

**APPLICATION FOR INCIDENTAL TAKE REGULATIONS AND
LETTERS OF AUTHORIZATION;
U.S. SPACE FORCE LAUNCHES, U.S. AIR FORCE AIRCRAFT
AND HELICOPTER OPERATIONS AT VANDENBERG SPACE
FORCE BASE, CALIFORNIA**

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November 2, 2022

This version submitted May 25, 2023

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Acronym List

ABR	Auditory Brainstem Response (testing)
AGL	Above Ground Level (altitude)
AFB	Air Force Base
BMDS	Ballistic Missile Defense System
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	(United States) Endangered Species Act of 1973, as amended
GBSD	Ground-Based Strategic Defense (Program)
GERTS	General Electric Radio Tracking Station
ICBM	Intercontinental Ballistic Missile
IHA	Incidental Harassment Authorization
LF	Launch Facility (missiles)
LOA	Letter of Authorization
LZ	Landing Zone (SpaceX)
MDA	Missile Defense Agency
MMCG	Marine Mammal Consulting Group (Santa Barbara, CA)
MMIII	Minuteman III (ballistic missile)
MMPA	Marine Mammal Protection Act of 1972
NCI	Northern Channel Islands
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
PSF	Pounds per square foot
PTS	Permanent Threshold Shift (related to hearing)
SAIC	Science Applications International Corporation
SBMMC	Santa Barbara Marine Mammal Center (no longer active)
SFB	Space Force Base
SLC	Space Launch Complex / Space Landing Complex (SpaceX, only)
SLV	Small Launch Vehicles (program)
SMI	San Miguel Island
SRP	Scientific Research Permit
TP-01	Test Pad-01
TTS	Temporary Threshold Shift (related to hearing)
UAS	Unmanned Aerial Systems (“drones”)
USFWS	United States Fish and Wildlife Service
UUV	Unmanned Underwater Vehicle (remote controlled miniature-submarine)
VAFB	Vandenberg Air Force Base (now Vandenberg Space Force Base)
VSFB	Vandenberg Space Force Base, also Vandenberg SFB

Executive Summary

Vandenberg Space Force Base (VSFB), located in Santa Barbara County, California, is requesting regulations and a Letter of Authorization (LOA), to authorize “Taking Marine Mammals Incidental to U.S. Space Force Launches and Operations at Vandenberg Space Force Base, California.” “Take,” as defined in the Marine Mammal Protection Act, may occur, but it is not expected to exceed Level B harassment. Note: Vandenberg Air Force Base (VAFB) was formally re-named Vandenberg Space Force Base (VSFB) in May 2021; some historic references to VAFB remain in this document.

This application shall update and replace an LOA issued to VAFB in April 2019, scheduled to expire in April 2024, however VSFB and National Oceanic and Atmospheric Administration (NOAA) personnel have discussed a desire for earlier renewal. Although we are aware that the National Marine Fisheries Service (NMFS) is now able to issue 7-year LOAs, due to expectations of further changes to mission operations at VSFB and the likelihood that such changes will require additional coordination, we are requesting a standard 5-year LOA at this time.

There are 9 active missile launch facilities and 7 active space launch facilities on the 99,400 acre VSFB; several additional space launch facilities are currently being developed (as detailed later in this document). SpaceX continues to conduct recovery of the first stage of their Falcon 9 rocket, either to Landing Zone 4 (LZ-4) at VSFB or to an “autonomous barge” pre-positioned a minimum of 30 miles offshore. The Space Force and SpaceX do not reasonably anticipate impacts to hauled-out pinnipeds in any location resulting from offshore recoveries. Additionally, SpaceX has successfully recovered more than 80 consecutive Falcon 9 first stages (launching from California and Florida), therefore we now consider failed landings an anomaly (a failed offshore landing could result in debris entering the ocean).

Several new non-governmental space launch proponents have requested a very significant increase in launch frequency; however a large percentage of this increase will be comprised of new, smaller rockets and payloads than those previously utilized at VAFB. Some of these new launch proponents are not yet active, however we believe that they may be operational before the conclusion of the requested 5-year authorization. With these increases, the Space Force anticipates launch frequency will not exceed 15 missile and 110 rocket launches per year during the five-year period. Small launches could occur as frequently as twice in one day. Again, a large majority of these rockets will be smaller than those previously launched at VAFB, but the largest new rockets will be slightly larger than those currently in use. In this application, VSFB proposes to only monitor pinniped response to larger or louder rocket launches (i.e. no longer monitor launches of existing launch programs at currently operating launch facilities) and at least the first three launches from any new facilities from 1 March to 31 July. VSFB would monitor boost-back landings, by SpaceX or other launch programs only when a boom greater than 2.0 psf is predicted to impact VSFB or elsewhere on the mainland.

Piloted aircraft operations may result in very minimal levels of take, as VSFB no longer has aircraft stationed on site, but “transient” aircraft can be temporarily stationed here several times per year for periods of two or more weeks per operation. Security patrols and other routine aircraft operations occur frequently. Emergency aircraft operations (to include Search and Rescue, Anti-Terrorism patrols and wildfire suppression) are emergent or unpredictable in nature and are thus not discussed further in this application.

The Space Force is also proposing to use Unmanned Aerial Systems (UAS or drones) for various purposes. Except for take-off and landing actions, a minimum altitude of 300 feet above ground level (AGL) will be maintained for Class 0-2 UAS over all known marine mammal haul-outs when marine mammals are present. Class 3 will maintain a minimum altitude of 500 feet AGL, except at take-off and landing. Class 4 or 5 UAS will fly at a minimum altitude of at least 1000 feet over marine mammal haul-outs.

Numerous monitoring and effects minimization measures are included within this application. Notable updates to the previous application measures are requested. Following nearly twenty years of rocket launch monitoring on the Northern Channel Islands (NCI), the Space Force requests additional reduction in monitoring requirements. Monitors have observed few effects beyond alert, startle or flush following sonic booms less than 5 pounds per square foot (psf). Launch-related injury or mortality has never been detected. Therefore, we request that NMFS change the NCI monitoring requirements to:

- 1 March – 31 July, monitor pinnipeds when boom is modeled to exceed 5 psf.
- 1 August – 30 September, monitor pinnipeds when boom is modeled to exceed 7 psf.
- 1 October – 28 February, no monitoring.

Similarly, monitoring of pinnipeds on VSFb has been required for more than 20 years, with no significant reaction observed beyond alert, startle or flush from launch noise or SpaceX “boost back.” Therefore, we request that NMFS change the VSFb monitoring requirements to:

- 1 January – 31 December (all year), biological and acoustic modeling of new, larger or louder rockets or rocket types that have not already been launched from VSFb.
 - Monitor the first three launches of “small” or “medium” rockets from new or existing facilities.
 - Monitor the first three launches of “heavy” or (“super heavy,” if such programs are proposed) rockets from new or existing facilities. Discuss any observed adverse pinniped reactions with NMFS.
 - Following the first three launches described above as well as for established launch programs, VSFb proposes to change the focus of monitoring from that directly related to a specific space launch event toward a program where we will combine bi-monthly pinniped monitoring with launch monitoring (described in more detail in sections 8.2.2 and 8.2.3).
- 1 January – 31 December (all year), biological and acoustic monitoring of SpaceX or any other entity conducting boost-back operations, if a boom is predicted to exceed 2 psf at a haulout location on VSFb. The same requirement would also apply to any other entity planning boost-back actions.

All VSFb on-site pinniped monitoring, when required as detailed above, will commence three days before and continue two days after each launch. At present, no personnel are authorized to be present near the active haul-out areas at launch time due to safety requirements. VSFb agrees to conduct and report on new and additional testing of timed or remotely controlled video cameras, to potentially include night or low-light vision equipment.

The following species and number of individual marine mammals may be minimally affected (Level B) as a result of all VSFb activities, including government and tenant actions:

Pacific harbor seals (*Phoca vitulina richardsi*) – 31,500 animals at VSFb; 6,769 animals at NCI. A maximum 38,269 animals minimally affected as a result of all activities described in this application.

California sea lions (*Zalophus californianus*) – 21,780 animals at VSFb; 409,344 at NCI. A maximum of 431,124 animals minimally affected as a result of all activities described in this application.

Northern elephant seals (*Mirounga angustirostris*) – 17,100 at VSFb, 25,756 at NCI. A maximum of 42,856 animals minimally affected as a result of all activities described in this application.

Steller sea lions (*Eumetopias jubatus*) – 1,900 at VSFb, 0 at NCI. A maximum of 1,900 animals as a result of all activities described in this application.

Northern fur seals (*Callorhinus ursinus*) – 0 on VSFb, 28,496 on NCI. A maximum of 28,496 animals minimally affected from as a result of all activities described in this application.

Guadalupe fur seals (*Arctocephalus townsendi*) – 0 on VSFb, a maximum of 67 on NCI. A maximum of 67 animals minimally affected as a result of all activities described in this application.

Note: Each of the 14 items required by the NOAA, NMFS for authorization requests is included as a bulleted topic at the beginning of each section following. Some sections include more than one bulleted item. This was done in response to NOAA’s 2018 request to reduce the size of submittal documents.

1. Operations with Potential to Result in Incidental Takes

- Detailed description of specific activity or class of activities expected to result in incidental taking of marine mammals.

At Vandenberg Space Force Base (VSFB), Space Delta 30 operates VSFB as well as its associated Western Range (Figure 1). Manned and unmanned aircraft flying at low altitudes can disturb pinnipeds. Occasional helicopter and aircraft operations involve search-and-rescue, delivery of space vehicle components, launch mission support, security reconnaissance, and training flights. Use of Unmanned Aerial Systems (UAS or “drones”) may also occur; Class 0-3 drones will operate at altitudes of 300 feet or more (except for take-off and landing); Class 4 or 5 UAS will maintain a minimum altitude of 1000 feet.

VSFB supports launch activities for the U.S. Space Force, Department of Defense, National Aeronautics and Space Administration, and commercial entities. It is the primary west coast launch facility for placing commercial, government, and military satellites into polar orbit on unmanned launch vehicles, and for the testing and evaluation of intercontinental ballistic missiles (ICBMs) and sub-orbital target and interceptor missiles by the Missile Defense Agency (MDA). The current ICBM program (Minuteman III) is being phased out and replaced by the planned Ground-Based Strategic Deterrent (GBSD) program.

Space Exploration Technologies Corporation (SpaceX) returns certain rocket components to SLC-4 West for reuse; this action was formerly authorized under an independent Incidental Harassment Authorization (IHA), but was incorporated into the 2019-2024 VSFB LOA, and should remain in the LOA requested by this application. At least one additional corporate mission partner at VSFB (Stoke Space) intends to return some launch components to VSFB for re-use, however the timing and frequency of this plan is currently unknown.

The following sections describe the launch vehicles and aircraft that have potential to incidentally take marine mammals. Launch vehicles may disturb pinnipeds with launch noises, sonic booms, and at close range, the sight of vehicles being launched. Such impacts have been measured and monitored many times at VSFB over the past 25 years, resulting in some 150 reports by numerous qualified, independent researchers. Many of these reports, covering from 1991 through 2011, were reviewed and summarized in two documents prior to the issuance of VSFBs 5-year Authorization and LOA in 2014 (MMCG and SAIC 2012a); these and launch reports through and including the first several months of calendar year 2022 are available to NMFS upon request. Quarterly reports have been submitted to NMFS summarizing launch activity since 2014.

1.1 Space Vehicle Launches

VSFB anticipates, and therefore requests in this application authorization to significantly increase our space launch frequency (Table 1). However, the current expectation is to gradually increase to a total of 110 launches annually (predominantly smaller launch vehicles) over the next 3-5 years. Several new commercial entities are working with VSFB to coordinate re-use of existing launch facilities (after significant refurbishment) or construction of new launch complexes. From VSFB, space vehicles are launched into polar orbits on azimuths from 140 to 210 degrees; SpaceX is assessing additional launches to the northwest, at azimuths of 305-325 degrees (refer to additional text below).

There are currently seven active Space Launch Complex (SLC) facilities at VSFB used to launch satellites into polar orbit (Table 2; Figures 2, 3 and 4). Two new facilities (SLC-9 / Blue Origin; SLC-11 / Relativity

Space) have been approved, but construction has not begun, and one facility (SLC-5, Phantom Space Corporation) not used since about 2005 is being re-opened. One existing launch facility (TP-01), on north VSFB, was unused for several years but was reactivated in 2020; four launches have taken place from this facility as of July 2022, including one failed launch. The seven existing facilities support launch programs for the United Launch Alliance (ULA) Atlas V and Delta IV, SpaceX Falcon 9, Firefly Alpha and Minotaur. The final launch of a ULA Delta II rocket occurred in September 2018; however Firefly Aerospace is now using SLC-2W (to date, one failed launch effort in September 2021 and one successful launch in October 2022). The final launch of the Delta IV (SLC-6, also ULA) occurred on 24 September 2022. The final launch of the Atlas V (SLC-3, ULA) occurred in November 2022. SLC-3 is currently being modified by ULA to launch the Vulcan heavy-lift vehicle. SLC-6 is likely to be modified for another future launch program (information will be provided to NMFS in annual reports).

Table 1: Anticipated Number of Launches, by Year

Year	Small	Medium	Heavy	Total
2023	10	15	5	30
2024	15	20	5	40
2025	25	20	10	55
2026	40	20	15	75
2027	50	30	20	100
2028	60	30	20	110

As mentioned above, SpaceX has proposed to add a northerly mission profile with a launch azimuth between 305 and 325 degrees (Figure 1). As of the submittal date of this application, we are unsure of the likelihood of this taking place, as there are many decisions unrelated to NMFS and pinnipeds that need to be considered. We expect to have additional information within the timeframe of the review of this application. Nevertheless, the northerly trajectories are included in this application. Initial sonic boom modeling has been conducted, with results demonstrating that northward trajectories between 305 and 325 degrees will result in no sonic boom, either from launch or first stage recovery, impact to the mainland, any islands, or other locations where pinnipeds haul out. VSFB will also be able to provide a precise recovery location (for the autonomous barge) to NMFS several months before this is scheduled to occur.

Sonic booms on the Northern Channel Islands (NCI) resulting from VSFB launches (for SpaceX Boost-back, refer to section 1.1.1) are dependent upon the trajectory of the launch in addition to the size of the rocket; for example, “small” rockets, generally those less than 100 feet tall, are much less likely to result in a boom. We estimate that fewer than 10% of small rockets, 25% of medium rockets and 33% of large rockets will “boom” the NCI. Additionally, sonic booms most frequently impact San Miguel and occasionally Santa Rosa Islands; Santa Cruz and Anacapa Islands are not expected to be impacted by sonic booms in excess of 1 pound per square foot (psf). Pinnipeds hauled out on most if not all sites on Santa Cruz and Anacapa Islands will not be exposed to significant sonic booms. Although exact numbers are uncertain, the Space Force estimates that launches will result in NCI sonic booms higher than 2 psf not to exceed 5 times in 2024, 12 times in 2025 and 24 times in 2026.

The location of the launch sites in relation to specific pinniped haul-out and rookery areas at VSFB is shown in Figures 2-4. On Figure 3, launch complexes 3 and 4-E are both about 5.5 kilometers (km) north of SLC-6 (additional figures available upon request).

The primary rocket launch programs and types are described above (and in Table 2), but others may be implemented before the permit issued as a result of this application expires. Table 1 presents estimated launch numbers from calendar year 2023 to 2028, inclusive. The Space Force would notify NMFS of any new programs that would be implemented at VSFB. New rockets that are larger or louder than those that

have been launched from VSFb previously would be monitored acoustically and biologically during their first three launches, using the NOAA-approved launch monitoring protocols for VSFb. This would include new launch proponents using previously used facilities, if the new rocket is larger or louder. Results of that monitoring would be shared promptly for further discussion.

Monitoring of pinnipeds on VSFb has been required for more than 20 years, with no significant reaction observed beyond alert, startle or flush from launch noise or “boost back.” Therefore, we request that NMFS change the VSFb monitoring requirements to:

- 1 January – 31 December (all year), biological and acoustic modeling of new, larger or louder rockets or rocket types that have not already been launched from VSFb.
 - Monitor the first three launches of “small” or “medium” rockets from new or existing facilities. Monitor all subsequent launches from 1 March to 30 June.
 - Monitor the first three launches of “heavy” (or “super heavy,” if such programs are proposed) rockets from new or existing facilities. Discuss any observed adverse pinniped reactions with NMFS. Monitor all subsequent launches from 1 January to 31 July.
- 1 January – 31 December (all year), biological and acoustic monitoring of SpaceX boost-back only if a boom is predicted to exceed 2 psf at a haulout location on VSFb. The same requirement would also apply to any other entity planning boost-back actions.

In this application, VSFb proposes to only monitor pinniped response to larger or louder rocket launches (i.e. no longer perform launch-specific monitoring of existing launch programs at currently operating launch facilities) and at least the first three launches from any new facilities from 1 March to 31 July.

Table 2: Space Launch Vehicles (Rockets) and Nearest Haul-out Sites

Rocket	Rocket diameter	Rocket height	Launch facility	Nearest pinniped haul-out	Distance to haul-out
Current (and recent) launch programs					
Atlas V	12.5 feet	191 feet	SLC-3E	North Rocky Point	9.9 km
Firefly	6 feet	95 feet	SLC-2W	Purisima Point	2.3 km
Delta IV	16 feet	236 feet	SLC-6	North Rocky Point	2.3 km
Falcon 9	12 feet	230 feet	SLC-4E	North Rocky Point	8.2 km
Minotaur	8 feet	81 feet	SLC-8	North Rocky Point	1.6 km
Minotaur/ Taurus	8 feet	91 feet	LF-576E	South Spur Road	0.8 km
Minotaur / Buzzard	6 feet	63 feet	TP-01	Purisima Point	7.1 km
Future launch programs¹					
Vector	4 feet	40 feet	SLC-8	North Rocky Point	1.6 km
Daytona	5 feet	62 feet	SLC-5	Point Arguello	3.9 km
New Glenn	23 feet	200 feet	SLC-9	Point Arguello	10.2 km
Vulcan	17.7 feet	>220 feet	SLC-3E	Point Arguello	8.75 km
Terran	7.5 feet	126 feet	SLC-11	North Rocky Point	1.2 km
Abbreviations: SLC = Space Launch Complex; LF = Launch Facility; E = East; W = West; TBD: To be determined Notes: 1 – All future launch program specifications should be considered notional and are subject to change					



Figure 1. VSBF and the Western Range. Blue: Missile launch trajectories; Green: Current rocket launch trajectories; Orange: proposed SpaceX northern launch trajectories.

1.1.1 SpaceX Boost Back and Landing

Described in much greater detail in Appendix A of the 2019 application, the boost-back and landing of the first stage of SpaceX Falcon 9 rockets is now covered in the current VSBF LOA as well as in this application. The landing can occur either on pad LZ-4 within Space Launch Complex 4 or on an autonomous “drone ship” no less than 50 km offshore and downrange, often off the coast of Mexico. It is important to note that because the LZ-4 landing will always occur less than ten minutes after launch, it should be considered the same “harassment.” If animals flush, they will often not have returned to the haul-out before the landing. Therefore, the Space Force does not anticipate that any new individuals will respond to boost-back to a level that rises to take that were not already alerted or disturbed by the launch. We propose to no longer monitor LZ-4 boost-back landings unless the sonic boom is modeled to exceed 2 psf.

Recovery of the first stage of the Falcon 9 spacecraft allows for unprecedented and environmentally beneficial reutilization of rocket components. To date, SpaceX has re-used some Falcon 9 components more than ten times, whereas other launch partners deposit rocket components in the South Pacific Ocean. However, first stage recovery does include the use of parachutes and parafoils to control the descent of components to the ocean’s surface. These are usually recovered, but on occasion, parachutes or parafoils are abandoned, followed by them sinking rapidly to the ocean floor. NMFS has concurred with a joint determination from USSF and the Federal Aviation Administration that these incidents are “not likely to adversely affect” protected species under the Endangered Species Act (NOAA/NMFS 2022). In this application, USSF concludes that infrequent failures to recapture all launch components is equally not of a

level of importance to impact protected species under the Marine Mammal Protection Act of 1972 (MMPA).

Autonomous drone ship landings occur far offshore (usually at least 30 nautical miles or 50 km), where there are no anticipated impacts to hauled-out pinnipeds. In the past, we have modeled the sonic boom for the offshore boost-back, VSFb believes that this is no longer necessary. Additionally, in earlier LOAs that included drone ship landings, we considered the potential for rocket debris to enter the ocean. However, SpaceX has perfected the Falcon 9 launch and landing procedures to a degree where we would now consider failed drone ship recoveries to be a significant anomaly, and thus not a likely outcome.

1.1.2 Small Launch Vehicles (proposed program)

VSFB is developing a new Small Launch Vehicles program (SLV) on south base. In this LOA application, we are requesting that NMFS consider two proposed new launch sites; however, other sites are under consideration but have been determined to require significant additional environmental impacts analysis, to potentially result in an Environmental Impact Statement (EIS). The two sites that have progressed to a more complete degree of environmental review, which will be addressed in an Environmental Assessment (EA) are Vina Terrace (new development) and the General Electric Radio Tracking Station (GERTS, extensive renovation of an existing facility), both shown in Figure 3. Some additional SLV launches may occur from existing SLCs, to include SLC-5 and SLC-8. Overall, the SLV program is expected to consist of as many as 100 launches annually (included in the basewide 110 launch/year total), perhaps two launches per day, and as the program title implies, these small rockets will carry payloads of approximately 4,400 pounds or less.

1.2 ICBM, GBSD and MDA Launches

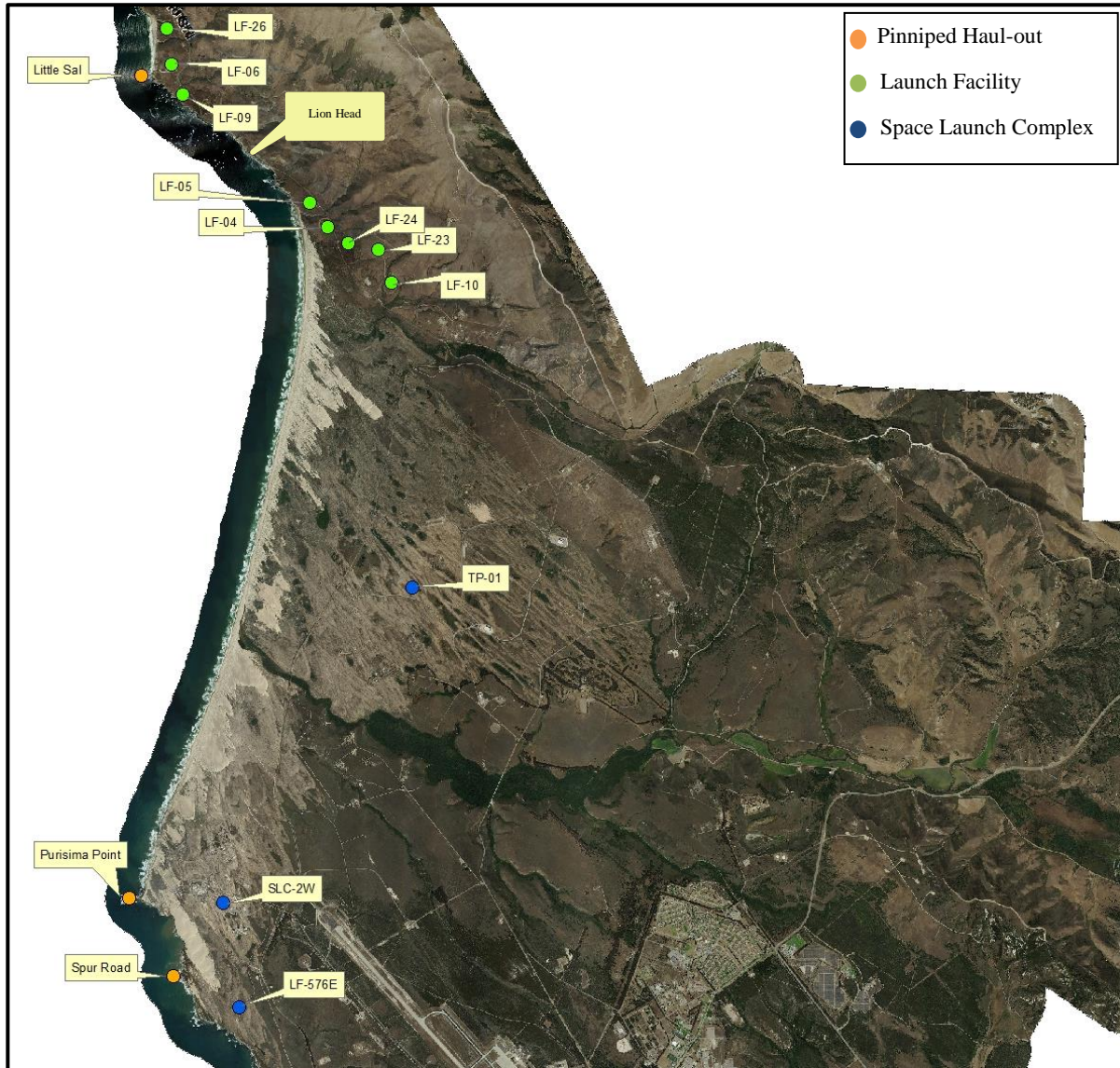
A variety of small missiles are launched from various Launch Facilities (LFs) on north VSFb, including Minuteman III, an Intercontinental Ballistic Missile (ICBM) which is launched from underground silos. VSFb is currently modifying several existing silos (including LF-04 and LF-26) for future testing of the new Ground Based Strategic Defense (GBSD) program, which is intended to replace the Minuteman III as early as 2026 (additional information on this program can be found below).

Several types of interceptor and target vehicles are launched for the Missile Defense Agency (MDA). The MDA develops various systems and elements, including the Ballistic Missile Defense System (BMDS). The BMDS test plans, including those involving tests from VSFb, are subject to constant change as the BMDS is being developed. Thus, it is difficult for the MDA to predict its launch schedule or number of launches over the next five years. However, due to test resource limitations, MDA does not envision conducting more than three missile tests per quarter (on average) over the next five years from VSFb, and none of the missiles would be significantly larger than the Minuteman III. This limitation (three missiles per quarter and none being larger than the Minuteman III) represents the likely extent of MDA testing at VSFb over the next five years.

Current missile programs and types are described above, but the Space Force is currently developing the GBSD system, including the retrofitting of existing Launch Facilities; no test launches have occurred as of this application date. Completely new types of missiles would be monitored acoustically and biologically during their first launch, using the NOAA-approved launch monitoring protocols for VSFb. However, there is no requirement for monitoring of existing missile launches, following discussions with NMFS in 2016-2017 -- NMFS and VSFb agreed that nominal missile launches do not result in take of pinnipeds on VSFb. Following initial testing, launch frequency by GBSD is expected to approximately match that of the current MMIII.

LF-09 is the closest active missile launch facility to a haul-out area, located about 0.5 km from Little Sal (Figure 2). LF-10 is the most remote facility from any haul-out area, located about 2.7 km from Lion's Head. The trajectories of all missile launches are generally westward (220-270 degrees); thus, they do not cause sonic boom impacts on the California mainland or the NCI. Missiles also transition to nearly horizontal flight within seconds of launch; thus, they do not have extended noise impacts to the coastline or hauled-out pinnipeds. For these reasons, the Space Force does not anticipate or request take of marine mammals on the NCI due to missile launch operations.

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



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Figure 3. Launch Sites, Landing Site and Pinniped Haul-out Areas on South VSFB

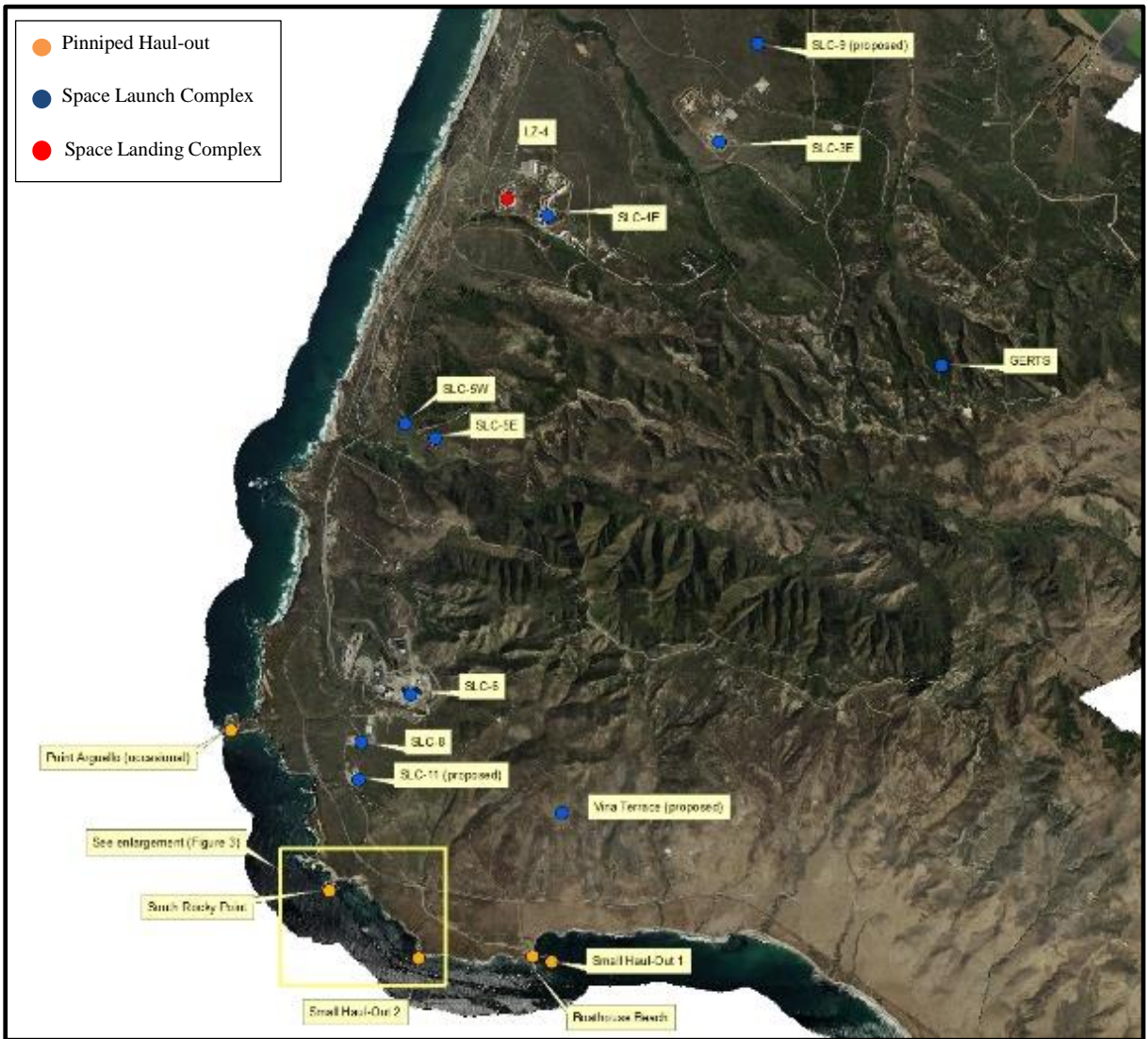


Figure 4. Enlarged Area, Pinniped Haul-outs on South VSFB



1.3 Aircraft Operations

The VSFB airfield, located on north VSFB, supports various aircraft operations further described below. Aircraft operations include tower operations, such as take-offs and landings (training operations), and range operations such as overflights and flight tests. Over the past five years, an average of slightly more than 600 flights has occurred each year. There is potential for take as aircraft operations increase over the next 5 years, therefore we are requesting a small amount of take.

Fixed-wing Aircraft Operations

Fixed-wing aircraft use VSFB for various purposes, including delivering rocket or missile components, high-altitude launches of space vehicles (e.g., Pegasus) and emergency landings. No aircraft are currently based permanently at VSFB, however a small group of “transient” F-15’s are expected to be present at VSFB for periods of about 2 weeks as many as three times per year starting no earlier than early 2024. VSFB is also used for flight testing, evaluation of fixed-wing aircraft and training exercises, including “touch-and-goes.” Three approved routes are used that avoid established pinniped haul-out sites. All aircraft are required to maintain a minimum altitude of 500 feet over coastal areas, and most aircraft operate at much higher altitudes (emergency operations are exempted from this minimum altitude). Aircraft flown through VSFB airspace and supported by Space Delta 30 include, but are not limited to: A-10, F-15, F-18, and F-35; B-52, cargo planes, such as the C-130, C-5, C-17, and AN-124, KC-135 and KC-10 tankers. A very small number of takes could occur from normal airfield operations.

Helicopter Operations

The number of helicopter operations at VSFB has decreased considerably since 2008 with the deactivation of the VSFB helicopter squadron. Other squadrons and units sometimes use VSFB for such purposes as transiting through the area, exercises and launch mission support. A small number of takes could occur from this action. Emergency helicopter operations, including but not limited to search-and-rescue and wildfire containment actions are somewhat common, but due to the unplanned nature of such actions, they are not predictable, thus we do not anticipate or request take from emergency actions.

Unmanned Aerial Systems Operations

Unmanned Aerial Systems (“drone”) operations may include either rotary or fixed wing aircraft. These are typically divided into as many as six classes, numbered 0-5 (Table 3). Classes graduate in size from “nano” or class 0, which are often smaller than 5x5 inches and always weigh less than one pound, to Class 5, which can be as large as a small piloted aircraft. Classes 0-3 can be used in almost any location, Classes 4 and 5 typically require an actual runway and for that reason will only be operated from the VSFB airfield. A small number of takes could occur from this action.

Table 3: UAS Classes

UAS GROUP/ CLASS	Weight (pounds)	Operational Altitude (feet above ground level)	Speed (knots)
0	<1	<500	Low
1	1-20	<1,200	<100
2	21-55	<3,500	<250
3	<1,320	<18,000	<250
4	>1,320	<18,000	Any
5	>1,320	>18,000	Any

Harbor Operations

VSFB operates a small harbor on the south coast, immediately adjacent to the site labeled “Small Haul-Out 1” (Figure 3). Historically, mission operations at this site have been limited to fewer than two large ship visits per year, in addition to routine dredging typically not to exceed once every other year. SpaceX (section 1.1.1) has declared intentions to significantly increase harbor use, however they would be using smaller ships with less draft, thus likely not exceeding the previous dredge requirements. VSFB consulted with NMFS (Long Beach) to assess impacts of harbor operations and dredging on pinnipeds; with a small number of minimization measures, NMFS agreed that these operations did not adversely affect Pacific harbor seals, in part because “Small Haul-Out 1” is entirely inundated at all but minus tides. Recent pupping of Northern elephant seals at nearby “Boathouse Beach” (2 years, 2 pups each year), however of concern, this is discussed further in section 3.1.3.

2. Dates, Durations and Region of Operations

- Dates, Frequency and Duration of activities and specific geographical region where they will occur.

2.1 Dates, Frequency and Durations of Operations

Launch and aircraft operations could occur at any time of the day or night during the period to be covered under the LOA resulting from this application. The Space Force anticipates that no more than 15 missile and 110 rocket launches (many of these would be quite small) would occur in any year, and may on occasion include as many as two launches in one day (however we believe that to be rather unlikely at least until 2025 or later). This number is much higher than launch activity in previous years, but new commercial launch proponents advocate a very aggressive expansion of launches reaching polar orbits in the near future. 5-year launch activity is not anticipated to exceed 75 missile and 550 rocket launches, however USSF understands that NMFS does not limit actions, but “take” impacts to pinnipeds.

All launch operations would occur at VSF, potentially resulting in launch noise and visual impacts there. Current launch actions at VSF do not result in sonic booms impacting the mainland; sonic booms resulting from SpaceX first stage recoveries (boost-back) at LZ-4 can impact the mainland, and a new mission partner Stoke Space also plans to boost-back certain rocket components. Sonic boom impacts from space launch vehicles could occur over the NCI; occasionally, sonic booms resulting from SpaceX recovery actions can impact the NCI. All current and planned missiles are launched in a trajectory generally west-southwest to west, and will not impact the NCI.

2.2 Area of Operations

VSF is composed of approximately 99,100 acres of land and approximately 42 miles of coastline, all within Santa Barbara County on the southern central coast of California. From here, space vehicles are launched into polar orbits on azimuths from 140 to 220 degrees. Missile launches are directed west toward Kwajalein Atoll in the Pacific. This over-water sector, from approximately 225 to 270 degrees, comprises the Western Range. Part of the Western Range encompasses the NCI (Figure 1). As mentioned above (section 1.1), SpaceX is proposing to add a northerly mission profile with a launch azimuth between 305 and 325 degrees (Figure 2).

The NCI include San Miguel, Santa Rosa, Santa Cruz, and Anacapa islands, and all are part of Channel Islands National Park. The waters out to six nautical miles offshore from the islands comprise Channel Islands National Marine Sanctuary. The closest part of the NCI (Harris Point, San Miguel Island) to VSF is located more than 30 nautical miles south-southeast of the nearest launch facility. Potential impacts of sonic booms from space launch vehicles launched from VSF are a matter of concern to the National Park Service as well as the U.S. Fish and Wildlife Service (USFWS) and NMFS, particularly at San Miguel Island. Sonic booms can result in an alert or other response from pinnipeds and other special status species. Sonic booms could also impact the other three NCI, although the booms are generally less intense farther east along the chain of islands.

3. Marine Mammals in the Operations Area

- Species and numbers of marine mammals likely to be found within the activity area.

Table 4: Corrections and Adjustments by Stock

Stock	VSFB- Tidal inundation of haul-outs	VSFB- Proportion individuals assumed taken per launch	NCI- Proportion of individuals assumed taken per sonic boom > 2.0	NCI- Correction for limited extent of each boom effect across NCI.	NCI- Correction for seasonal breeding and dispersal cycle
Harbor Seal (CA)	50%	100%	50%	25%	
CA Sea Lion (US)	50%	100%	25%	25%	50% for seasonal male dispersal
Northern elephant seal (CA breeding)		15%	5%	25%	
Steller sea lion (Eastern)		100%	50%	25%	
Northern fur seal (CA)			25%	25%	33% for seasonality (approx. 125 Nov-May, S. Melin, 2019)
Guadalupe fur seal (MX)			50%	25%	

3.1 VSFB

Marine mammal counts collected in the course of VSFB monthly marine mammal surveys is the authoritative data set for characterizing abundance of marine mammals at the site. We reviewed data made available by VSFB and compared counts taken each month from 2020-2022. We compared monthly counts across three consecutive years 2020-2022 and selected the highest count for each month, creating a hypothetical twelve month period. We then selected the highest count from that twelve month period, expecting that would over-estimate the number of animals present during any given launch and provide a conservative estimate of the number of takes that could occur. We then applied the applicable correction factors for tidal displacement and species response/proportion affected.

Of the six species of pinnipeds known to occur in this region, four species of pinnipeds regularly haul out at VSFB. The remaining two species – both fur seals – are known along this part of the mainland coast only from strandings (MMCG and SAIC 2011a and b; 2012a and c). All six species are discussed in this section.

Table 5. Vandenberg Maximum Counts from Monthly Surveys, 2020-2022

	Pacific harbor seal <i>Phoca vitulina</i> (30,968)	California sea lion <i>Zalophus californianus</i> (257,606)	Steller sea lion <i>Eumetopias jubatus</i> (43,201)	Northern elephant seal <i>Mirounga angustirostris</i> (187,386)
Jan	61	11	None in VSFB record 2020-2022	76
Feb	73	9		63
Mar	105	0		50
Apr	87	3		173
May	95	112		302
Jun	149	72		78
Jul	61	26		20
Aug	60	1		11
Sept	54	16		82
Oct	59	2		228
Nov	65	28		251
Dec	51	16	N/R	122
			VSFB Estimated Max: 5	
Tidal Displacement	$(149)(.5)=75$	$(112)(.5)=56$	N/A	N/A
Proportion taken per launch	100%	100%	100%	15% $302(.15)=45$
Max count adjusted	75	56	5 (estimated)	45

We considered all months of the year in order to ensure a conservative approach and to capture the peak counts by season, and we looked across three years of monthly monitoring data to also account for longer term variability. The greatest number of animals present during a monthly survey across a recent three-year span is likely to over-estimate the greatest number that will be present during any given launch.

3.1.1 Pacific Harbor Seals

Pacific harbor seals (*Phoca vitulina richardsi*) are the most common marine mammals at VSFB. Harbor seals generally remain within 20 or 30 nautical miles from their haul-out sites, which consist of offshore rocks or reefs, and sandy or cobblestone coves. Occasional journeys of some 300 nautical miles have been recorded in some parts of California (Carretta *et al.* 2011).

There are 11 harbor seal haul-out sites on south VSFB. Since the Space Force’s 2013 application was submitted, approximately 5 haul-outs have been largely abandoned due to sand deposition following natural cliff erosion (which allows increased beach access by terrestrial mesocarnivores). There are four harbor seal haul-out sites on north VSFB. The position of haul-outs in relation to the SLCs and LFs is shown in Figure 3. With the exception of Amphitheatre (elephant and harbor seal rookery), Small Haul-out 1 and South Rocky Point, nearly all of the haul-out sites are only used during low tides and are wave-washed or submerged during high tides.

Harbor seal numbers have been estimated by various means over the years. Table 6 compares older estimates with current estimates. The older estimates are shown as they were presented, then as revised in accordance with correction factor currently used by NMFS for assessing populations (Harvey and Goley, 2011).

Table 6. VSFB Harbor Seal Population Estimates

Year	Month	Maximum Number of Animals Hauled Out	1.3X Correction Factor (1996-2017)	1.54X Correction Factor (2009-2021) ³
1993 ¹	June	300	390	462
1999 ¹	June	400	520	616
2001 ¹	June	500-515	650-670	770-793
2009 ²	June	304	395	468
2010 ²	June	249	324	383
2011 ²	June	259	337	399
2012 ²	January	179	231	274
2013	November	185	241	285
2014	October	216	281	333
2015	October	533	693	821
2016	May	310	403	477
2017	January	125	163	193
2018	June	161		248
2019	June	119		183
2020	June	127		196
2021	June	149		229

Harbor seal population estimates are usually made during the summer molting season, when the greatest numbers of animals are hauled out. Surveys during 2011 and earlier follow this trend, though surveys from 2012-2017 indicated that peak numbers were seen in the fall and winter months at VSFB, generally October or January. Since 2017, this trend has returned to the previous model, where the highest numbers were present in the summer.

The harbor seal population at VSFB appears to fluctuate, potentially due to natural processes affecting the overall population. Some declines in use of VSFB for hauling out is likely related to a series of natural landslides at south VSFB, resulting in the abandonment of many haul-out sites. These slides have also resulted in extensive down-current sediment deposition, making these sites accessible to coyotes, which are now occasionally seen there. The displaced seals have likely shifted use to other haul-outs in the vicinity or have moved to Point Conception, about six miles south of the southern boundary of VSFB. High numbers of harbor seals have been reported at Point Conception and in the kelp beds from south VSFB to east of Point Conception (Laroche 2012). A new haul-out site on south VSFB was discovered at Point Arguello (Figure 3). This consists of a ledge in a deep, protected crack on the north side of the point. Though not a large area, it offers a suitable haul-out for both California and Steller sea lions and is used occasionally (refer to following sections). Harbor seal numbers also appear to have decreased overall as Northern elephant seal numbers have increased significantly (see 3.1.3).

On north VSFB, coyotes have been observed regularly at Spur Road and Purisima Point haul-out sites. Only rocky outcrops located just off shore and exposed during the lowest tides are utilized by harbor seals. Before the coyotes arrived, much more of the intertidal area was used. In 2012, a new haul-out site, informally named Little Sal, was discovered on north VSFB near LF-06 (Figure 2).

3.1.2 California Sea Lions

Individual California sea lions (*Zalophus californianus*) have been noted hauled out at various locations along the VSFB coast; With the exception of North Rocky Point (Figure 3), these are usually considered to be transient or stranded animals. Larger numbers of California sea lions occasionally haul out on Point Conception, located south of VSFB. On VSFB, California sea lions are only regularly hauled out on North Rocky Point (Figure 3), occasionally on South Rocky Point and Amphitheatre Cove, with numbers often peaking in spring. North Rocky Point can be observed from the western extent of South Rocky Point utilizing a spotting scope, though some areas are not visible. Previous counts are underestimates, since biologists only started using the vantage point from South Rocky Point in mid-2016. An average of 32 California sea lions were counted each month (range 0-416) prior to 2018 (see following note about 2019 and 2020).

Successful pupping has not been observed. During the 2003 pupping season, five pups were born at north Rocky Point but were abandoned shortly after birth (MMCG and SAIC 2012a). This general observation was repeated in 2012 and 2014-15. One hypothesis is that only California sea lions affected by domoic acid toxicity give birth at VSFB. These pups are either stillborn or are abandoned by malnourished female sea lions, and these pups do not survive long. Thousands of California sea lions typically pup at the NCI.

In May through July of 2018, previously unprecedented numbers of California sea lions (500-900) were observed at South Rocky Point. This phenomenon reoccurred May through July of 2019, with numbers estimated to be more than 1,300 sea lions, most believed to be subadults. This did not re-occur in 2020-2023. Some sea lions were also seen at Amphitheater, a haul-out usually dominated by harbor and elephant seals. The gender and age-class distribution at Amphitheater is believed to be primarily sub-adult (both sexes) and adult female California sea lions with no more than 5 mature males present at any one observation (again, no pupping was observed). At South Rocky Point, our initial thoughts were that these individuals were predominantly transiting sea lions, including juveniles, adult females and a small number of adult males. Simply said, it is too early for VSFB to hypothesize why California sea lion numbers on South base quadrupled in two consecutive years but not since 2019. VSFB will continue to monitor future numbers and will discuss additional monitoring and management of this species with NMFS as needed.

3.1.3 Northern Elephant Seals

Northern elephant seals (*Mirounga angustirostris*) historically hauled out at VSFB only rarely, mostly subadult males. In 2004, a record count of 188 animals was made, mostly newly weaned seals (MMCG and SAIC 2012a); these numbers continued to increase (unpublished data, however reported annually to NMFS). In November 2016, mature adults were observed in Amphitheatre Cove, and pupping was first documented in January 2017 with 18 pups born and weaned. In January 2018, a total of 25 pups were born and weaned; 26 in 2019, 34 in 2020, 33 in 2021 and 49 in 2022. Two pups were born and weaned at Boathouse Beach in both 2021 and 2022. We assume that this site, in addition to Amphitheater, will also be used for pupping in future years.

In 2019, VSFB initiated work with Dr. Heather Liwanag at California Polytechnic State University-San Luis Obispo. Initially under NMFS permit #19108, Dr. Liwanag and her cooperators applied flipper tags to several dozen weanling elephant seals. After issuance of an independent permit (#22187) to Dr. Liwanag, her team applied flipper tags in 2020 and 2021. In 2022, after receiving an amendment to that permit, Dr. Liwanag applied radio and satellite transmitters to weanling elephant seals, an action that is planned to continue in 2023 and 2024 (this project is funded by the Space Force).

Primarily due to the recent pupping by northern elephant seals at Boathouse Beach, VSFB initiated discussions with NMFS regarding potential impacts of harbor operations, including dredging. As a result of detailed, although informal monitoring of northern elephant seals during recent harbor operations, we believe that impacts are insignificant, and that no formal monitoring program is necessary. VAFB is open to discussions regarding the possibility of monitoring northern elephant seals during dredging operations if any are scheduled in the most sensitive months of January and February.

3.1.4 Steller Sea Lions

In April and May of 2012, Steller sea lions (*Eumetopias jubatus*) were observed for the first time at VSFB. Since that initial sighting, they have been observed only infrequently, and only at one location. A maximum of 16 adults have been documented in one month at the same locations that California sea lions haul out at North Rocky Point. Some individuals with distinctive scars were observed on several occasions over a several-week period, indicating that this site was being used over time rather than as a brief rest stop (MMCG and SAIC 2012a and c).

3.1.5 Fur Seals

Two species of fur seals exist in the region: the Northern fur seal (*Callorhinus ursinus*) and the Guadalupe fur seal (*Arctocephalus townsendi*). No haul-out or rookery sites exist for fur seals on the mainland VSFB coast. The only specimens that do appear on mainland beaches are stranded animals, with only one fur seal stranding reported at VSFB. This involved a northern fur seal that came ashore at Surf Beach (this beach is on VSFB property but has public access). The seal, a nine-month old male, was rescued by the Santa Barbara Marine Mammal Center (SBMMC) on 11 March 2012 (SBMMC 2012). Two deceased northern fur seals are known to have washed onto VSFB beaches since approximately 2011.

3.2 Northern Channel Islands

Several species of pinnipeds inhabit the NCI and are discussed island-by-island detailed in Table 7.

Table 7. NCI Pinniped Population Estimates

Species	San Miguel Island	Santa Rosa Island	Total
Pacific harbor seal	254	256	520
California sea lion ¹	60,277	1,618	62,969
Northern elephant seal ¹	2,791	1,169	3,960
Steller sea lion	0	5	5t
Northern fur seal	4520	0	4,520
Guadalupe fur seal	0	0	0

Source: Lowry *et al*, 2021

3.2.1 San Miguel Island

San Miguel Island is the largest and most diverse pinniped rookery on the west coast. Four species of pinnipeds regularly breed there, including California sea lions, Northern elephant seals, Northern fur seals, and Pacific harbor seals. Steller sea lions bred in the past on San Miguel Island (Allen and Angliss 2011 and 2012). They disappeared from San Miguel Island after the 1982-1983 El Niño and have been sighted only occasionally since then, thus far as individual animals. Guadalupe fur seals are reported occasionally at San Miguel Island, and in 1998, a pup was successfully weaned there (Melin and DeLong 1999).

Pinnipeds are found throughout the San Miguel Island coastline. The main rookeries for California sea lions and northern elephant seals are on Point Bennett. California sea lions also breed on Castle Rock, and are sometimes seen at Richardson Rock. Northern fur seals have small rookeries at Point Bennett and on Castle Rock. Pacific harbor seals occur along the north coast, at Tyler Bight and from Crook Point to Cardwell Point.

3.2.2 Santa Rosa Island

Three species of pinnipeds frequent Santa Rosa Island: Pacific harbor seals, California sea lions and Northern elephant seals. Harbor seals are scattered throughout the island. Sea lions haul out at the west end, at Ford Point and at Carrington Point. A few California sea lions have been born on Santa Rosa, but no rookery has been established. Northern elephant seals mostly stay near the west end of the island, where they pup and breed.

3.2.3 Santa Cruz Island

Pacific harbor seals inhabit small coves and rocky ledges along much of the coast of Santa Cruz Island. California sea lions haul out from Painted Cave almost to Fraser Point, on the west end. Fair numbers haul out at Gull Island, off the south shore near Punta Arena. Pupping appears to be increasing there. Sea lions also haul out near Potato Harbor, on the northeast end of the island. Sonic booms more than 1.0 psf resulting from VSFBRocket launches are not expected to impact Santa Cruz Island.

3.2.4 Anacapa Island

Pacific harbor seals haul out on rocky ledges, caves and cobble beaches in small numbers at Anacapa Island. California sea lions haul out by the hundreds on the south side of East Anacapa. Sonic booms in excess of 1.0 psf resulting from VSFBRocket launches are not expected to impact Anacapa Island.

4. Marine Mammal Status and Distribution in Area

- Description of the status, distribution, and seasonal distribution of affected species or stocks of marine mammals likely to be affected by such activities.

Table 8 (below) provides the findings of relevant NOAA Fisheries Stock Assessment Reports, updated 2/15/2023. We use the stock abundance estimates for calculation of take and to assess “small numbers” in the pages that follow.

Table 8. Pinniped Stock Status and Abundance

Common name	Scientific name	Stock	ESA/MMPA status; Strategic (Y/N)	Stock abundance (CV, Nmin, most recent abundance survey)	PBR	Annual M/SI3
Guadalupe fur seal	<i>Arctocephalus townsendi</i>	Mexico	T, D, Y	34,187 (N/A, 31,019, 2013)	1,062	≥3.8
Northern fur seal	<i>Callorhinus ursinus</i>	CA	-, D, N	14,050 (N/A, 7,524, 2013)	451	1.8
CA sea lion	<i>Zalophus californianus</i>	U.S.	-, -, N	257,606 (N/A, 233,515, 2014)	14,011	>321
Steller sea lion	<i>Eumetopias jubatus</i>	Eastern	-, -, N	43,201 (N/A, 43,201, 2017)	2,592	112
Pacific harbor seal	<i>Phoca vitulina</i>	CA	-, -, N	30,968 (N/A, 27,348, 2012)	1,641	43
Northern Elephant seal	<i>Mirounga angustirostris</i>	CA Breeding	-, -, N	187,386 (N/A, 85,369, 2013)	5,122	13.7

4.1 Pacific Harbor Seal (California Stock)

4.1.1 Distribution

Harbor seals haul out on intertidal sandbars, rocky shores and beaches along the California coast and islands. From 400 to 600 haul-out sites exist (Carretta *et al.* 2011 and 2012). Few to several hundred animals occupy each of these sites. Harbor seals generally haul out in greatest numbers during the afternoon, when it is usually warmest. Considerable beach area is often available irrespective of tides on some of the Channel Islands, especially at San Miguel and San Nicolas. On the mainland, however, harbor seals usually haul out during low tides in areas closest to the water because of threats from land. In some populated areas, they have switched to a nighttime haul-out pattern to avoid being disturbed (Howorth 1995).

4.1.2 Seasonal Distribution

Harbor seals generally forage locally but may travel up to 300 nautical miles on occasion, either to find food or suitable breeding areas. The greatest numbers haul out during the molting season, from May into August throughout the state (Carretta *et al.* 2011 and 2012). In general, both molting and pupping seasons occur earlier in Southern California and later farther north. In Southern California, the pupping season peaks from mid-February through April; at VSFB, it extends from March through June. Molting season follows, sometimes overlapping the pupping season. At VSFB, the greatest numbers of harbor seals historically hauled out in June, but in some recent years the highest numbers have been in the fall and winter (see Table 4).

4.2 California Sea Lion (U.S. Stock)

4.2.1 Distribution

In the U.S., the breeding range of the California sea lion extends from the Channel Islands as far north as Año Nuevo Island in central California (Carretta *et al.* 2011 and 2012). San Miguel and San Nicolas islands are the main breeding areas for the California sea lion.

4.2.2 Seasonal Distribution

The pupping season begins in late May, reaching a peak about the third week of June. By July, most pups have been born. Females stay with the pups for the first few days, then begin going to sea for progressively longer foraging trips, returning periodically to nurse their pups. Mating takes place as the females come and go. The pups begin to catch their first fish at about three months of age, but will nurse as long as the mother allows it and provided they are not separated. This continues for about 8 to 12 months, usually no later than just before the next pup is born (Carretta *et al.* 2011 and 2012).

Females usually range from the Mexican border to as far north as San Francisco. If prey is scarce, particularly during El Niño years, they have been known to extend their range into Oregon. Adult males claim their breeding territories in late May, usually leaving by August, with most animals moving north. Adult males may venture as far north as British Columbia or southeast Alaska.

4.3 Northern Elephant Seal (California Breeding Stock)

4.3.1 Distribution

The California breeding stock of the Northern elephant seal extends from the Channel Islands to the southeast Farallon Islands (Carretta *et al.* 2011 and 2012). Pupping at VSFB was first documented in January 2017. Pupping occurs from December through March, with peak breeding in mid-February. Pups are weaned at three to four weeks of age, then abandoned. The weaners then undergo their first molt, which can take several weeks. Afterwards, they venture seaward. Both pups and weaners can be washed out from rookery beaches and may end up almost anywhere along the California coast, usually from February through April.

4.3.2 Seasonal Distribution

Females and juveniles feed from California into Washington, while males travel as far as Alaska and the Aleutians. Males and females return between March and August to molt.

4.4 Steller Sea Lion (Eastern U.S. Stock)

4.4.1 Distribution

The eastern U.S. stock of Steller sea lions ranges from Cape Suckling, Alaska, to California (Cape Suckling is almost at the northernmost part of the Gulf of Alaska, at 140° west longitude.) Año Nuevo Island, in central California, is now the southernmost known breeding colony for Steller sea lions (Carretta *et al.* 2011 and 2012), although they did breed at San Miguel Island until the 1982-1983 El Niño. Sightings were rare after that. From 2010 to 2012, individual Steller sea lions have shown up along the mainland coast of the Southern California Bight, often hauled out on navigation buoys. At VSF, Steller sea lions have been observed in generally low numbers since approximately 2012, but no breeding or pupping behavior has been documented.

4.4.2 Seasonal Distribution

At Año Nuevo Island, Steller sea lions bear their young from May through July. Females alternate between foraging at sea and nursing their pups. Females continue this pattern, with the pups accompanying them to sea as they get older. Small numbers of juveniles and sub-adult males may be present at the rookery throughout the year. Pups can nurse up to a year, with some individuals continuing to nurse until they are two or three years old. Adult males remain at the rookery throughout the breeding season, then leave by September, migrating north to forage.

4.5 Northern Fur Seal (San Miguel Island Stock)

4.5.1 Distribution

Northern fur seals range from southern California to the Bering Sea and west to the Okhotsk Sea and Japan. About 74 percent of the breeding population is found on the Pribilof Islands of the southern Bering Sea. The San Miguel Island stock, though separate, comprises less than one percent of the population. While at sea, northern fur seals range throughout the North Pacific (Carretta *et al.* 2011 and 2012).

4.5.2 Seasonal Distribution

Adult males stay on or near haul-outs from May through August, with some non-breeding individuals remaining until November. Adult females generally stay on or near haul-outs from June to as late as November. Peak pupping is in early July. The pups are weaned at three to four months. Some juveniles are present year-round, but most juveniles and adults head for the open ocean and a pelagic existence until the next year.

4.6 Guadalupe Fur Seal (Guadalupe Island Stock)

4.6.1 Distribution

Guadalupe fur seals pup and breed mostly on Isla Guadalupe, Mexico. All other Guadalupe fur seals are considered descendants of one breeding colony on the island, so only a single stock is recognized. In 1997, a new colony was discovered on Isla Benito del Este, off the west coast of Baja California. Guadalupe fur seals also are occasionally seen on San Miguel and San Nicolas Islands, almost always as single individuals. Single adult males twice established territories on San Nicolas Island which lasted a few years each time, but no females arrived (Carretta *et al.* 2011 and 2012). Melin and DeLong (1999) reported that a pup was born and successfully weaned on San Miguel Island in 1998.

4.6.2 Seasonal Distribution

Males arrive at the rookeries in late May or early June and remain for one to four months. After breeding, they head out to sea. Females give birth in June and July, with most births in mid-June. Pups are nursed for five to six months, although the females can lactate up to eleven months. Little is known of their seasonal distribution at sea.

5. Request for Five-year Permit for Incidental Take

- Type of incidental taking authorization being requested and the method of incidental taking.

VSFB, Space Delta 30 requests a five-year permit and LOA for the harassment by Level B take of small numbers of marine mammals incidental to space vehicle and missile launches and UAS operations. Under the MMPA and its amendments, Level B harassment is defined as having “...*the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, nursing, breeding, feeding, or sheltering but which does not have the potential to injure a marine mammal or marine mammal stock in the wild.*”

Discussions between NMFS and the U.S. Navy determined that multiple year LOAs are beneficial to both the Navy and NMFS; VSFB greatly appreciated the issuance of a multiple-year LOA starting in calendar year 2014. Although we are aware that NMFS is now able to issue 7-year LOAs, due to expectations of further changes to mission operations at VSFB and the likelihood that such changes will require additional coordination, we are requesting a standard 5-year LOA at this time. The applicant understands that annual reports will still be necessary.

The five-year period is consistent with new regulations which allow for longer periods of validity for such authorizations. A five-year programmatic permit and LOA is requested because no potential for serious injury or mortality exists, or such potential can be negated by mitigation requirements. VSFB has complied with yearly incidental harassment LOAs issued over the nearly 20 years, as well as with the current LOA (valid 10 April 2019 through 9 April 2024; NOAA, NMFS 2019). VSFB has also followed the conditions of the current five-year permit (NOAA, NMFS 2019), as well as with previous five-year permits issued over the past 20 years. No serious injuries or mortalities of marine mammals have ever been known to result from VSFB operations. VSFB will continue to submit annual reports on its mitigation efforts, including reports on its monthly marine mammal surveys.

VSFB did not renew Scientific Research Permit (SRP) Number 14197 upon its expiration in 2014. In addition, VSFB will submit marine mammal monitoring reports following each rocket launch during which monitoring was required.

6. Potential Number and Causes of Takes from Operations

- Age, sex, and reproductive condition, number of marine mammals by species that may be taken by each type of taking, and number of times such takings by each type of taking are likely to occur.

Take Estimation

Population estimates for take calculations are drawn from stock assessment reports, direct observations and recent literature and tailored by subject matter experts on staff at VSFB. To estimate takes at VSFB, we review data collected in the course of monthly surveys over the last three years. To ensure a conservative calculation, for each species recorded we take the highest count each month in any of the three years to serve as a conservative reference. Instances of take for Pacific harbor seals at VSFB haul-outs were reduced considering that takes will only occur when haul outs are not inundated by the tidal cycle. Launches from

different sites within the base create different degrees of ensonification at specific haul out sites. Due to the difficulty in forecasting which launch sites may be used for future launches, and in order to provide conservative estimates, the applicant’s calculations anticipate 100% level B harassment from all VSFB launches for Harbor Seal and California sea lion. Northern elephant seal and Steller sea lion takes are adjusted to reflect observed reaction to launch stimulus. Given the short period of time between (1) launch and (2) recovery of the booster for that launch (less than ten minutes) at VSFB the two disturbances are treated as a single instance of Level B harassment.

6.1 Vandenberg SFB

Table 9 lists the limits of incidental take by Level B harassment over the five-year period requested in this application. Please note that these numbers are likely overestimates. Pacific harbor seal numbers were then reduced considering that takes will only occur to this species during low tides. Because launches from different SLCs impact different haul-outs, we again recognize that the total numbers listed are almost certainly overestimates. These Level B takes are from noise or visual disturbance only; no launch actions covered in this authorization are expected to produce a sonic boom over the mainland (SpaceX boost-backs and planned Stoke Space boost-backs may produce mainland sonic booms). No Level A takes are anticipated. Disturbances from individual launch events last no longer than one hour per event; therefore previous attempts to quantify harassment “animal days” is no longer considered by the Space Force to be a useful strategy.

Aircraft are required to maintain a 1000-foot “bubble” around pinniped haul-out and rookery areas except in emergency circumstances, such as Search and Rescue. One specific site, called Small Haul-Out 1, allows for a 500-foot “bubble,” as pinnipeds using this particular site are more accustomed to anthropogenic disturbances. A small number of Level B takes by UAS may occur at Small Haul-Out 1, only. Only Pacific harbor seals and occasionally California sea lions are known to use this haul-out, although Northern elephant seals have been observed on nearby beaches since about 2014, with minimal pupping since 2021 (4 pups in 2 years); far more elephant seal pups have been counted at Amphitheater Cove.

Table 9. Proposed Incidental VSFB Takes from Launch, Recovery and UAS Activities (5 years)

	2024 (40 launches)		2025 (55 launches)		2026 (75 launches)		2027 (100 launches)		2028 (110 launches)		5 yr Total Estimated Takes
	launch	UAS	launch	UAS	Launch	UAS	launch	UAS	launch	UAS	
Pacific harbor seal (CA)	3,000	600	4,125	600	5,625	600	7,500	600	8,250	600	31,500
California sea lion (U.S.)	2,240	100	3,080	100	4,200	100	5,600	100	6,160	100	21,780
Northern elephant seal (CA breeding)	1,800	0	2,475	0	3,375	0	4,500	0	4,950	0	17,100
Steller sea lion (Eastern)	200	5	275	5	375	5	500	5	550	5	1,900

6.1.1 Harbor Seals

Pacific harbor seals haul out regularly at more than ten sites on both north and south VSFB. They are the most widespread pinniped species on VSFB, and have been seen in all months, including decades of successful pupping. Many of their sites are deluged by tidal fluctuation. Rocket launches from sites closer to the haul-outs (SLC's 2, 6 and 8, and LF-576E) are more likely to cause disturbance, including noise and visual impacts. However, to ensure conservative calculations we assume that all launches result in 100% Level B response from harbor seals. Annual take of up to 8,250 animals is requested specific to space launches (take to these animals will only coincide with low tides); Level B take of up to 3,000 animals is requested specific to UAS operations (30 animals, 100 operations over a 5-year period).

6.1.2 California Sea Lions

California sea lions on VSFB only haul out regularly at Rocky Point (north and south) and Amphitheatre Cove. Both juveniles and adults of both sexes have been observed. The “most attended” haul out in Zone G is a short distance north of the VSFB boundary at Lion Rock. Historically, the greatest numbers observed at Lion Rock (a high count of 518 was recorded in 2016 (NOAA, NMFS 2021) usually appeared in late spring and summer, although some are usually present year-round (MMCG and SAIC 2011a and b; 2012a and c). In 2018 and 2019, as many as 1,300 California sea lions were observed at South Rocky Point, but this did not re-occur in 2020-2022; (refer to section 3.1.2). During very high tides and strong winds, when spray is heavy, the sea lions often leave this site or are unable to access it. Launches from SLC-6, SLC-8, and the future SLC-11, which are closest to North Rocky Point, would be the most likely to result in launch noise and visual impacts. Launches from SLC-3E and SLC-4E, both farther inland and some four times the distance, are less likely to impact California sea lions at North Rocky Point. Noise from missile launches from north VSFB may result in take to California sea lions at the off-base haul out Lion Rock, however missile launch operations are not expected to exceed 15 launches per year. Up to 21,780 instances of take are requested over 5-year period).

6.1.3 Northern Elephant Seals

Elephant seal pupping was first observed at VSFB in January 2017, preceded by several weeks of adult presence. Additional pupping has been observed every year since 2017, increasing each year, with a maximum of approximately 40 pups in 2022. Currently, Amphitheatre Cove (Figures 3 and 4) is the primary site used by elephant seals for breeding and pupping, however “Boathouse Beach” was the site for two successful pups each year in 2021 and 2022. All age classes and sexes haul out on VSFB, at different times of the year, to rest, undergo molting and reproduce. Juveniles and adults of both sexes also haul out at VSFB to undergo their catastrophic molt or occasionally to rest at other times of year. Level B take of up to 17,100 animals is requested over a 5-year period).

6.1.4 Steller Sea Lions

Steller sea lions have been observed at VSFB since April 2012 (MMCG and SAIC 2012c). They have been observed infrequently since then, never exceeding 12 individuals in one survey (unpublished data). Total individuals documented are very small, as many as 34 total present in one year, Level B take of up to 1,925 animals is requested over a 5-year period. Level B take of up to 25 animals is requested specific to UAS operations (5 animals, 5 operations over a 5-year period).

6.1.5 Fur Seals

Only one live northern fur seal has been reported at VSFB in the past 25 years (SBMMC 2012); therefore, it is extremely unlikely that any will be taken. At least two deceased fur seals have been found on VSFB.

Guadalupe fur seals have yet to be reported at VSFB. Consequently, we are not requesting take on VSFB for either species.

6.2 Northern Channel Islands

The number of pinnipeds taken will depend on the number of animals expected to be present (Table 10) in addition to the intensity, frequency and duration of the sonic boom or booms received by the pinnipeds (Table 11). The number of pinnipeds present where the boom strikes is also a significant factor. For example, on one occasion pinnipeds on one side of San Miguel Island, reacted to a boom, while animals four miles away on the other side never heard it, nor was it detected there by acoustic instruments (MMCG and SAIC 2012a). Accordingly, and consistent with the 2019 LOA, we include a .25 correction factor in the take calculations to account for the fact that boom effects from any given launch scenario will only affect a portion of the haul outs on San Miguel and Santa Rosa Islands.

Table 10. North Channel Islands, high count 2017-2019 from SWFSC-656, Lowry *et al.*, 2021

	2017	2019	High from 2017-2019
Pacific harbor seal			520
San Miguel	230	254	254 (2019)
Santa Rosa	266	148	266 (2017)
California sea lion			
			62,969
San Miguel	49,252	60,277	60,277 (2019)
Santa Rosa	2,692	1,618	2,692 (2017)
Northern elephant seal			
			3,960
San Miguel	2,327	2,791	2,791 (2019)
Santa Rosa	1,169	1,015	1,169 (2017)
Northern fur seal			
			4,520
San Miguel	4,520	4,377	4,520 (2017)
Santa Rosa	N/R	N/R	N/R
Guadalupe fur seal			
San Miguel	N/R	N/R	N/R

Santa Rosa	N/R	N/R	N/R
(San Nicholas)	N/R	1	N/R
Steller sea lion			
			5
San Miguel	N/R	N/R	N/R
Santa Rosa	N/R	N/R	N/R
(Anacapa)	N/R	3	N/R

The take table below is based on more than 20 years of observations during launches and considers the number of pinnipeds of each species expected to be present and each species’ observed sensitivity to sonic booms (MMCG and SAIC 2012a). Summarizing 20 years of sonic boom modeling, we anticipate that no more than 25% of space launches will produce a sonic boom greater than 2 psf over the NCI (estimated to be 165 launches over 5 years). Therefore, Table 10 shows higher numbers of takes than those to sound and visual disturbance on VSFB, shown in Table 9, except the actual disturbance to all pinnipeds on the NCI is expected to be much less than that on VSFB. No Level A takes are anticipated.

Table 11. Proposed Level B Take, Northern Channel Islands (San Miguel and Santa Rosa)
(Number in parenthesis below “year” is the maximum expected number of sonic booms in that year)

	2024 (5)	2025 (12)	2026 (24)	2027 (30)	2028 (33)	5-year Total estimated Takes
Pacific harbor seal	325	780	1,560	1,959	2,145	6,769
California sea lion	19,680	47,232	94,464	118,080	129,888	409,344
Northern elephant seal	1,240	2,976	5,952	7,440	8,148	25,756
Steller sea lion	0	0	0	0	0	0
Northern fur seal	1,370	3,288	6,576	8,220	9,042	28,496
Guadalupe fur seal	3	8	16	19	21	67

Pacific harbor seal: $520(\text{num}) \times .50 (\text{react}) \times .25(\text{affected area}) = 65(\text{num}) \times (\text{Booms})$
California sea lion: $62,969(\text{num}) \times .25(\text{react}) \times .25(\text{affected area}) = 3,936(\text{num}) \times (\text{Booms})$
Steller sea lion: N/A; virtually no presence on San Miguel
Northern elephant seal: $3,960(\text{num}) \times .25(\text{react}) \times .25(\text{affected area}) = 248 \times (\text{Booms})$
Northern fur seal: $4,377 \times .25(\text{react}) \times .25(\text{affected area}) = 274 \times (\text{Booms})$
Guadalupe fur seal: Infrequent, Estimated: $5(\text{num}) \times .50 (\text{react}) \times 25(\text{affected area}) = 0.63 \times (\text{Booms})$

7. Impacts on Marine Mammal Habitats and Stocks

Anticipated impact of the activity upon stock;

- Anticipated impact of activities upon the habitat of marine mammal populations, and likelihood of restoration of affected habitat and;
- Anticipated impact of loss or modification of the habitat on the marine mammal populations involved.

No adverse impacts are anticipated on marine mammal stocks or populations. No impacts, losses or modifications are anticipated on marine mammal habitats; therefore, no restoration of marine mammal habitats would be necessary.

- Anticipated impact of the activity upon species.

Pinnipeds will be taken only by incidental harassment from noise or visual disturbances and unmanned aircraft, rocket and missile launches. Reactions of pinnipeds to launch noise and sonic booms have ranged from no response to heads-up alerts, from startle responses to some movements on land, and finally from some movements into the water, and on only one occasion, to a stampede, involving California sea lions at the NCI. This was the result of a sonic boom much louder than any boom expected in the next five years. Therefore, we consider the likelihood of a stampede to be very low.

- Anticipated Impacts from Launch Noise

From more than two decades of pinniped monitoring by numerous qualified, independent researchers, we know that at VSFB harbor seals generally alert to nearby launch noises, with some or all of the animals going into the water. Usually within minutes to two hours of each launch as many or more animals haul out than are present during each launch. Exceptions to this occur during rising tides, breakers or when other disturbances are involved. When launches occur during high tides at VSFB, impacts at most beaches / haul-outs are greatly decreased, because the haul-out sites are submerged (MMCG and SAIC 2012a). Amphitheater and South Rocky Point are not completely submerged at high tide. We anticipate that such patterns will continue.

In addition to monitoring pinniped haul-out sites before, during and after launches, researchers were previously required to capture harbor seals at VAFB and Point Conception to test their sensitivity to launch noises. Auditory Brainstem Response (ABR) tests were performed under five-year SRPs starting in 1997. The goal was to determine whether launch noise affected the hearing of pinnipeds (MMCG and SAIC 2012a). The low frequency sounds from launches can be intense, with the potential of causing a temporary [hearing] threshold shift (TTS), in which part or all of an animal's hearing range is temporarily diminished. This can last from minutes to days, but eventually hearing returns to normal. Meanwhile, TTS has the potential to compromise the survival of the animal. A permanent threshold shift (PTS) could occur if the sound is sufficiently loud. PTS is considered Level A take under the MMPA and is not authorized under the Final Rule, IHA or LOA. None of the tested seals showed any signs of TTS or PTS. The researchers

stated that the animals could have experienced TTS but recovered fully by the time they were retested (MMCG and SAIC 2012a). This research has concluded. Thus, after 15 years of ABR research, we anticipate no impacts from launch noises on harbor seal hearing.

7.1 Anticipated Impacts from Sonic Booms

At the Channel Islands, harbor seals react more strongly to sonic booms than most other species. Pups sometimes react more than adults, either because they are more easily frightened or because their hearing is more acute. Harbor seals also appear to be more sensitive to sonic booms than most other pinnipeds, often startling and fleeing into the water. From prior monitoring, no more than 27% of California sea lions have ever responded to sonic booms at a level that would be considered “take.” Northern fur seals generally show little or no reaction. Northern elephant seals generally exhibit no reaction at all, except perhaps a head-lift response or some stirring, especially if sea lions in the same area or mingled with the elephant seals react strongly to the boom. Post-launch monitoring generally reveals a return to normal patterns within minutes up to an hour of each launch, regardless of species.

Table 9 compares modeled and actual sonic boom results at San Miguel Island. Launch monitoring has shown that few animals from the four species reacted to overpressures below 2 pounds per square foot (psf). In general, elephant seals did not react unless other animals around them reacted strongly or if the sonic boom was extremely loud. Northern fur seals seemed to react similarly. From limited data about the reactions of harbor seals, it appears likely that they were quite sensitive to sonic booms (MMCG and SAIC 2012a and c). Their reactions to launch noise seem to suggest a sensitivity to low frequency sounds as well.

In summary, impacts have been considered minimal and temporary by various researchers. No evidence has been presented of abnormal behavior as a result of the launches, nor were any injuries or mortalities attributed to any launches. No pups were abandoned as a result of sonic booms. These findings came as a result of more than twenty-five years of research by numerous qualified, independent researchers, from March 1991 through present. We anticipate that such patterns will continue.

Table 12. Sonic Boom Modeling and Actual Recorded Levels (several additional examples are available upon request)

Launch Date	Mission	Vehicle	Launch Site	Modeled psf	Recorded psf
April 2006	Cloudsat	Delta II	SLC-2	2.0	0
March 2008	NROL 28	Atlas V	SLC-3	2.0	1.24
October 2011	NPOESS	Delta II	SLC-2	1.5	0.671
February 2013	LDCM	Atlas V	SLC-3	1.00	0
April 2014	DMSP-19	Atlas V	SLC-3	>3	0.74
December 2014	NROL 35	Atlas V	SLC-3	>3	1.175
October 2015	NROL 55	Atlas V	SLC-3	>2	1.956
March 2017	NROL 79	Atlas V	SLC-3	1.4	2.2
May 2018	InSight	Atlas V	SLC-3	1.53	0.64

7.2 Anticipated Impacts from Aircraft

Following the establishment of the 1000-foot “bubble” around pinniped haul-out and rookery sites at VSFB many years ago, no instances of pinnipeds reacting to aircraft have been reported; thus, no impacts from aircraft are anticipated (MMCG and SAIC 2012a). A small number of takes at Small Haul-Out 1 resulting for UAS operations are requested (refer to Table 6). Following coordination with NMFS (Long Beach), the “bubble” around Small Haul-Out 1 was reduced to 500 feet. This area is frequently used by recreationists, and is occasionally used for military mission harbor operations (including dredging); it appears that pinnipeds (usually only harbor seals, and Northern elephant seals at nearby “Boathouse Beach”) using this haul-out are much more accustomed to human presence than those at other locations (unpublished data; Evans, personal observation).

8. Minimizing Potential Impacts to Marine Mammals

- Suggested means of accomplishing necessary monitoring and reporting that will result in increased knowledge of species, decreased levels of taking or impacts on populations of marine mammals expected to be present during activities.

8.1 Space Force and Air Force Operations

8.1.1 Launches

The myriad of operations and requirements associated with each rocket or missile launch preclude the ability to alter or modify launch schedules. Launch dates are often scheduled months or years in advance. As each date approaches, technical issues and concerns can create short-term alterations to the launch schedule or delay launches for longer periods. Thus, it is not practical to modify launch schedules. Proven procedures, monitoring and research efforts designed for marine mammal protection (described below), help minimize potential impacts to marine mammals at VSFB and the NCI.

8.1.2 Flight Operations

The use of approved aircraft routes for testing and evaluation, as well as a requirement to remain outside of a 1,000-foot bubble around pinniped rookeries or haul-out sites (except in emergencies, and with a reduced, 500-foot bubble at Small Haul-out 1), ensures minimal impacts from aircraft operations to marine mammals and their habitats on VSFB. Unmanned aerial systems in classes 0-2 are allowed at overflight altitudes of 300 feet. Class 3 will maintain a minimum altitude of 500 feet, except at take-off and landing. UAS in classes 4 and 5 only operate from the VSFB airfield and will always operate at or above 1,000 feet altitude except at take-off and landing.

8.1.3 Harbor Operations (including dredging)

The Space Force maintains and operates a small harbor on South VSFB. In preparation for launch operations, the Space Force may dredge the harbor as often as two times per year to accommodate vessels that unload rocket motors and large core or booster segments. To determine if dredging is required, personnel conduct bathymetric surveys. Dredging activities typically take 3-5 weeks, including mobilization and demobilization, and can include night-time operations.

The harbor also supports routine ship, small boat, and may be used for unmanned underwater vehicle (UUV) operations. The Space Force expects that there will be approximately 20 individual ship operations in the VSFB harbor per calendar year (likely much less). The Space Force expects that there will be approximately 100 individual small boat/UUV operations in the VSFB Harbor per calendar year (likely much less); night operations will not exceed 25 per year.

Harbor seals are frequently hauled out, limited to low-tide, at Small Haul-Out 1 (Figure 3); Northern elephant seals are found on nearby Boathouse Beach, often from October through April, including successful pupping in 2021 and 2022 (two pups each year). As detailed previously, these animals are seemingly adapted to more human disturbances than other sites on VSFB (yet much less disturbance than they might be exposed to at off-VSFB locations). VAFB is open to discussions regarding the possibility of monitoring northern elephant seals during dredging operations if any are scheduled in the most sensitive months of January and February (we do not believe that monitoring at other times of the year is necessary).

8.2 Marine Mammal Monitoring

Impacts to marine mammals at VSFB and the NCI are monitored in several ways described in detail below. Such monitoring ensures that any impacts from existing rocket launches are observed and documented as required. It also ensures that impacts from new rockets and missiles (if any) are assessed and monitored. Finally, when significant alterations are made to rockets or missiles that could change the potential for impacts, then the impacts from such vehicles are also assessed and monitored.

The monitoring and reporting protocols proposed in this application are significantly different from those used during the former five-year programmatic permit, yet we believe that they meet all requirements of the current LOA. Due to the planned increase in launch frequency through the next five years, significant consolidation of monitoring is, we believe, prudent, as with a potential, yet incremental increase to as many as 110 launches annually, it is clear that 3-5 days of monitoring specific to any single launch is impractical. For that reason, we propose to reduce direct monitoring of individual launches and incorporate that into enhanced bi-monthly monitoring.

8.2.1 VSFB Missile Launch Monitoring

Multiple years of monitoring has shown that insignificant take results from missile launches and therefore biological monitoring of missile launches is not proposed, with the exception of the first three launches of the GBSD between 1 March and 31 July. North base missile launches may result in minimal take to California sea lions at the off-base haul-out identified as Lion Rock.

8.2.2 VSFB Rocket Launch Monitoring

The biological monitoring for new or reconfigured vehicles, if they are louder than existing rockets or are launched from new facilities, will follow the protocols discussed below. If no unusual or different effects from existing vehicles is observed, then monitoring will be combined with bi-monthly monitoring efforts described below. VSFB agrees to conduct new and additional testing of remotely controlled video cameras, to potentially include night or low-light vision equipment and other technologies. When and if these technologies test successfully, the Space Force will consider coordination with the National Park Service to implement similar monitoring on the NCI.

On both VSFB and NCI, monitors typically complete 4-6 observations of each significant haul-out area each day, over a period of 3-5 hours. Monthly surveys typically count each haul-out only once; we attempt to schedule these to coincide with afternoon low tides.

For launches that occur during the harbor seal pupping season (1 March to 30 June) or when higher numbers of California sea lions are present (1 June-31 July), monitoring will be conducted by at least one NMFS-approved marine mammal observer trained in marine mammal science. Authorized marine mammal observers shall have demonstrated proficiency in the identification of all age and sex classes of both common and uncommon marine mammal species found at VSFB. They shall be knowledgeable of approved count methodology and have experience in observing pinniped behavior, especially that due to human disturbances.

Monitoring at the haul-out site closest to the facility where the vehicle will be launched will begin at least 72 hours prior to the launch and continue until at least 48 hours after the launch. For launches within the harbor seal pupping season, a two-week follow-up pup survey will be required to ensure that there were no adverse effects to pups. For launches that occur during daylight, time-lapse video recordings will be made of the reactions of pinnipeds to each launch. This is necessary because access to observation points near

launches is not allowed during the launches due to personnel safety issues. As noted above, monitoring using remotely controlled cameras or other technologies will be considered and tested.

Monitoring for each required launch will include multiple surveys each day that record, when possible: species, number, general behavior, presence of pups, age class, gender, and reaction to launch noise, or to natural or other human-caused disturbances. Environmental conditions will also be recorded, including visibility, air temperature, clouds, wind speed and direction, tides, and swell height and direction. A launch monitoring report containing all of the required information in an approved format will be submitted to NMFS within its deadlines. An annual report describing all of the launches during each year will also be submitted to NMFS within its deadlines and in an approved format.

8.2.2 VSFB Bi-monthly Monitoring

Marine mammal species of concern at VSFB listed in the past and current LOAs include Pacific harbor seals, California sea lions, and northern elephant seals. The main focus is on elephant and harbor seals along the VSFB coastline, especially during pupping season. However, discoveries of unsuccessful California sea lion pupping on VAFB in 2003 (Section 3.1.2) and reports of substantial numbers of northern elephant seals hauling out on the VAFB coastline starting in 2004 (Section 3.1.3) indicated the need for continuing to collect baseline data on VSFB's pinniped population. The subsequent monthly surveys resulted in observations of Steller sea lions starting in 2012 (Section 3.1.4), the discovery of northern elephant seal pupping in 2017 (3.1.3), and a large but apparently temporary increase in California sea lions noted in May-July 2018 and 2019 (3.1.2; no pupping was observed) were also notable results of recurring monthly monitoring. Should local populations continue to increase, the numbers and species of marine mammals included in the LOA may require adjustment to ensure that incidental take protections are adequate for MMPA compliance.

Another goal of the current monthly surveys has been and will continue to be assessing the relative abundance of pinnipeds at peak haul-out times, usually during the lowest afternoon tides. Launches are not scheduled around tides. If a launch occurs during a high tide, no animals are usually present because most haul-out areas are usually submerged, with the exceptions of North and South Rocky Point, and Amphitheatre Cove as previously mentioned. An erroneous assumption could be made that a launch affected haul-out patterns when in fact only a high tide affected them. The current monthly surveys allow researchers to assess haul-out patterns and relative abundance over time, presenting a better picture of pinniped population trends at VSFB and whether Space Force operations are resulting in cumulative impacts.

Following the first three launches described above as well as for established launch programs, VSFB will change the focus of monitoring from that directly related to a specific space launch event toward a program where we will combine bi-monthly pinniped monitoring with launch monitoring. The current, monthly survey protocol will be applied on a bi-monthly basis to monitor the abundance, distribution, and status of pinnipeds at VSFB in order to achieve the original goals of the prior monthly surveys (baseline abundance and species occurrence) as well as monitor the effects of launch activities. Whenever possible, these surveys will be timed to coincide with the lowest afternoon tides of each month, when the greatest numbers of animals will usually be hauled out. This timing is not always possible if the tides occur too close to sunrise or sunset, since south VSFB surveys start about two hours before the low tide and end two hours afterward. North VSFB surveys are either conducted by a separate surveyor on the same day as south VSFB, or on the day before/after south VSFB surveys. North VSFB surveys require approximately 90 minutes. Monitoring during nighttime low tides is not possible because of the dangerously unstable nature of the bluffs overlooking many of the observation points. Occasional VSFB or area closures also sometimes preclude monitoring on a given day, in which case the next best day will be selected.

During the bi-monthly surveys, a NOAA-approved monitor, as required in the LOA, will visit each site. In addition, another person may accompany the monitor for safety reasons. Counts will be made and recorded at each site, then the monitor(s) will move to the next site.

Data gathered will include: species, number, general behavior, presence of pups, age class, gender, and any reactions to natural or human-caused disturbances. Environmental conditions will also be recorded, including visibility, air temperature, clouds, wind speed and direction, tides, and swell height and direction. Monthly reports will be submitted to VSFB and an annual report, describing all of the bi-monthly surveys each year, will also be submitted to NMFS within its deadlines and in an approved format, as a portion of the annual LOA report.

8.2.3 NCI Sonic Boom Modeling

Sonic boom modeling will be performed prior to the first three small or medium rocket launches from new launch proponents or at new launch facilities, and all heavy or super-heavy rocket launches. PCBoom, a commercially available modeling program, or an acceptable substitute, will be used to model sonic booms from new vehicles. Different versions of the PCBoom software provide different specificities of results; for example PCBoom 3 tends to provide results rounded to the nearest 1/10th of one PSF, whereas PCBoom 4 produces predications to the 1/100th of one PSF – however, as just models (or predictions), it seems that the more precise results of PCBoom 4 tend to be less accurate.

Launch parameters specific to each launch will be incorporated into each model run, these include: launch direction and trajectory, rocket weight, length, engine thrust, engine plume drag, and launch profile (vehicle position versus time from launch to first-stage burnout), among other aspects. Various weather scenarios will be analyzed from NOAA weather records for the region, then run through the model. Among other factors, these will include the presence or absence of the jet stream, and if present, its direction, altitude and velocity. The type, altitude, and density of clouds will also be considered. From these data, the models will predict peak amplitudes and impact locations. Should a model indicate that a peak overpressure could impact the NCI in excess of proposed thresholds shown in Table 10, then acoustic and biological monitoring, described in the next section, may be implemented.

Modeling will no longer be conducted for SpaceX landings to the “down range” autonomous barge (where certain launches of the Falcon 9 rocket return the first stage to a site at least 50 km off the coast of Mexico).

Modeling will not be required for launches of currently deployed missiles because of their trajectories west of VSFB and north of San Miguel Island and the previously well-documented acoustic properties of the missiles. GBSD is expected to utilize approximately the same trajectories as the current MMIII, and the GBSD program will be required to model at least one representative launch. When missiles are launched in a generally western direction (they turn south several hundred miles from VSFB and at high altitude), there is no sonic boom impact on the NCI, thus there is no concern for pinnipeds from these launches.

8.2.4 NCI Launch Monitoring

Acoustic and biological monitoring will be conducted on the NCI if the sonic boom model indicates that pressures from a boom will reach or exceed the psf level detailed in Table 10. These dates have been determined appropriate to account for sensitive seasons, primarily pupping, for the various pinniped species. The monitoring site will be selected based upon the model results. Emphasis will be placed on selecting a location on one of the islands where the maximum sound pressures are reached and where suitable assemblages of pinnipeds are present.

Table 13. Proposed NCI Sonic Boom Level Requiring Monitoring, By Date

Dates	Sonic boom level
1 March – 31 July	>5 psf
1 August – 30 September	>7 psf
1 October – 28 February	no monitoring

Specialized acoustic instruments will be used to record sonic booms generated during launches from VSF. The recordings will then be analyzed to determine the intensity, duration, and frequency of sonic booms so this can be compared with levels considered potentially harmful to marine mammals. The analysis can also be used to validate the efficacy of the model.

Biological monitoring will be conducted at the closest significant haul-out site to the modeled sonic boom impact area. Emphasis will be placed upon selecting a site where pinnipeds are present that are most sensitive or least understood when it comes to reactions to sonic booms. At present, monitoring the reactions of northern fur seals and Pacific harbor seals to sonic booms is more important than monitoring those of California sea lions and northern elephant seals, which have already been monitored more often (Table 8). Monitoring the reactions of mother-pup pairs of any species is also important.

Considering the large numbers of pinnipeds found on some island beaches—sometimes thousands—smaller focal groups will be monitored instead. Estimates of the entire beach population will be made and their reactions to the launch noise noted. Photos and/or video recordings can help with this task if feasible. This is not always practical when visibility is reduced, not all animals are in sight from one observation point, severe glare, fog and/or other factors.

Monitoring will be conducted by at least one NMFS-approved marine mammal observer, trained in marine mammal science. Another person will accompany the monitor for safety reasons. Monitoring will usually commence at least 72 hours prior to the launch, during the launch and at least 48 hours after the launch, unless no sonic boom is detected by the monitors and/or by the acoustic recording equipment, at which time monitoring would be stopped. If the launch occurs in darkness, night vision equipment will be used. Monitoring for each launch will include multiple surveys each day that record, when possible: species, number, general behavior, presence of pups, age class, gender, and reaction to sonic booms or natural or human-caused disturbances. Photos and/or video recordings will be taken when feasible.

Environmental conditions will also be recorded, including visibility, air temperature, clouds, wind speed and direction, tides, and swell height and direction. A launch monitoring report containing all of the required information and in an approved format will be submitted to NMFS within its deadlines. An annual report describing all launch monitoring during each year will also be submitted to NMFS within its deadlines and in an approved format.

8.3 Scientific Research

VAFB did not renew the SRP that expired in 2014. No Space Force led research by VSF is currently in progress or planned, however the Space Force has cooperated with permitted researchers from the University of California - Santa Cruz, California Polytechnic State University - San Luis Obispo (refer to 3.1.3) and other universities.

Unexpected responses of pinnipeds to scientific research, beyond “alert” or “flush,” will be promptly reported to NMFS and discussed in detail in VSF’s annual LOA report.

8.4 Coordination of Reporting Requirements

- Suggested means of minimizing burdens by coordinating such reporting requirements with other schemes already applicable to other persons conducting such activity.

Each monitoring task has its own reporting requirements. Monitoring tasks at VSFB are conducted by government employees or independent consulting firms selected by the Space Force, or in some cases, privately through the launch proponent (e.g., SpaceX). Task-specific reports, such as a monitoring reports for a specific launch or quarterly reports on monthly surveys, are submitted to natural resource managers in the 30th Civil Engineer Squadron, then to NMFS. At the end of each reporting period, annual reports are prepared by qualified personnel. Descriptions of various tasks in the annual reports are based on data from specific monitoring efforts over the year and often contain information about work conducted by other firms. This eliminates duplication of efforts and allows for a more objective approach in the annual reports.

8.5 Coordination of Research Activities

- Suggested means of learning of, encouraging and coordinating research opportunities, plans and activities related to reducing such incidental taking and evaluating its effects.

Monitoring tasks at VSFB are conducted by government employees and various qualified, independent consulting firms. New findings, such as the 2012 discovery of Steller sea lions at VAFB, or of northern elephant seal pupping in 2017 are promptly reported to NMFS.

A five-day launch monitoring effort may bracket a period of low tides needed for the monthly surveys. If two different firms have been selected for these separate tasks, such firms will coordinate with the natural resource managers in the 30th Civil Engineer Squadron. This means that one firm will share data needed by another firm so that a duplication of efforts does not occur. This reduces the potential for impacts from the research efforts by avoiding too many observers on the scene. As an example, a firm observing pinnipeds at Rocky Point to fulfill the five-day launch monitoring requirement will share its data with another firm conducting a monthly survey. The data applied to the monthly survey results will be obtained for the same survey day to ensure consistent data gathering. Since both firms will employ qualified biologists and utilize approved monitoring protocols, the LOA requirements can be satisfactorily met.

Ongoing research at VSFB on sea otters (*Enhydra lutris nereis*) is authorized by the USFWS. A variety of government agencies and universities participate in this research. Often such research takes biologists into areas not censused during launch monitoring efforts or monthly marine mammal surveys. Good communications between the researchers ensure that findings of interest to other researchers are shared. As one example, the presence of increased numbers of harbor seals at Point Conception and in nearby kelp beds (Laroche 2012) was of interest to researchers conducting monthly surveys at VSFB. In other cases, deceased sea otters that have washed ashore in areas monitored during launches or during monthly surveys are immediately brought to the attention of appropriate parties. When possible, researchers on the scene have collected the carcasses for pickup and detailed necropsies by authorized sea otter researchers. This has ensured that such carcasses are recovered before they begin to deteriorate, get washed away by a high tide, or are scavenged by predators such as coyotes (*Canis latrans*) or turkey vultures (*Cathartes aura*). Each carcass is important, and fresh specimens are much more valuable because of what can be learned from them.

Research on Western snowy plovers (*Charadrius nivosus*), federally listed as threatened, and California least terns (*Sternula antillarum browni*), federally listed as endangered, is carried out in season on various sandy beaches throughout VSFB. Purisima Point happens to host colonies of these listed birds as well as being a haul-out and rookery area for harbor seals. Marine mammal surveyors avoid conflicts by viewing

harbor seals a safe distance from the birds with a spotting scope, or by providing monitors that also are qualified to work with both species of birds.

When launch monitoring is required at the NCI, notification is provided to Channel Islands National Park. In turn, checks are made to ensure that using a prospective launch monitoring site would not interfere with ongoing research on the island by others, especially NMFS researchers from the National Marine Mammal Laboratory in Seattle, who have a field station on San Miguel Island, and other researchers from NMFS Southwest Fisheries in La Jolla, CA. Launch monitors at San Miguel sometimes utilize the ranger station above Cuyler Harbor or the NMFS field station above Point Bennett as a base of operations. This is done on an as-available basis in a way that does not conflict with other island research activities. Launch monitors also coordinate travel to and from the NCI with the National Park Service and other researchers, for both personnel and supply transportation. Logistics coordination has increased in complexity in recent years due to changes in NPS policy as well as corporate decisions made by private aircraft services.

9. Potential Impact of Operations on Subsistence Uses

- Anticipated impact of activities on availability of species or stocks of marine mammals for subsistence uses;
- Availability and feasibility of equipment, methods, and manner of conducting activity or other means of effecting the least practicable adverse impact upon affected species or stocks, their habitat, availability for subsistence uses and;
- Plan of cooperation or information on measures taken to minimize adverse effects on availability of marine mammals for subsistence uses where proposed activity would take place in or near traditional arctic subsistence hunting area and/or affect the availability of species or stocks of marine mammals for arctic subsistence uses.

No subsistence use of marine mammals exists in or near the area of Space Force operations; thus, no impacts to such uses would occur.

10. Section 7 Consultations and Biological Opinions

Section 7 consultations for the federally listed Threatened southern sea otter (*Enhydra lutris nereis*) were completed with the U.S. Fish and Wildlife Service. Two Biological Opinions are currently in effect for current launch programs on VSFB, authorizing potential effects to southern sea otters, including one Programmatic Biological Opinion issued to the Air Force (8-8-13-F-49R) and one issued to Space Exploration Technologies, Inc (SpaceX; Biological Opinion 2017-F-0480). Revision and renewal of the former PBO is in progress at the time of this application.

In 2016, NMFS concurred with a finding that space launches “may affect, but are not likely to adversely affect” the federally listed threatened Guadalupe fur seal on the NCI (NOAA-NMFS, 2016); this concurrence was updated/renewed in 2022. We believe that the level of potential Level B take described in this application does not exceed the ESA “NLAA” determination described above.

The eastern U.S. stock of Steller sea lions was delisted on 4 November 2013 (NMFS 2013). Steller sea lions have been seen at VSFB in very small numbers (as many as 16) starting in April 2012. The site at which the Steller sea lions were observed is included in monthly surveys.

11. Equipment, Methods and Activities to Minimize Adverse Impact upon Affected Species or Stocks and Their Habitat

The myriad of operations and requirements associated with each rocket and missile launch preclude the ability to easily alter or modify launch schedules. Launch dates are often scheduled months or years in advance. For example, avoiding launches “when possible” during pupping season has little realistic value.

As the launch date approaches, small technical issues and concerns frequently create short-term alterations to the launch schedule, or delay launches for longer periods. Therefore, it is not practicable to modify launch schedules. Required monitoring and procedures in place for marine mammal protection ensure the least practicable adverse impacts from launches to marine mammals and their habitats on VAFB and the NCI. VAFB will continue to test equipment and emerging technologies, including but not limited to night vision cameras and newer models of remote video cameras at both VAFB and on the NCI. UAS based or maybe even space-based imagery may be found useful in the future, in consideration that access to the NCI has become more complicated in the past 5-7 years.

Unless constrained by human safety, national security, or launch trajectories, the Space Force shall ensure the least practicable adverse impacts on Pacific harbor seals, California sea lions, northern elephant seals, Steller sea lions and northern fur seals, by:

- (A) Ensuring that all aircraft and helicopter flight paths maintain a minimum distance of 1,000 feet from recognized seal haul-outs and rookeries (e.g., Point Sal, Purisima Point, Rocky Point), except in emergency situations such as law enforcement response or Search and Rescue operations (Small Haul-Out 1 has a 500-foot avoidance distance);
- (B) Unmanned aerial vehicles in classes 0-2 avoid pinnipeds by a minimum of 300 feet;
- (C) Avoiding, whenever possible, launches that will produce a sonic boom over the Northern Channel Islands during the peak pinniped pupping season of March through June; and
- (D) Reviewing the launch procedure and monitoring methods. In cooperation with NMFS, if any incidents of injury or mortality of a pinniped discovered during post-launch surveys or indications of affects to the distribution, size, or productivity of the affected pinniped populations as a result of the authorized activities are thought to have occurred. If necessary, appropriate changes must be made through modification to this Authorization prior to conducting the next launch of the same vehicle.

11.1 Summary of Monitoring Protocols for VSFB

For new or reconfigured vehicles, if they are louder than existing rockets or are launched from new facilities, launches that occur during the harbor seal and California sea lion pupping season (1 March to 31 July) or if a boom is predicted to exceed 2 psf at a haulout location on VSFB as a result of a boost-back from SpaceX or any other launch action (1 January to 31 December):

- (A) Monitoring will be conducted by at least one qualified marine mammal observer, trained in marine mammal science (refer to section 8.2.1), at each appropriate pinniped monitoring location, to record the effects of launches on pinniped populations.
- (B) Monitoring at the haul-out site closest to the appropriate launch facility will commence at least 72 hours prior to the launch and continue until at least 48 hours after the launch.
- (C) A follow-up survey will be made within two weeks of the launch to ensure that there were no adverse effects to marine mammals.
- (D) For launches that occur during daylight hours, monitoring will be supplemented with video recording of mother-pup seal responses to the launch.

- (E) Acoustic and biological monitoring will be conducted for new or reconfigured vehicles, if they are louder than existing rockets or are launched from new facilities during at least the first launch, whether it occurs within the pupping season or not. Acoustic monitoring would also be conducted to record and estimate sonic boom levels during boost-back events predicted to exceed 2 psf at a haulout location on VSFB.
- (F) Monitoring for each launch will include multiple surveys each day that record, when possible: species, number of animals, general behavior, presence of pups, age class, gender, and reaction to launch noise (only during the harbor seal and northern elephant seal pupping seasons), sonic booms, or other natural or human-caused disturbances. Environmental conditions, including tide, wind speed, air temperature, and swell will also be recorded.
- (G) A report detailing the collected information will be submitted to the NOAA NMFS within 90 days of each monitored launch.

For launches that occur the remainder of the year (1 August to 28 February), no launch-specific monitoring will be required (the current situation at VSFB), with the exception of sonic booms predicted in excess of 2 psf during Pacific harbor seal pupping season from SpaceX boost-backs to LZ-4 or planned Stoke Space boost-back at a site not yet determined. This standard will also apply to any additional commercial launch providers that may plan boost-back to VSFB sites. Boost-backs 10 or more miles from the coastline will not require monitoring (unless the landing results in a sonic boom on the mainland or NCI).

Following the first three launches described above as well as for established launch programs, VSFB will combine bi-monthly pinniped monitoring with launch monitoring.

- (A) Bi-monthly marine mammal surveys will be conducted to monitor the abundance, distribution, and status of pinnipeds at VSFB in order to achieve the original goals of the prior monthly surveys (baseline abundance and species occurrence) as well as monitor the effects of launch activities.
- (B) Whenever possible, these surveys will be timed to coincide with the lowest afternoon tides of each month, when the greatest numbers of animals will usually be hauled out. This timing is not always possible if the tides occur too close to sunrise or sunset, since south VSFB surveys start about two hours before the low tide and end two hours afterward.
- (C) We intend to examine trends in pinniped abundance (or decline) in comparison to an increase in launch frequency at VSFB.
- (D) We will consider adding year-round (or nearly year-round) acoustic monitoring at one or two key haul-outs to track changes in ambient sound levels in comparison to noise caused by rocket launches and recoveries.

11.2 Summary of Monitoring Protocols for the NCI

Using a sonic boom prediction model to determine the location of sonic booms in the vicinity of the NCI, biological and acoustic monitoring will be conducted on the NCI (San Miguel, Santa Cruz, and/or Santa Rosa Islands) whenever a sonic boom greater than 5.0 psf is predicted to impact one of the islands between 1 March and 31 July; greater than 7.0 psf between 1 August and 30 September; no monitoring will be conducted 1 October and 28 February.

- (A) Monitoring will be conducted at the closest significant haul-out site to the sonic boom impact area.
- (B) Monitoring will be conducted by at least one qualified marine mammal observer, trained in marine mammal science.

- (C) Monitoring will commence at least 72 hours prior to the launch and continue until at least 48 hours after the launch. Recording equipment capable of estimating sonic boom levels would be deployed to capture the launch noise. If no sonic boom is detected by the monitors and the acoustic recording equipment, the monitoring would be stopped.
- (D) Monitoring for each launch will include multiple surveys each day that record, when possible: species, number of animals, general behavior, presence of pups, age class, gender, and reaction to launch noise, sonic booms or other natural or human-caused disturbances. Environmental conditions will also be recorded, including tide, wind speed, air temperature, and swell. Due to the large numbers of pinnipeds found on some beaches of SMI, smaller focal groups should be monitored in detail rather than the entire beach population. A general estimate of the entire beach population should be made once a day and reaction to the launch noise noted.
- (E) During the pupping season, and for launches that occur during daylight, monitoring will be supplemented with photography or video recording of mother-pup seal responses to the launch.
- (F) A report detailing the collected information will be submitted to the NOAA NMFS within 90 days of each monitored launch.

12. Literature Cited

As noted previously, Vandenberg Air Force Base (VAFB) was officially renamed Vandenberg Space Force Base (VSFB) in May, 2021. However several “historic” references to VAFB remain in this document, including many in this section.

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