LETTER OF AUTHORIZATION:
TAKING AND IMPORTING MARINE MAMMALS; TAKING MARINE MAMMALS INCIDENTAL TO SPACE VEHICLE AND TEST FLIGHT ACTIVITIES AT VANDENBERG AIR FORCE BASE, CALIFORNIA

ANNUAL REPORT

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Submitted To:
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National Marine Fisheries Service
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EXECUTIVE SUMMARY

This report provides the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA Fisheries Service) with information on pinniped monitoring associated with space vehicle and missile launches, and helicopter and fixed-wing aircraft operations at Vandenberg Air Force Base (VAFB) and San Miguel Island (SMI), California, for the reporting period from 7 February to 30 November 2009. The species of concern are Pacific harbor seals (*Phoca vitulina richardii*), California sea lions (*Zalophus californianus*), and northern elephant seals (*Mirounga angustirostris*) at VAFB, and California sea lions, northern elephant seals, Pacific harbor seals and northern fur seals (*Callorhinus ursinus*) on SMI. This information is provided in accordance with the NOAA Fisheries Service 5-year permit for the incidental harassment of small numbers of marine mammals (74 Federal Register 6236-6244) and the one-year Letter of Authorization (LOA) issued to the United States Air Force, VAFB, 30th Space Wing on 6 February 2009 and effective as of 7 February 2009.

During the reporting period covered under the current LOA, there were a total of six launches from VAFB: two missile launches and four space vehicle launches. One missile launch was not monitored, as it occurred outside of the VAFB Pacific harbor seal pupping season (March through June), while one missile launch was monitored. There was no evidence of injury, mortality or abnormal behavior in any monitored harbor seals at VAFB from this Minuteman III launch.

All four space vehicle launches that occurred during the reporting period were monitored in some capacity, although only acoustic monitoring was performed for the October 2009 Atlas V launch, as it fell outside of the VAFB Pacific harbor seal pupping season. An additional space vehicle launch occurred 1 day prior to the commencement of this LOA, on 6 February 2009; information on that launch is included in this report as it had not been previously reported in an annual or summary report. There was no evidence of injury, mortality, or abnormal behavior of the monitored harbor seals at VAFB, or monitored pinnipeds on SMI from these five space vehicle launches. No auditory brainstem response testing, to determine impacts to the hearing ability of pinnipeds exposed to launch noise or sonic booms, was performed during this reporting period.

In Fiscal Year 2009, there were 5,934 tower operations and 651 range operations from the VAFB Airfield. These operations occurred on both north and south VAFB. There were no observed impacts to pinnipeds from fixed-wing aircraft or helicopter operations.

INTRODUCTION

Under the Marine Mammal Protection Act of 1972, the 30th Space Wing at Vandenberg Air Force Base (VAFB) was issued a 5-year 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] 2009), hereafter referred to as the 5-year Permit; and a 1-year Letter of Authorization (Department of Commerce, NOAA, National Marine Fisheries Service [Fisheries Service] 2009), hereafter referred to as the LOA. This LOA allows specified launch programs, aircraft flight test operations, and helicopter operations to unintentionally take small numbers of marine mammals. VAFB is required to comply with the conditions listed in this LOA and address NOAA Fisheries Service concerns regarding marine mammals at VAFB and on 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). The total population of harbor seals inhabiting the VAFB area was estimated at up to 1,115 seals in 2002 (SRS Technologies 2003). Up to 502 harbor seals have been seen hauled out at any one time (SRS Technologies 2003).

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 of the western 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).

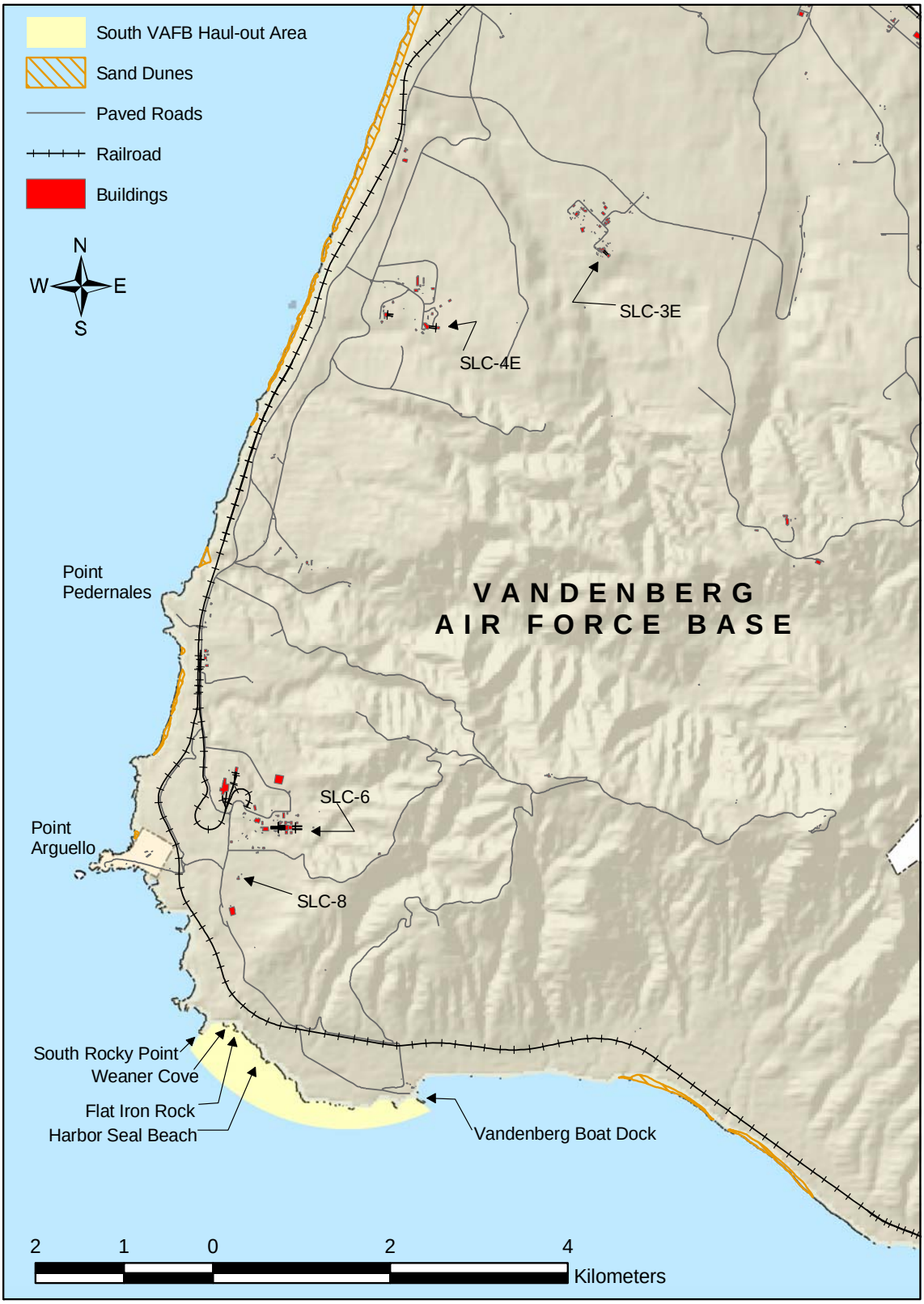

Figure 1. Map of the south VAFB harbor seal haul-out sites, and south VAFB Space Launch Complexes (SLCs).

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

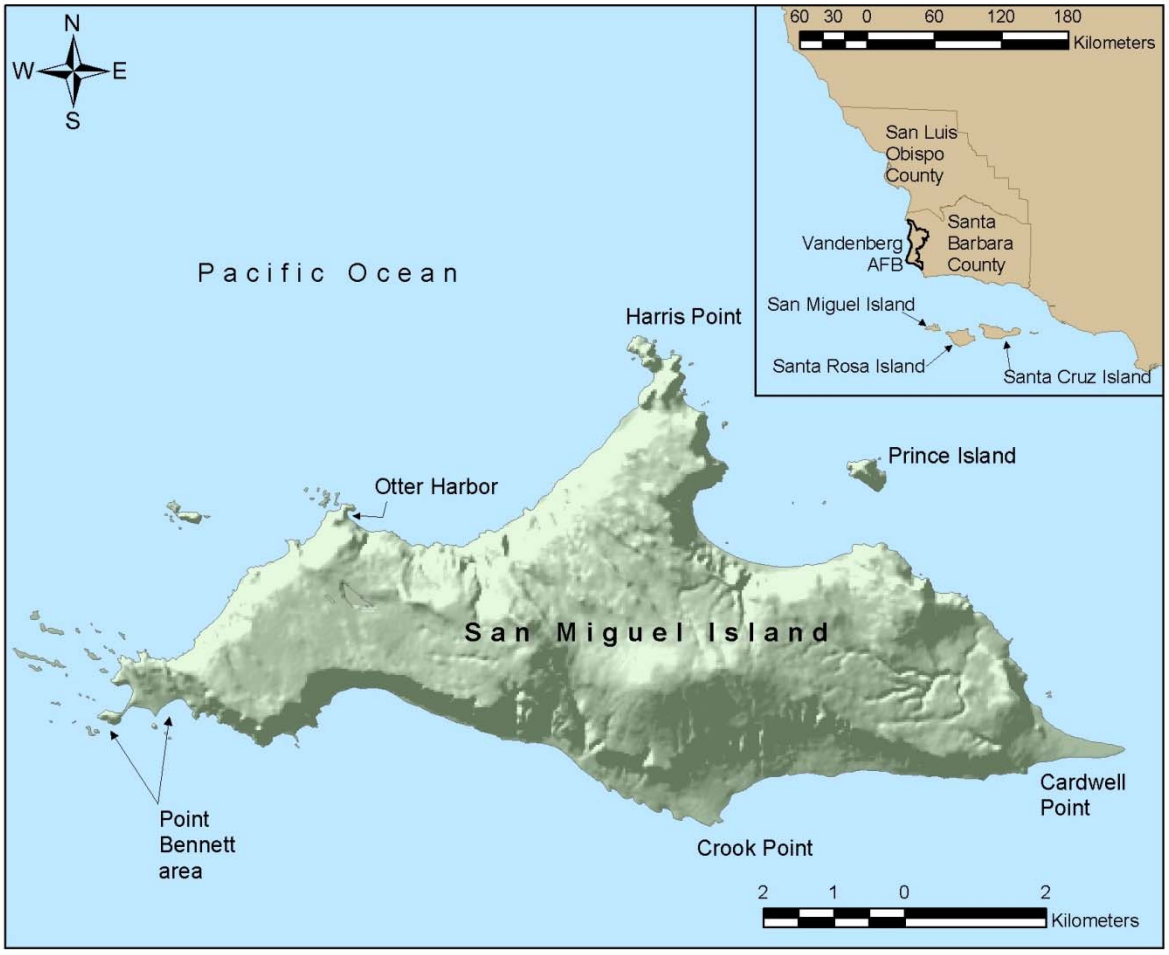

Figure 3. San Miguel Island and its monitoring sites. Inset shows the NCI in relation to VAFB.

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 Service/National Marine Mammal Laboratory [NMML], personal communication), over 10,000 elephant seal pups (Lowry 2002), and several hundred northern fur seal pups (Forney et al. 2000) 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.

METHODS

During the period covered under the current LOA (7 February through 30 November), there were a total of six launches from VAFB: two missile launches and four space vehicle launches. One missile launch was not monitored, as it occurred outside of the VAFB Pacific harbor seal pupping season (March through June), while one missile launch was monitored. All four space vehicle launches were monitored in some capacity. An additional space vehicle launch occurred 1 day prior to the commencement of this LOA. Information on the launch monitoring performed for that Delta II launch is included in this report, as it was not included in a previous annual or summary report (ManTech SRS Technologies 2008). The protocol used throughout this reporting period, and described herein, follows the established protocol outlined in the 5-Year Permit and the LOA.

No Auditory Brainstem Response (ABR) testing was required or performed during this reporting period as no Delta IV (one of the largest launch vehicles with a launch site closest to the main haul-out area [Figure 1]) or other launches occurred for which testing would be appropriate. For that reason, no methods or results for ABR testing are included in this report.

SONIC BOOM MODELING

Approximately 1 month prior to a scheduled launch, PCBoom3, 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 (Figure 3). 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.

BIOLOGICAL MONITORING

VAFB

The LOA requires monitoring of pinnipeds at VAFB, primarily harbor seals, although elephant seals may also be monitored when hauled out near harbor seals on south VAFB during El Niño events. Monitoring is required 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 2 weeks of the launch. A time-lapse video recorder was also set up at the haul-out site for daylight launches during pupping season. 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. For launches that occurred during night-time hours, counts were made either immediately before dark or, more often, as close to sunrise as possible. 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 and the SLCs and LFs on south and north VAFB, respectively.

Counts at all haul-out sites 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 wind gauge with a built-in

Table 1. Types of launch vehicles, their launch sites, and monitored VAFB haul-out or acoustic monitoring site for launches between 6 February and 30 November 2009.

Type of Launch Vehicle	Launch Facility or Complex	Monitored VAFB Haul-Out or Acoustic Site
Atlas V	SLC-3E	South VAFB (Oil Well Canyon)
Delta II	SLC-2W	Spur Road
Minuteman III	LF-04, LF-09	Lion's Head
Taurus	576E	Spur Road

thermometer was used to obtain wind speed and air temperature. 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 tidal prediction program, JTides 5.2 using the Port San Luis, CA site. While Port San Luis is not the closest site to VAFB, its tides have been found to more accurately reflect conditions at VAFB than the Avila Beach, CA site, which is closer.

SMI

The LOA requires 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 1 pound per square foot (psf) is predicted to impact the islands. In accordance with the LOA, observations of selected pinnipeds were made at various locations on SMI, depending on the location of the predicted boom. Monitored locations on SMI for launches from 6 February through 30 November 2009 included Adams Cove and West Judith Cove, both in the vicinity of Point Bennett. The monitored sites were selected because higher psf levels of a predicted boom were anticipated, as well as impacting a major area for pinnipeds, or a smaller area of pinnipeds within a pupping season.

Pre- and post-launch counts were completed if a sonic boom impacted the island. No post-launch counts were made if no 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 window. 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.

ACOUSTIC MONITORING

As no new launch vehicles were launched during the reporting period, acoustic monitoring did not need to be performed at VAFB, as stipulated in the LOA. However, because there was an equipment malfunction during the acoustic monitoring for the initial Atlas V launch in March 2008, acoustic monitoring was performed for the second Atlas V launch from VAFB in October 2009. The remaining launches during the reporting period were not acoustically monitored at VAFB, as required acoustic monitoring for on-going programs was completed under the previous 5-year permit.

Acoustic monitoring on SMI was performed when sonic booms greater than 1 psf were predicted to impact the NCI. Acoustic monitoring on SMI was performed for three Delta II launches during this reporting period.

A system consisting of 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 was used to monitor the sound environment and to measure launch noise and sonic booms (Figure 4). This system is linear over a wide range of frequencies, and is specially tailored for recording the low frequency sound associated with rocket launches and sonic booms. The microphone was designed by the manufacturer to have a low frequency cut-off (-3.0 decibels [dB]) at 0.015 Hertz (Hz).

This DAT system records the launch noise and sonic boom digitally to tape, which allows for detailed post-analysis of the frequency content, and the calculation of other acoustical metrics. Using Maxell HS4/90 DAT tapes, the DAT system will record

Figure 4. DAT system used to record the launch noise and sonic booms.

for just over 3 hours, providing ample time to record launch noise or sonic booms. The digital data was directly downloaded from the DAT recorder to a computer using TEAC QuikVu software and hardware. The waveforms were then analyzed using custom routines programmed in MatLab, a technical computing language.

VAFB

For the Atlas V DMSP-18 launch, the DAT was located at Oil Well Canyon, the sound monitoring site regularly used during south VAFB launches. The DAT microphone was mounted 1.2 meters (m) above the ground atop a single tripod. The microphone was covered by an extra large wind ball (18 centimeter [cm] diameter) and mounted in a short length of weatherproofing PVC. The system was calibrated prior to launch using a Bruel and Kjaer sound level calibrator type 4220 (123.8 dB calibration tone at 250 Hz).

SMI

A TEAC DAT recorder was placed near the biological monitoring site on SMI (Figure 6) and set up to record the potential sonic boom. The microphone was mounted inverted (grid cap facing down), five millimeters above a custom- made heavy steel plate. This mounting configuration has been shown to accurately collect sonic boom waveforms (Lee 1988). For protection from the wind, several layers of thin nylon material enclosed the steel plate holding the microphone. Prior to the collection of data, the DAT recorder was calibrated with a Bruel & Kjaer sound level calibrator type 4230 (94 dB calibration tone at 1000 Hz). During the launch event, the acoustic monitoring personnel watched the equipment display to determine if the equipment registered a sonic boom impact.

Figure 5. The DAT system used to record sonic booms from launch vehicles passing over near SMI.

PROGRAMS AND OPERATIONS

SPACE LAUNCH VEHICLES PROGRAMS

In 2009, there were five space launch vehicle programs with active facilities on VAFB. On north VAFB, the Delta II (SLC-2W) and Taurus (576E) space launch vehicles are launched from within 0.7 to 2.2 kilometers (km) of the Spur Road and Purisima Point harbor seal haul-out sites (Figure 2). On south VAFB the Atlas V (SLC-3E), Delta IV (SLC-6), and Minotaur (SLC-8) are launched from within 1.4 to 8.5 km of the harbor seal haul-out area between Harbor Seal Beach and South Rocky Point (Figure 1). The Delta IV vehicle did not have any launches in 2009. The Falcon program (operated by Space Exploration Technologies Corporation) is currently planning to launch from SLC-4E, but has yet to launch from VAFB.

OTHER PROGRAMS

Minuteman III missiles are intercontinental ballistic missiles (ICBM) launched from silos on the northern part of north VAFB. The missile launch facilities are 11 to 16.5 km north of the Spur Road and Purisima Point harbor seal haul-out sites (Figure 2). The small Lion's Head haul-out site to the north is within 0.65 to 3.9 km of the ICBM launch facilities.

In addition to the Minuteman III missiles, a variety of smaller target or intercept missiles launch from the northern part of north VAFB. These launches have included Missile Defense Agency (MDA) missiles, the Booster Verification Test vehicle, and the Scud missile. These missiles are much smaller than the Minuteman III (18.0 m in length x 1.7 m in diameter) and range in size from the HERMES (4.0 m in length x 0.6 m in diameter) to the Booster Verification Test vehicle (15.8 m in length x 1.4 m in diameter).

FIXED-WING AIRCRAFT AND HELICOPTER OPERATIONS

A variety of fixed-wing military aircraft use the airfield (Figure 2) on north VAFB. All pilots must fly outside of the 1,000-foot bubble around pinniped rookeries and haul-

out sites, except when performing emergency rescue missions, when responding to a security incident, or during an aircraft emergency (VAFB 2009). VAFB has approximately 120 fixed-wing flights per year and 10,000 take offs and landings (training operations), which occur mostly on north VAFB (VAFB 2009).

Helicopters use the airfield on north VAFB but may fly over all areas of the base. Helicopters are used for launch surveillance and rescue purposes. Like fixed-wing aircraft, all helicopter pilots must fly outside of the 1,000-foot bubble around pinniped rookeries and haul-out sites unless performing an emergency rescue mission, responding to a security incident, or during an aircraft emergency (VAFB 2009). After the 2007 relocation of a VAFB-based helicopter squadron to another Air Force installation, VAFB now typically has less than five helicopter sorties per month (VAFB 2009).

SPACE VEHICLE LAUNCHES

DELTA II NOAA-N Prime, 6 February 2009

The Delta II NOAA-N Prime launch occurred from SLC-2W on 6 February 2009, at 0222 Pacific Standard Time (PST). As the launch occurred outside of the VAFB harbor seal pupping season, no biological or acoustical monitoring was required or performed on VAFB. Using the PCBoom3 program, it was predicted that a sonic boom greater than 1 psf could impact SMI. In accordance with the LOA, personnel were sent to SMI to conduct biological monitoring of selected pinnipeds, and to record any potential sonic booms.

Observations of northern elephant seals were conducted from 1 through 7 February at East Adams Cove, in the vicinity of Point Bennett on the west side of SMI. The pre-launch monitoring period was extended due to launch delays. The number of adult elephant seals within the focal group over the launch monitoring period ranged from 225 to 249 seals. Post-launch counts fell within the pre-launch range. The number of elephant seal pups in the focal group over the course the monitoring period ranged from 185 to 218 pups. Post-launch counts of pups exceeded pre-launch counts.

Monitoring on SMI was also performed immediately prior to and during the launch using a night vision scope. At the time of the launch, the Delta II vehicle was not visible to monitors on SMI due to the dense cloud cover. At 0226 PST, monitors heard a faint rumbling in the distance which was barely audible over the crashing waves. No elephant seals exhibited a change in behavior or moved toward or into the water; no vigilant or alert behaviors were observed. The four pups observed to be suckling prior to the launch remained suckling throughout the observation period (0200 to 0246 PST). Post-launch analysis of the DAT recording showed that no sonic boom had been recorded.

Between 18 and 22 dead pups were seen each day during the launch monitoring period, both before and after the launch occurred. On 7 February, the second day after the launch, two of the dead pups were noted to be “freshly dead”. These two fresh dead pups were thought to have been a result of high swell that was present on the monitored beach. High swells and tides are one of the major causes of mortality in dependent elephant seal pups (Le Boeuf and Laws 1994).

A dead adult female elephant seal, with puncture marks in her back, was observed near the tide line on 6 February in the morning following the launch. Although monitors were uncertain if a sonic boom had been produced by the Delta II NOAA-N Prime launch, post-launch monitoring was continued for this reason. Upon review of photographs taken of the dead adult female present on the morning after the Delta II NOAA-N Prime launch, it was determined (by Philip Thorson, Ph.D.) that she had bite injuries. The bite injuries, which were just below the neck, indicate that the female was likely killed by an aggressive male attempting to mate with her (Le Boeuf and Mesnick 1990).

In summary, based on post-launch analysis, there was no evidence of injury, mortality, or abnormal behavior in any of the monitored elephant seals on SMI as a result of the launch of the Delta II NOAA-N Prime.

TAURUS OCO, 24 February 2009

The Taurus OCO launch occurred from 576E on 24 February 2009, at 0155 PST. As the launch occurred outside of the VAFB harbor seal pupping season, no biological

or acoustical monitoring was required or performed on VAFB. Using PCBoom3, a sonic boom modeling program, it was predicted that no sonic boom greater than 1 psf would impact the NCI. Therefore, no biological or acoustical monitoring was required or performed there.

DELTA II STSS ATRR, 5 May 2009

The Delta II STSS ATRR launch occurred from SLC-2W on 5 May 2009, at 1321 Pacific Daylight Time (PDT). In accordance with the LOA, quantitative biological monitoring of harbor seals at the north VAFB Spur Road harbor seal haul-out site was performed for this launch, as it occurred during the harbor seal pupping season. No acoustical monitoring was performed at VAFB for this launch, as the noise from Delta II vehicle had been well quantified during previous Delta II launches.

Using the PCBoom3 program, it was predicted that a sonic boom greater than 1 psf could impact SMI. In accordance with the LOA, personnel were sent to SMI to conduct biological monitoring of selected pinnipeds, and to record any potential sonic booms.

Diurnal observations of harbor seals were conducted at the north VAFB Spur Road harbor seal haul-out site from 2 through 4, and 6 and 7 May 2009. The number of harbor seals (including all age classes, except pups, as differentiated below) observed during the monitoring period ranged between zero and 27 seals. Between zero and one pup was seen during the monitoring period.

Direct observations during the launch (1324 PDT) could not be made due to safety concerns that require personnel to evacuate the area. A time-lapse video recorder was set up and recorded a selected portion of the haul-out site during the launch. At the time of the launch, no seals were hauled out at the site due to the presence of a coyote that caused all the seals to flush into the water prior to the launch. The coyote left the frame of the camera during the launch.

During the post-launch follow-up survey conducted on 12 May, 24 harbor seals and one pup were observed. Two fishermen were also present in the area, sitting on the shore and fishing just inland from the rocks. At 1320 PDT a fisherman stood; the seals raised their heads and were at the same time hit by a large wave. Eleven of the

seals flushed into the water and did not haul out again by 1400 PDT, when 13 adult seals and one pup were present. The monitor believed it was the combination of events (large wave and the fisherman standing) that caused the seals to flush, instead of just alerting at the movement and then resuming rest. No other disturbances, natural or human-caused, were observed during the monitoring period or follow-up survey.

On SMI, observations of California sea lions and northern elephant seals were conducted from 2 through 7 May at West Judith Cove on the west side of SMI. There were between 262 and 684 sea lions observed each day. Only two pups were observed being whelped during the monitoring period, and both died soon after birth and prior to the launch. The highest sea lion count seen over the course of the monitoring period occurred on the day of the launch and after it, with a high of 684 sea lions. The number of elephant seals observed over the course of the monitoring period ranged from 97 to 339 elephant seals.

During the launch event the monitors recorded that the rocket was not visible due to the dense cloud cover, but some faint crackling associated with the rocket boosters was audible in the distance. At 1329 PDT, a sonic boom was heard. The monitors reported that the boom was moderately weak and did not cause the sea lions, elephant seals, or even the gulls in the area, to alert. Behaviors were noted to be completely unchanged, and no animals raised their heads in response to the sound.

The peak overpressure of the sonic boom was measured to be 0.76 psf (125.2 dB) with the majority of acoustic energy being below several hundred Hz. The unweighted sound exposure level (SEL) was 120.0 dB, the C-weighted SEL was 86.6 dB and the A-weighted SEL was 110.5 dB. The rise time (10 to 90 percent of the peak overpressure) was 6.91 milliseconds, which was relatively slow for a sonic boom.

In summary, there was no evidence of injury, mortality, or abnormal behavior in any of the monitored harbor seals at VAFB or the monitored sea lions or elephant seals on SMI as a result of the Delta II STSS ATRR launch.

DELTA II Worldview-II, 8 October 2009

The Delta II WorldView-II launch occurred from SLC-2W on 8 October 2009, at 1151 PDT. As the launch occurred outside of the VAFB harbor seal pupping season,

no biological or acoustical monitoring was required or performed on VAFB. Using the PCBoom3 program, it was predicted that a sonic boom greater than 1 psf could impact SMI. In accordance with the LOA, personnel were sent to SMI to conduct biological monitoring of selected pinnipeds, and to record any potential sonic booms. Monitoring at Point Bennett, specifically Adam's Cove, on SMI began on 5 October 2009, and included monitoring prior to, during, and immediately after the launch.

Immediately prior to the launch, monitors were able to view 938 adult and pup California sea lions, 282 adult and pup northern fur seals, and 48 subadult and female northern elephant seals. The launch vehicle was not seen or heard during the launch window, and no sonic boom was heard or recorded. None of the monitored animals made any visible movements outside of normal behavior during or after the launch, and animals continued to haul out at the site and persist at high numbers immediately after the launch.

No further biological observations were made on SMI, as no sonic boom was heard by the monitors or registered on the acoustic monitoring equipment. No further analysis was performed on the SMI biological or acoustic data from this launch, and no report was generated for this launch.

In summary, there was no evidence of injury, mortality or abnormal behavior of the monitored pinnipeds on SMI as a result of the Delta II WorldView-II launch.

ATLAS V DMSP-18, 18 October 2009

The Atlas V launch occurred from SLC-3E on 18 October 2009, at 0912 PDT. As the launch occurred outside of the VAFB harbor seal pupping season, no biological monitoring was required or performed on VAFB. Using PCBoom3, a sonic boom modeling program, it was predicted that no sonic boom greater than 1 psf would impact the NCI. Therefore, no biological or acoustical monitoring was required or performed there.

Due to an equipment malfunction during the acoustic recording of the initial Atlas V launch in March 2008, only an incomplete acoustic profile was obtained. Therefore, acoustic monitoring of this second Atlas V launch was performed.

Acoustic measurements at VAFB were made at Oil Well Canyon (N 34.55657^{o}, W 120.6246^{o}) approximately 9.8 km southwest of SLC-3E. The DAT recorder provided detailed information on the launch noise. The A-weighted 1-hour average sound levels (L_{eq1H}) at VAFB in the Oil Well Canyon area typically range from 35 to 60 dB with an average of 52 dB (Thorson et al. 2001). During the launch, the unweighted SEL was 125.2 db, while the C-weighted SEL was 119.0 db and the A-weighted SEL was 95.2 db. The unweighted peak level was 118.6 db and the A-weighted peak level was 116.2 db. The majority of the sound from the Atlas V DMSP-18 was produced within the first 120 seconds of the launch, but some low-frequency rumbling and crackling was audible for over 5 minutes after launch.

SUMMARY

Table 2 provides a summary of all space vehicle launches from VAFB during the reporting period (7 February through 30 November), with the addition of the Delta II launch that occurred on 6 February, the day prior to the LOA commencement. It also provides information on monitoring performed for each launch.

Table 2. Summary of space vehicle launches from VAFB and monitoring conducted during this reporting period.

Vehicle	Date (2009)	Time	Launch Site	Monitoring Conducted
Delta II NOAA-N Prime	6-Feb	0222 PST	SLC-2W	SMI
Taurus OCO	24-Feb	0155 PST	576E	No
Delta II STSS ATRR	5-May	1324 PDT	SLC-2W	VAFB/SMI
Atlas V DMSP-18	18-Oct	0912 PDT	SLC-3E	VAFB (Acoustics Only)

OTHER LAUNCHES

MINUTEMAN III GT-199 GM, 29 June 2009

The Minuteman III GT-199 GM launch occurred from LF-04 on 29 June 2009, at 0301 PDT. Due to the Minuteman's westward launch trajectory, no sonic boom modeling or launch monitoring was required on the NCI for this launch. Additionally, no acoustic recordings were required as noise from the Minuteman launch vehicle has been well quantified by measurements performed for previous Minuteman launches.

Diurnal observations of harbor seals were conducted at the Lion's Head haul-out site from 26 June through 1 July 2009. The number of harbor seals (including all age classes, except pups, as differentiated below) observed at the Lion's Head haul-out site during the monitoring period ranged between zero and 11 seals, with daily maximum numbers ranging from three to 11 seals. Pre-launch counts (from 26 through 28 June) ranged between zero and six seals, with daily maximums ranging from three to six seals. Post-launch counts (from 29 June through 1 July) exceeded pre-launch counts and included daily maximum counts ranging from seven to 11 seals. No pups were seen during the launch monitoring period. A follow-up survey, as required during harbor seal pupping season, was also conducted at Lion's Head haul-out site on 7 July. No harbor seals were observed, but a single juvenile California sea lion (*Zalophus californianus*), which appeared healthy, was observed hauled out at the site.

While the launch occurred during hours of darkness on 29 June, the launch lit up the haul-out area within the frame of a video recorder that had been placed at the site in case the launch occurred after sunrise. No seals were present within the recorder's frame at the time of the launch.

Given that post-launch counts exceeded pre-launch counts, and no seals were present within the video recorder's frame at the haul-out site during the launch, it is unlikely that the launch resulted in any negative effect on the seals. There was no evidence of injury, mortality, or abnormal behavior in any monitored harbor seals resulting from the launch of the Minuteman III GT-199 GM.

MINUTEMAN III GT-195 GM-2, 23 August 2009

The Minuteman III GT 195 GM-2 launch occurred from LF-09 on 23 August 2009 at 0901 PDT. As this launch occurred outside of the VAFB harbor seal pupping season, no biological or acoustical monitoring was required or performed.

SUMMARY

Table 3 provides a summary of all other launches from VAFB during the reporting period (7 February through 30 November), and provides information on monitoring performed for each launch.

RESEARCH ACTIVITIES

In addition to the above activities, surveys of pinniped numbers at each of the VAFB haul-out sites were conducted during each month of 2009 (Table 4). Activities were conducted under Scientific Research Permits (No. 859-1680-01 and 14197) and results will be published in the annual report for the current permit.

Table 3. Summary of all other launches from VAFB and monitoring conducted during this reporting period.

Launch Vehicle	Date (2009)	Time	Launch Site	Monitored
Minuteman III GT-199 GM	20-Jun	0301 PDT	LF-04	Yes
Minuteman III GT-195 GM-2	23-Aug	0901 PDT	LF-09	No

Table 4. Dates for monthly surveys in 2009.

Monthly Survey Dates (2009)										
9-Jan	6-Feb	5-Mar	6-Apr	12/19-May	3-Jun	20-Jul	31-Aug	16/17-Sep	15-Oct	13-Nov

FIXED-WING AIRCRAFT AND HELICOPTER OPERATIONS

In Fiscal Year (FY) 2009, there were 5,934 tower operations and 651 range operations from the VAFB Airfield (W. Schobel, 2 ROPS/DON, pers. comm.). Tower operations include all arrivals and departures from the airfield, while range operations include activities such as overflights, flight tests, etc. Helicopter and fixed-wing operations occurred on both north and south VAFB. There were no observed impacts to pinnipeds from the fixed-wing aircraft or helicopter operations that occurred in FY 2009.

CONCLUSIONS

There was no evidence of injury, mortality or abnormal behavior of any harbor seals at VAFB, and/or other pinnipeds monitored on SMI as a result of the launches that were monitored in 2009. No ABR testing was required or conducted in 2009. There were no observed impacts to marine mammals from fixed-wing or helicopter operations on VAFB in 2009.

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