December 2017 (CEMML 2016a, 2016b, 2018 unpublished data).

Elephant seals historically have hauled out in low numbers on VAFB beaches, with a total of 10 elephant seals observed on monthly counts between 2007 and 2010. Beginning in 2013, greater than average numbers of elephant seals were observed at South Rocky Point with numbers peaking at 191 individuals (mostly sub-adult males) in November 2013 (MSRS 2014a). Greater than average numbers were again reported in 2014, with a total of 237 elephant seal observations, there were smaller numbers in 2015 with a total of 41 individuals observed (likely due to South Rocky Point not being surveyed during the majority of months), and again an increase in 2016 with a total of 288. This trend has continued into 2017 with a total of 916 elephant seals detected during 2017 surveys. These numbers peaked in October with 225. One elephant seal mortality was documented and reported to NMFS in June 2017 (R. Evans, pers. comm., 2017). The most notable difference in 2017 was that elephant seal pupping was documented at Amphitheatre Cove. This location typically has subadult male elephant seals and occasionally some adult females present, but it had been extremely rare for a mature adult male to be present. An adult male was present beginning in December 2016 until February 2017. Pups were first documented on 09 January 2017 during routine surveys which documented five pups and eight adult females; an incidental survey on 26 January 2017 by 30 CES biologist Rhys Evans documented 1 adult male, 28 adult females and 19 pups. On 23 February 2017, 13 pups and one adult female were documented, indicating that by the end of February the pups were weaned. Once again in December 2017, pupping was documented with one pup present during the 28 December 2017 survey date. Beginning in September 2016, elephant seals have been regularly documented during surveys with totals greater than California sea lions and in some cases harbor seals as well (i.e. May, October, and November 2017).

Routine observations of California sea lions were recorded throughout 2014 to 2017 (Figure 4). During 2017, the highest number of California sea lion observations was 68 adults during September. California sea lions were most often observed utilizing the western slope and upper ledge of North Rocky Point. Three juveniles and no pups were observed during the 2017 survey period. Twenty-six California sea lion mortalities were documented and reported to NMFS in May, June, July, August, and September 2017 (R. Evans, pers. comm., 2017).

A total of 34 Steller sea lions were recorded at North Rocky Point in 2017 with a peak of 11 individuals in July. These totals are higher than 2016 (total 6) and 2014 (total 13) years surveys, but is similar to 2015 surveys which documented 31 Steller sea lions (Figure 4). Some of these totals may be artificially low as surveys completed prior 2017 did not survey the western slope of North Rocky Point. Based on survey data from 2014–2017, Steller sea lion numbers consistently peak in the summer at VAFB. No Steller sea lion mortalities were documented in 2017 (R. Evans, pers. comm., 2017).

4.5 Fixed-wing Aircraft and Helicopter Operations

During the reporting period, 6,727 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 are below 2,500 feet in altitude. The total number of take-offs and landings (including touch and goes) was 2,934. The total number of low altitude

flights that did not use our airfield was 3,793. No indications of significant disturbances, abnormal pinniped behavior, injury or mortality were reported as a result of these operations (R. Evans, pers. comm. 2018).

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, CEMML 2016, 2018). 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 reacting 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. Additionally, elephant seals have become more prevalent at Amphitheatre Cove as they have also establishing a rookery. It is unknown what effect this is having or may have on harbor seals' use of Amphitheatre Cove in the future. Harbor seals are still using this site as a rookery.

5.2 Effects of VAFB Operations

There was no evidence of injury, mortality, or abnormal behavior as a result of the rocket, missile, or GMD launches. No abnormal activity or mortalities were observed during the active monitoring of two launches this year or during monthly marine mammal surveys. No observations indicated that activities associated with airfield operations caused any significant effects on pinniped counts, or have caused injury, mortality, or significant abnormal behavior.

6.0 Conclusions and Recommendations

Two launches required monitoring and both concluded that no abnormal behavior, injuries, or mortalities resulted from these launch events, and in one case the associated sonic boom. Monthly surveys provided routine assessment potential effects of launch operations on pinniped populations at VAFB. In previous years, consistent results have been obtained showing no indications of significant disturbances, abnormal behavior, injury, or mortality as a result of launch or aircraft operations. In the past, responses to launches, when they did occur, were short-lived and of no significance. Fluctuations in monthly counts were mostly due to environmental conditions, such as natural landslides and 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).

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