Final Environmental Assessment on the Issuance of Regulations to Take Marine Mammals by Harassment Incidental to Space Vehicle and Test Flight Activities from Vandenberg Air Force Base, California

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Appendix B Primer on Noise (Adopted from USAF, 1997)

ACRONYMS AND ABBREVIATIONS

Acronym	Definition
ABL	Air-Borne Laser
ABR	Auditory Brainstem Response
ASEL	A-weighted Sound Exposure Level
BMDS	Ballistic Missile Defense System
CBC	Common Booster Core
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
Commission	Marine Mammal Commission
CSEL	C-weighted Sound Exposure Level
CZMA	Coastal Zone Management Act
DARPA	Defense Advanced Research Projects Agency
DAT	Digital Audio Tape
dB	Decibel (re 20 µPa)
EA	Environmental Assessment
EELV	Evolved Expendable Launch Vehicle
EIS	Environmental Impact Statement
EPT	Elevating Platform Transporter
ESA	Endangered Species Act
ft	Foot (feet)
FY	Fiscal Year
GBI	Ground Based Interceptor
GEM	Graphite Epoxy Motor
GMD	Ground-based Midcourse Defense
ICBM	Intercontinental Ballistic Missile
IHA	Incidental Harassment Authorization
ITA	Incidental Take Authorization
KEI	Kinetic Energy Interceptor
kHz	Kilohertz
km	Kilometer(s)
LF	Launch Facility
LFTS	Liquid Fueled Target System
Lmax	Maximum Fast A-weighted Sound Level
LOA	Letter of Authorizations
m	meter(s)
MDA	Missile Defense Agency
mi	Mile(s)
MMPA	Marine Mammal Protection Act
ms	Millisecond(s)

Acronym	Definition
Navy	United States Navy
NAWCWD	Naval Air Warfare Center Weapons Division
NCI	Northern Channel Islands
NDAA	National Defense Authorization Act
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Laboratory
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
OPAREA	Operating Area
OPR	Office of Protected Resources
PAAT	Patriot as a Target
PL	Public Law
psf	Pound Per Square Foot
PTS	Permanent Threshold Shift
SCI	San Clemente Island
SEL	Sound Exposure Level
SLC	Space Launch Complex
SLM	Sound Level Meter
SLV	Space Launch Vehicle
SMI	San Miguel Island
SNI	San Nicolas Island
SOCAL	Southern California
Space X	Space Exploration Technologies
SPL	Sound Pressure Level
SUA	Special-use Airspace
SW	30th Space Wing
TP	Test Pad
TTS	Temporary Threshold Shift
U.S.	United States
USAF	United States Air Force
USC	United States Code
USFWS	United States Fish and Wildlife Service
VAFB	Vandenberg Air Force Base

Chapter 1 PURPOSE AND NEED FOR ACTION

1.1 Proposed Action

Pursuant to the National Environmental Policy Act (NEPA), this Environmental Assessment (EA) analyzes the potential impacts to the human environment that may result from the proposed action of the National Marine Fisheries Service (NMFS) to promulgate five-year regulations and subsequently to issue Letters of Authorization (LOAs) pursuant to section 101(a)(5)(A) of the Marine Mammal Protection Act (MMPA; 16 USC 1361 *et seq.*) to the U.S. Air Force (USAF), 30th Space Wing (SW), for the harassment of marine mammals incidental to space vehicle and test flight activities from Vandenberg Air Force Base (VAFB), California. These activities are considered military readiness activities.

On March 21, 2008, NMFS received an application from the USAF requesting authorization for the take[1] of four species of marine mammals incidental to its missile and aircraft activities from VAFB, which would impact pinnipeds on VAFB and the Northern Channel Islands (NCI). The application was determined to be complete on July 1, 2008. A notice of receipt of the application and request for comments and information from the public regarding the USAF's application published in the *Federal Register* on July 25, 2008 (73 FR 43410). NMFS published proposed regulations in the *Federal Register* on December 19, 2008 (73 FR 77577), which included a request for comments from the public. NMFS' proposed action is to promulgate five-year regulations and subsequently to issue annual LOAs to the USAF to take four species of marine mammals, by harassment, incidental to space vehicle and test flight activities from VAFB. The four species of marine mammals that would be authorized for taking are: Pacific harbor seals (*Phoca vitulina richardii*); California sea lions (*Zalophus californianus*); northern elephant seals (*Mirounga angustirostris*); and northern fur seals (*Callorhinus ursinus*).

1.2 Purpose and Need

The purpose and need of the proposed action is to ensure compliance with the MMPA and its implementing regulations in association with VAFB's proposed space vehicle and missile launch activities and aircraft operations. The MMPA prohibits takes of all marine mammals in the U.S., including territorial seas and on the high seas by persons or vessels under the jurisdiction of the U.S., with a few exceptions.

Sections 101(a)(5)(A) and (D) of the MMPA direct the Secretary of Commerce (Secretary) to allow, upon request, the incidental, but not intentional taking of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and regulations are issued or, if the taking is limited to harassment and of no more than one year, a notice of a proposed authorization is provided to the public for review.

[1] Take under the MMPA means to harass, hunt, capture, collect, or kill, or attempt to harass, hunt, capture, collect, or kill any marine mammal. 16 U.S.C. § 1362(13).

Permission may be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not (where relevant) have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses, and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring, and reporting of such takings are set forth. NMFS has defined "negligible impact" in 50 CFR 216.103 as "...an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival."

The National Defense Authorization Act (NDAA) of Fiscal Year (FY) 2004 (Public Law [PL] 108-136) amended the definition of "harassment" as applied to military readiness activities. Military readiness activities, as defined in PL 107-314, Section 315(f), include "training and operations of the Armed Forces that relate to combat" and constitute "adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use." These two definitions apply to the USAF's activities from VAFB. For purposes of "military readiness activities," harassment is defined as:

> (i) any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B harassment].

The USAF determined that conducting space vehicle and test flight activities from VAFB might potentially disturb marine mammals and, accordingly, submitted an application for regulations and subsequent LOAs under the MMPA. The primary concern related to potential take of marine mammals incidental to the USAF's activities relates to airborne noise levels associated with certain launch and associated activities that may disturb marine mammals (specifically, certain pinniped species) on nearby haulout sites. If the actions proposed in the application will have no more than a negligible impact on the species or stocks, will not have an unmitigable adverse impact on the availability of the species or stock for subsistence uses, and the permissible methods of taking and required monitoring are set forth, then NMFS shall promulgate regulations and issue LOAs pursuant to the MMPA. For military readiness activities (as described in the NDAA), a determination of least practicable adverse impacts on a species or stock includes consideration, in consultation with the Department of Defense, of personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity. VAFB is currently operating in accordance with the MMPA under regulations and LOAs issued by NMFS pursuant to section 101(a)(5)(A) of the MMPA that addressed specific activities for the period February 6, 2004, through February 6, 2009.

The current action is needed to achieve MMPA compliance for VAFB activities proposed to occur beginning February 7, 2009, through February 6, 2014.

1.3 Description of the Specified Activity

As described above, section 101(a)(5)(A) of the MMPA requires that an applicant indicate the specified activity sought for authorization. This applicant's activity is evaluated by NMFS and informs NMFS' development of a proposed action and range of alternatives to be considered by NMFS in accordance with NEPA. The specified activity is summarized in this subsection and is also described in more detail in the USAF's application for authorization pursuant to section 101(a)(5)(A) of the MMPA, which is available on the NMFS Office of Protected Resources (OPR) website at: http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications.

VAFB (Figure 1) is headquarters to the 30th SW, USAF Space Command unit that operates VAFB and the Western Range. VAFB operates as a missile test base and aerospace center, supporting west coast space launch activities for the USAF, Department of Defense, National Aeronautics and Space Administration, and commercial contractors. VAFB is the main west coast launch facility for placing commercial, government, and military satellites into polar orbit on expendable (unmanned) launch vehicles and for testing and evaluation of intercontinental ballistic missiles (ICBM) and sub-orbital target and interceptor missiles. In addition to space vehicle and missile launch activities at VAFB, there are helicopter and aircraft operations for purposes such as search-and-rescue, delivery of space vehicle components, launch mission support, and security reconnaissance. The USAF expects to launch a maximum of 30 rockets and missiles per year from VAFB.

1.3.1 Space Launch Vehicles

There are currently six active space launch vehicle (SLV) facilities at VAFB (VAFB, 2007), used to launch satellites into polar orbit. These facilities support the launch programs for space vehicles including the Atlas V, Delta II, Delta IV, Falcon, Minotaur, and Taurus. The Falcon has yet to launch from VAFB and is scheduled for its first launch in August 2009 (30 SW, 2008a).

In order to compare launch noise from past and current SLVs, as it was received near the north and south VAFB marine mammal haul-out sites, Tables 1 through 3 provide information on the sound exposure levels (SELs) that were measured during previous launch events. Table 1 provides a comparison of SELs as measured at the sound monitoring site by the south VAFB marine mammal haul-out site. Table 2 provides the SELs as measured at the sound monitoring site by the north VAFB Spur Road marine mammal haul-out site. Finally, Table 3 provides the SELs as measured at the sound monitoring site by the north VAFB Lion's Head marine mammal haul-out site. Further details on SELs are described by vehicle in the following sections. Note that all decibel (dB) levels as used in this EA are measurements in air and are therefore referenced to 20 microPascals (re 20 µPa).

Figure 1. Map of VAFB and coastal landmarks and its location within California (inset).

Table 1. Sound levels in air from launches on VAFB, as measured by the digital audio tape recorder near the south VAFB marine mammal haul-out site

Launch Vehicle	Satellite	Launch Complex	Launch Date	Dist. to Haul-out (km)	TSEL (dB)	CSEL (dB)	ASEL (dB)	TPeak (dB)	Lmax (dB)
Delta IV	DMSP-17	SLC-6	4-Nov-06	2.7	131.3	127.5	111.3	129.0	102.6
Titan IV	B-34	SLC-4E	5-Oct-01	8.5	130.2	124.2	104.5	125.0	100.6
Athena II	Ikonos-1	SLC-6	27-Apr-99	2.8	127.9	123.7	107.3	125.6	99.9
Delta IV	NROL-22	SLC-6	27-Jun-06	2.7	127.7	122.9	106.2	130.0	103.1
Titan IV	B-12	SLC-4E	22-May-99	8.5	127.6	121.9	103.6	123.7	97.0
Athena I	Lewis	SLC-6	22-Aug-97	2.8	127.0	121.3	107.3	126.8	101.0
Titan IV	B-28 NRO	SLC-4E	17-Aug-00	8.5	126.8	119.9	99.0	123.5	91.5
Athena II	Ikonos-2	SLC-6	24-Sep-99	2.8	125.9	123.4	107.8	124.6	102.2
Titan IV	A-18	SLC-4E	23-Oct-97	8.5	125.9	119.0	96.6	121.8	88.2
Atlas IIAS	AC-141 Terra	SLC-3E	18-Dec-99	9.9	124.2	113.6	87.3	120.3	76.4
Minotaur	MightySat	SLC-8	19-Jul-00	2.3	122.9	117.9	107.0	122.0	101.7
Titan II	G-7	SLC-4W	19-Jun-99	8.5	120.3	112.3	87.7	121.4	79.1
Minotaur	JAWSAT	SLC-8	26-Jan-00	2.3	119.4	116.6	105.4	125.0	103.4
Titan II	G-12	SLC-4W	13-May-98	8.5	119.3	115.0	95.4	113.0	85.9
Delta II	MS-9	SLC-2	17-May-98	22.0	118.1	103.1	72.4	113.9	61.8
Atlas IIAS	MLV-10	SLC-3E	8-Sep-01	9.9	118.0	112.1	88.5	112.6	80.8
Titan II	G-6	SLC-4W	4-Apr-97	8.5	116.5	112.4	88.5	111.3	76.1
Titan II	G-13	SLC-4W	21-Sep-00	8.5	116.3	109.6	83.5	109.5	74.9
Taurus	KOMPSAT	SLC-576	20-Dec-99	20.3	106.4	101.3	76.4	102.9	65.0

Notes: km = kilometers; TSEL = unweighted SEL; dB = decibels (re 20 µPa); CSEL = C-weighted SEL; ASEL = A-weighted SEL; Tpeak = unweighted peak sound level; Lmax = maximum fast A-weighted sound level.

Table 2. Sound levels in air from launches on VAFB, as measured by the digital audio tape recorder near the north VAFB Spur Road marine mammal haul-out site (all decibels are dB re 20 µPa)

Launch Vehicle	Satellite	Launch Complex	Launch Date	Dist. to Haul-out (km)	TSEL (dB)	CSEL (dB)	ASEL (dB)	TPeak (dB)	Lmax (dB)
Taurus	MTI	SLC-576	12-Mar-00	0.55	136.8	134.8	125.6	141.8	120.6
Taurus	STEX	SLC-576	3-Oct-98	0.55	136.7	134.7	124.8	142.1	121.4
Taurus	T6	SLC-576	21-Sep-01	0.50	135.8	133.8	123.8	141.5	119.8
Taurus	Lite	SLC-576	6-Feb-03	0.55	133.8	133.1	125.4	144.8	
Delta II	MS-9	SLC-2	17-May-98	1.92	128.9	126.7	116.9	137.3	112.5
Delta II	JASON/TIMED	SLC-2	7-Dec-01	2.00	127.7	125.8	114.8	133.0	111.0
Delta II	IMAGE	SLC-2	25-Mar-00	2.06	126.9	125.1	113.9	129.4	109.2
Delta II	Quickbird2	SLC-2	18-Oct-01	2.06	126.9	124.2	111.8	128.7	104.2
Delta II	Landsat	SLC-2	15-Apr-99	2.02	126.5	124.3	114.1	133.3	108.8
Atlas IIAS	AC-141 Terra	SLC-3E	18-Dec-99	11.10	117.2	110.0	86.1	113.0	75.2

Notes: km = kilometers; TSEL = unweighted SEL; dB = decibels (re 20 µPa); CSEL = C-weighted SEL; ASEL = A-weighted SEL; Tpeak = unweighted peak sound level; Lmax = maximum fast A-weighted sound level.

Table 3. Sound levels in air from launches on VAFB, as measured by the sound level meter near the north VAFB Lion's Head marine mammal haul-out site

Launch Vehicle	Launch Complex	Launch Date	Dist. to Haul-out (km)	ASEL (dB)	Tpeak (dB)	Lmax (dB)
Minuteman III	LF-04	11-Jun-03	1.15	114.9	131.2	112.1
Peacekeeper	LF-02	12-Mar-03	3.70	106.1	128.8	100.9
BV	LF-23	16-Aug-03		105.5	125.9	102.5
Peacekeeper	LF-02	3-Jun-02	3.70	102.4	126.6	97.8
Minuteman III	LF-26	7-Jun-02	3.15	100.6	121.2	98.2

Notes: km = kilometers; dB = decibels (re 20 µPa); ASEL = A-weighted SEL; Tpeak = unweighted peak sound level; Lmax = maximum fast A-weighted sound level.

Atlas V

The Atlas V vehicle is launched from Space Launch Complex (SLC)-3E on south VAFB. This SLC is approximately 9.9 km (6.2 mi) from the main marine mammal haul-out area on VAFB, known as South Rocky Point (Figure 2), which encompasses several smaller haul-outs. SLC-3E is approximately 11.1 km (6.9 mi) from the closest north VAFB haul-out, known as the Spur Road haul-out site (Figure 3) and 13.5 km (8.4 mi) from the next closest haul-out, the nearby Purisima Point haul-out site (Figure 3).

The Atlas V is a medium lift vehicle that can be flown in two series of configurations—the Atlas V400 series and the Atlas V500 series. Both series use the Standard Booster as the single body booster. The V400 series accommodates a 4.2 m (13.8 ft) payload fairing and as many as three solid rocket boosters. The V500 series accommodates a 5.4 m (17.7 ft) fairing and as many as five solid rocket boosters. The Atlas V400 series will lift as much as 7,800 kg (17,196 lbs) into geosynchronous transfer orbit or as much as 13,620 kg (30,027 lbs) into low earth orbit. The Atlas V500 series will lift as much as 8,700 kg (19,180 lbs) into geosynchronous transfer orbit or as much as 21,050 kg (46,407 lbs) into low earth orbit. The Atlas V consists of a common booster core (CBC; 3.8 m (12.5 ft) in diameter and 32.5 m (106.6 ft) high) powered by an RD180 engine that burns a liquid propellant fuel consisting of liquid oxygen and RP1 fuel (kerosene). The RD180 engine provides 840,000 lbs of thrust on liftoff. There is a Centaur upper stage (3.1 m (10.2 ft) in diameter and 12.7 m (41.7 ft) high) powered by a liquid oxygen and liquid hydrogen fuel.

The first Atlas V launch occurred on March 13, 2008. Acoustic monitoring was conducted for this launch at VAFB. However, an equipment malfunction during the launch prevented the proper functioning of the digital audio tape (DAT) recorder during the launch. Since acoustic data were only gathered with the sound level meter (SLM), not all metrics were obtained for that launch. The Atlas V launch had an A-weighted SEL (ASEL) of 96.5 dB (MSRS, 2008b). The Atlas V was predicted to create a sonic boom of as much as 7.2 pounds per square foot (psf), impacting the NCI including San Miguel Island (SMI; see Figure 4). The size of the actual sonic boom would depend on meteorological conditions, which can vary by day and season and with the trajectory of the vehicle. A sonic boom greater than 1 psf was predicted for the initial Atlas V launch,

thus acoustic monitoring was performed on SMI. Measurements conducted at Cardwell Point indicated a sonic boom of 1.24 psf with a rise time of 2.4 milliseconds (ms).

Delta II

The Delta II is launched from SLC-2 on north VAFB (Figure 3) approximately 2 km (1.2 mi) from the Spur Road harbor seal haul-out site and 2.3 km (1.4 mi) from the Purisima Point haul-out site. The Delta II is a medium-sized launch vehicle approximately 38 m (124.7 ft) tall. The Delta II uses a Rocketdyne RS-27A main liquid propellant engine and additional solid rocket strap-on graphite epoxy motors (GEMs) during liftoff. A total of three, four, or nine GEMs can be attached for added boost during liftoff. When nine GEMs are used, six are ignited at liftoff and three are lit once the rocket is airborne. When three or four GEMs are used they are all ignited at liftoff. The number of GEMs attached to each vehicle will determine the amount of sound power produced by the vehicle.

Eight Delta II launches have been acoustically quantified near the Spur Road harbor seal haul-out site. Based on these measurements of received levels, the Delta II is the second loudest of the SLVs at the Spur Road haul-out site, the Taurus vehicle being the loudest (see Table 2). The Delta II has an unweighted SEL measurements (based on the six initial acoustically-measured launches) ranging from 126.5 to 128.8 dB and averaging 127.4 dB, as measured by the DAT recorder. The C-weighted SEL (CSEL) ranged from 124.3 to 126.7 dB with an average of 125.4 dB (DAT). The ASEL measurements from both a SLM and the DAT were similar and ranged from 111.8 to 118.2 dB and had an average of 114.5 dB (DAT). The maximum fast A-weighted sound level (Lmax) values ranged from 104.2 to 112.5 dB and averaged 109.5 dB.

Sonic booms have been measured on SMI from three Delta II launches: the EO-1, Iridium MS-12, and AURA (November 2000, February 2002, and July 2004, respectively). Both the Iridium MS-12 and AURA had two small sonic booms impact the Point Bennett area of SMI. Iridium MS-12 had peak overpressures of 0.47 and 0.64 psf and rise times of 18 and 91 ms, while AURA had peak overpressures of 0.79 and 1.34 psf and rise times of 9.5 and 10.5 ms. The Delta II EO 1 had a single sonic boom with a peak overpressure of 0.4 psf and rise time of .041 ms.

Delta IV

The Delta IV is launched from SLC-6, which is 2.8 km (1.7 mi) north of the main harbor seal haul-out site at South Rocky Point (see Figure 2). The Delta IV family of launch vehicles consists of five launch vehicle configurations utilizing a CBC first stage (liquid fueled) and zero, two, or four strap on solid rocket GEMs. The Delta IV comes in four medium lift configurations and one heavy lift configuration consisting of multiple CBCs (Table 4). The Delta IV can carry payloads from 4,210 to 13,130 kg (9,281 to 28,947 lbs) into geosynchronous transfer orbit.

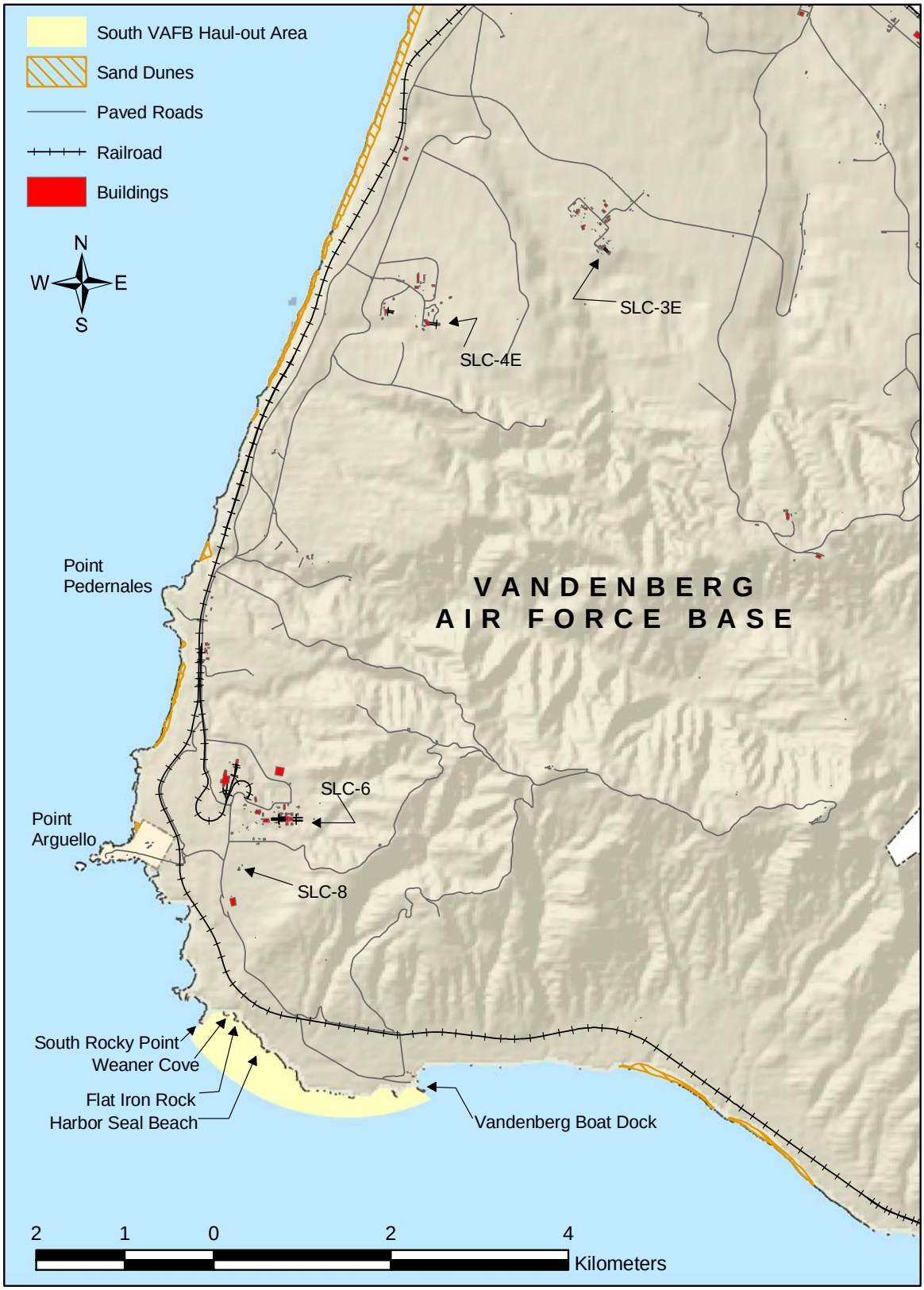

Figure 2. Map of main harbor seal haul-out area and active SLCs on south VAFB.

Figure 3. Map of harbor seal haul-out sites and active SLCs and launch facilities on north VAFB, as well as test pad TP-01.

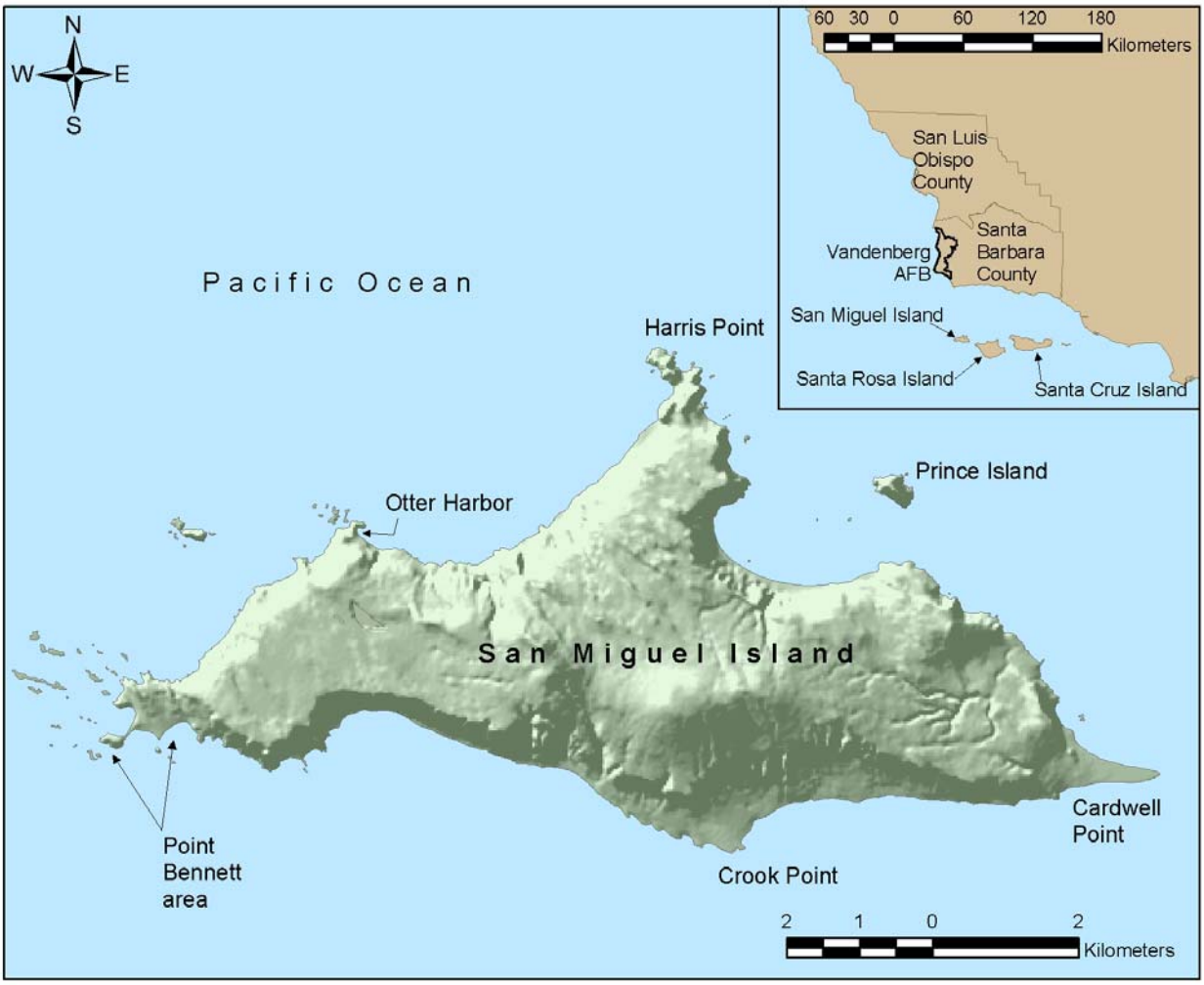

Figure 4. SMI and its major haul-out sites, and the NCI in relation to VAFB (inset).

Table 4. Delta IV vehicle configurations and estimated maximum overpressures

Launch Vehicle	Qty. CBC	Size Upper Stage	Qty. Solid Rocket Motor	Launch Weight	Est. Max. Overpressure
Medium	1	4 meter	0	1,016,750 lbs	4 psf [1]
M+(4,2)	1	4 meter	2	1,176,750 lbs	4-5 psf [2]
M+(5,2)	1	5 meter	2	1,208,750 lbs	6.5 psf [1]
M+(5,4)	1	5 meter	4	1,368,750 lbs	7.2 psf [1]
Heavy	3	5 meter	0	2,890,250 lbs	8-9 psf [3]

Notes:
1. United States (U.S.) Air Force 2000 (calculation).
2. PCBoom3 model.
3. Comparison to Titan IV data.

Previously the Athena launch vehicle was launched from SLC-6. The Athena was a much smaller vehicle than the Delta IV but was one of the top three loudest vehicles (see Table 1) at the haul-out, given its close proximity. Because the Delta IV was predicted to be the loudest vehicle at the south VAFB harbor seal haul-out site, it was required under

the current (February 2004 to February 2009) MMPA section 101(a)(5)(A) regulations and subsequent LOAs that acoustic and biological monitoring be conducted for its first three launches. In addition, harbor seal hearing tests were required before and after each of the first three launches.

The first two Delta IV launches occurred in 2006. Although the Delta IV is larger than the Athena, it was found after its initial launch (NROL-22, June 2006) that the Delta IV had similar noise levels to the Athena vehicle. As measured by the DAT, the unweighted SEL was 127.7 dB, while the CSEL was 122.9 dB, and the ASEL was 106.2 dB (Fillmore *et al*., 2006). The Lmax was found to be 103.1 dB (Fillmore *et al*., 2006).

During its second launch (DMSP-17, November 2006), the DAT recorder was located at the VAFB Boathouse (near where the harbor seal hearing tests were performed), rather than at the more usual sound monitoring location of Oil Well Canyon, where an SLM was placed. The DAT measured the unweighted SEL at 131.3 dB, the CSEL at 127.5 dB, and the ASEL at 111.3 dB. The Lmax was measured at 102.6 dB (Thorson *et al*., 2007).

The Delta IV was predicted to create maximum sonic booms of as much as 7.2 psf for the largest of the medium configurations and 8 to 9 psf for the heavy configuration (Table 4). The size of the actual sonic boom would depend on meteorological conditions, which can vary by day and season, and with the trajectory of the vehicle. A sonic boom greater than one psf was predicted for the initial Delta IV launch, thus acoustic monitoring was performed on SMI. An equipment malfunction resulted in uncertainty regarding the amplitude of the sonic boom that was recorded for the launch, and the peak overpressure from the boom could have ranged from 0.77 psf to as much as 3.36 psf. The rise time was able to be determined and was measured at 8.7 ms. Because a sonic boom was not predicted for the second Delta IV launch, monitoring was not performed on SMI.

Capture attempts of harbor seals for the initial Delta IV launch were unsuccessful; therefore, no hearing tests were performed on seals for that launch. Capture attempts for the second Delta IV launch were successful, and hearing tests were performed. There was no evidence that the launch noise from the Delta IV DMSP 17 caused a loss in harbor seal hearing acuity. However, given a 2 hr delay in starting the hearing test due to safety constraints, it is possible that a mild temporary threshold shift (TTS) could have been fully recovered by the time the testing was started. Even so, no long-term hearing loss from the Delta IV launch noise was found (Thorson *et al.*, 2007). The third Delta IV launch is currently scheduled for December, 2010. Appropriate biological and acoustic monitoring, as well as hearing testing, are proposed by the applicant as part of this specified activity.

Falcon

The Falcon is the launch vehicle for Space Exploration Technologies (Space X). Space X is a commercial program planning to launch small payloads into low earth orbit from VAFB. While it has not been officially decided (30 SW, 2008a), it is anticipated that Space X will utilize SLC-4E, instead of SLC-3W as originally planned (30 SW, 2008c). The Space X launch vehicle includes the Falcon I SLV, classified as a light-lift vehicle.

It is a two-stage liquid oxygen and rocket grade kerosene powered launch vehicle and is 21.3 m (69.9 ft) in length and 1.7 m (5.6 ft) in diameter (Space X, 2007). Beginning in 2009, the Falcon 1e vehicle will also be available. It is also 1.7 m (5.6 ft) in diameter, but will have an extended first stage and will be 26.8 m (87.9 ft) in length (Space X, 2007). The Falcon I has a thrust of 105,500 lbs (in vacuum) and the Falcon 1e has 115,000 lbs (in vacuum) and are capable of delivering approximately 554 kg (1,221 lbs) into sun synchronous low earth orbit (Space X, 2007). The first Falcon launch from VAFB is currently scheduled for August, 2009 (30 SW, 2008a).

Minotaur

The Orbital Suborbital Program launch vehicle, known as Minotaur I, is launched from SLC-8 on south VAFB (see Figure 2), approximately 2.3 km (1.4 mi) from the south VAFB haul-out sites. The Minotaur I is a four stage, all solid propellant ground launch vehicle (Orbital Sciences Corporation, 2006a). The launch vehicle consists of modified Minuteman II Stage I and Stage II segments, mated with Pegasus upper stages (Orbital Sciences Corporation, 2006a). The Minotaur is a small vehicle, approximately 19.2 m (63 ft) tall (Orbital Sciences Corporation 2006b), with approximately 215,000 lbs of thrust.

Two Minotaur launches were acoustically monitored at VAFB (January 2000 and July 2000). The unweighted SEL measurements varied by 3.5 dB between the two launches and were measured to be 119.4 and 122.9 dB. The CSELs varied less and were measured at 116.6 and 117.9 dB. From the DAT and SLM measurements, the ASEL ranged from 104.9 to 107.0 dB. The launch noise reached an Lmax level of 101.7 and 103.4 dB. No sonic booms of greater than one psf were predicted to impact the NCI for these two launches, nor for a third launch for which only biological monitoring was performed at VAFB given that acoustics had been previously quantified.

Taurus

The Taurus SLV is launched from 576E on north VAFB, approximately 0.5 km (0.3 mi) from the Spur Road harbor seal haul-out site and 2.3 km (1.4 mi) from the Purisima Point haul-out site (see Figure 3). The standard Taurus is a small launch vehicle, at approximately 24.7 m (81 ft) tall and is launched in two different configurations (Defense Advanced Research Projects Agency (DARPA) and standard) with different first stages providing 500,000 or 400,000 lbs of thrust, respectively. The different vehicle configurations have different thrust characteristics, with the standard configuration providing less thrust than DARPA.

The launch noise from five Taurus launches has been measured near the Spur Road haul-out site. The Taurus is the loudest of the launch vehicles at the Spur Road haul-out site, due to the close proximity of its launch pad to the haul-out site. The unweighted SEL measurements from the four initially measured Taurus vehicles ranged from 135.8 to 136.8 and averaged 136.4 dB. The CSEL measurements were slightly lower as expected, ranging from 133.8 to 134.8 dB and averaged 134.5 dB. The ASEL measurements ranged from 123.5 to 128.9 dB with an average of 126.6 dB (SLM). The Lmax values were measured to range from 118.3 to 122.9 dB and averaged 120.9 dB (SLM). No sonic

booms greater than one psf were predicted to impact the NCI for any of the six Taurus launches monitored since 1998.

1.3.2 ICBMs and Missile Defense Agency Interceptor and Target Vehicles

There are a variety of small missiles launched from north VAFB, including the Minuteman III and several types of interceptor and target vehicles for the Missile Defense Agency (MDA) program. The Peacekeeper missile program was recently deactivated. Active missile launch facilities (LFs) are spread throughout northern VAFB (see Figure 3), and are within approximately 1 to 3.9 km (0.6 to 2.4 mi) of the Lion's Head haul-out site, and approximately 11 to 16.5 km (6.8 to 10.3 mi) north of the Spur Road and Purisima Point haul-out sites. In addition to the LFs, Test Pad (TP)-01 is present on north VAFB. Although not currently active or associated with a missile program, MDA may eventually utilize this pad. The trajectories of ICBM and MDA launches are generally westward and therefore do not cause sonic boom impacts on the NCI.

ICBMs

The Minuteman III missile is an ICBM developed as part of the U.S. strategic deterrence force. The Minuteman III is launched from an underground silo. It is composed of three rocket motors, and is 18 m (59 ft) in length by 1.7 m (5.6 ft) in diameter with a first stage thrust of 202,600 lbs. The launch noise from the June 7, 2002, launch from LF-26 (see Figure 3) was measured at the Lion's Head haul-out site. This LF is approximately 3 km (1.9 mi) away from the haul-out site. The ASEL measurement of the launch noise was 100.6 dB and the Lmax value of 98.2 dB. The launch noise from the May 24, 2000, launch from LF-09 (Figure 3) was measured at the Spur Road haul-out site. At a distance of over 15 km from LF-09, the unweighted SEL measurement was 114.7 dB and the CSEL measurement was 111.6 dB. The ASEL measurement was 26 dB down from the unweighted value and was measured at 88.7 dB. The Lmax was measured to be 83.3 dB.

MDA Interceptor and Target Vehicles

The MDA continues development of various systems and elements, including the Ballistic Missile Defense System (BMDS), the Ground-based Midcourse Defense (GMD) element of BMDS, the Kinetic Energy Interceptor (KEI) element, and the Air-Borne Laser (ABL) element. The BMDS mission is to defend against threat missiles in each phase or segment of the missile's flight. MDA has been conducting and will continue to conduct BMDS testing at VAFB through 2014 and beyond.

The GMD element is designed to protect the U.S. in the event of a limited ballistic missile attack by destroying the threat missile in the mid-course phase of its flight. During the mid-course phase, which occurs outside the earth's atmosphere for medium and long-range missiles, the missile coasts in a ballistic trajectory. The missiles are comprised of a commercially available, solid propellant booster consisting of two or three stages, and an exo-atmospheric kill vehicle or emulator. A two-stage booster is being added to the current three-stage booster. The Ground Based Interceptor (GBI) was previously approved for launching from VAFB (68 FR 25347, May 12, 2003). GBI

flight tests are planned from LF-23. As a scheduled risk mitigation, some limited testing may occur from LF-24 (currently being refurbished for use).

The second element of BMDS, the KEI element, includes development of the KEI booster and its flight tests. Since the KEI has yet to be launched at VAFB, an EA is in preparation by the USAF. See section 4.5 of this EA for an explanation of how pending NEPA documents being prepared by the USAF relate to NMFS' proposed action of promulgating regulations and issuing subsequent LOAs analyzed in this EA. MDA anticipates a minimum of three KEI launches per year from 2009 to at least 2012. Candidate launch sites include 576E, TP-01, and LF-06.

The third element of BMDS, the ABL element, is being developed to provide an effective defense to limited ballistic missile threats during the boost segment of an attacking missile's flight. A Final and a Supplemental Environmental Impact Statement (EIS; USAF, 1997a, 2002) were prepared for ABL, and other NEPA work is currently in progress for the various targets that could be used under ABL testing. See section 4.5 of this EA for an explanation of how pending NEPA documents being prepared by the USAF relate to NMFS' proposed action of promulgating regulations and issuing subsequent LOAs analyzed in this EA. Under the ABL program, there could be as many as 10 launches per year. Launches could occur from LF-06a, which would be a new LF, yet to be constructed, near the current LF-06. Possible launch vehicles could include Black Brant IX, Hera, Terrier/Orion, two-stage Terrier, Liquid Fueled Target System (LFTS), Terrier Lynx, Storm, ARIES, Castor I, Lance, Patriot PAC-2, STRYPI-II, and Hermes.

As a part of BMDS testing, MDA envisions launching a wide variety of target missiles from VAFB northern LFs on westerly trajectories. Table 5 identifies missiles being considered by MDA for use at VAFB. Many of the small missiles under 13 m (42.7 ft), including the Hera, Lance, Patriot As A Target (PAAT), Black Brant, Terrier, SRTYPI II, Castor I, Storm, ARIES and Hermes, were covered under the Theater Ballistic Missile Targets Programmatic EA (USAF, 1997b). They are included in this document because of their launch site's proximity to the Lion's Head harbor seal pupping site that was established in 2002. Those missiles, in addition to missiles already approved for VAFB (such as Minuteman missiles and the three-stage GBIs), and the new generation of missiles from the MDA, such as the KEI and the GBI two-stage, are addressed as part of the specified activity presented in the USAF's request for five-year regulations and LOAs.

The LFTS target missile is a single-stage, short range, ballistic missile with a non-separating payload. The missile is fueled by kerosene, initiator fuel, and an oxidizer (Inhibited Red Fuming Nitric Acid). The Flexible Target Family target missiles include the LV 2 and the LV 3 missiles, which are solid-fueled. All of the missiles identified in Table 5 have been (or are currently being) assessed in NEPA analyses for use at VAFB. See section 4.5 of this EA for an explanation of how pending NEPA documents being prepared by the USAF relate to NMFS' proposed action of promulgating regulations and issuing subsequent LOAs analyzed in this EA.

Table 5. Identification of MDA missiles considered for use at VAFB

Missiles	Height (m)	Diameter (m)
KEI 3-Stage Booster	N/A	N/A
HERMES	4.0	0.6
PAAT	5.3	0.6
Lance	6.6	0.6
Aries	8.2	1.1
STRYPI II	9.3	0.8
SR-19	10.0	1.3
Storm	10.0	1.0
LV-2	10.4	1.9
Terrier/Lynx	10.7	0.5
Terrier/Orion	10.7	0.5
Two-Stage Terrier	10.7	0.5
Orbital Boost Vehicle	11.3	0.9
Castor I	11.6	0.8
LFTS (also LPT)	11.6	N/A
SR-19/M57	11.6	1.3
HERA	12.1	1.3
KEI 2-Stage Booster	12.2	1.0
SR19/SR73	12.4	1.3
Black Brant 9	13.6	0.4
LV-3	15.1	1.9
Terrier/Black Brant	15.3	0.5
SR19/SR19	15.5	1.3
Booster Verification Test	15.8	1.4
Castor IVB	15.8	1.0
GBI 2-Stage	16.5	1.3
GBI 3-Stage	16.5	1.3
Minuteman II Stack	18.2	1.7
Minuteman III	18.2	1.7
Peacekeeper	21.8	2.3

Note: N/A = Not available at this time.

As shown in Table 5, all of the target and interceptor missiles are smaller than the Minuteman III or Peacekeeper missiles previously or currently launched from VAFB. The MDA notes that the actual heights of the missiles shown in Table 5 will vary depending on the payload and associated electronic packages (*e.g.*, flight termination system) or special modifications. Many of the missile types have interchangeable first or second stage motors; therefore, most may have similar noise characteristics, depending on their configuration. Missiles, for which acoustic measurements have previously been made, as well as vehicle size, are included in Table 6.

The main missile programs and missile types are described herein, but others may be implemented before expiration of the requested 2009-2014 regulations. The USAF would be required to notify NMFS of any new missile programs that would be implemented at VAFB.

Table 6. Comparison of size and sound produced by acoustically measured MDA missiles and the Minuteman and Peacekeeper vehicles

Missile	Program	Height (m)	Diameter (m)	A-weighted Sound Exposure Level (dB)	Lmax (dB)
Orbital Boost Vehicle	GBI	11.3	0.9	114.5	113.8
Booster Verification Test	GBI	15.8	1.4	114.7	113.8
Minuteman III	USAF Strategic Deterrence Force	18.0	1.7	117.7	112.2
Peacekeeper	USAF Strategic Deterrence Force	21.8	2.3	122.5	117.0

Note: The Minuteman III and Peacekeeper missiles are provided as a comparison to the smaller MDA missiles. Sound levels are from actual launches and were extrapolated to the distance of 1 km to compare each missile.

The MDA's BMDS test plans, including those involving tests from VAFB, are subject to constant change as the BMDS is being developed through spiral evolution. Therefore, it is difficult for the MDA to predict with any accuracy its future launch schedule or number of launches over the next five years. However, due to test resource limitations, the MDA does not envision conducting more than three missile tests per quarter (on average) over the next five years from VAFB, and none of the missiles would be larger than the Minuteman III. These limitations can be used to establish the potential impacts posed by the MDA testing at VAFB over the next five years.

1.3.3 Aircraft Operations

The VAFB runway, located on north VAFB (see Figure 3), supports various aircraft operations further described below. Aircraft operations include tower operations, such as take offs and landings (training operations) from the airfield, and range operations, such as overflights and flight tests. Using data from FY 2003, 2006, and 2007 (FY 2004 and 2005 data not available), the number of tower operations averaged 12,325 operations per FY, while range operations averaged 502 operations per FY.

Flight Test Operations

VAFB is a limited site for flight testing and evaluation of fixed-wing aircraft. Three approved routes are used that avoid the established pinniped haul-out sites. Aircraft flown through VAFB airspace and supported by 30 SW include, but are not limited to, B1 and B2 bombers, F-15, F-16, and F-22 fighters, V/X-22, Unmanned Aerial Vehicles, and KC-135 tankers.

Fixed-wing Aircraft Operations

Various fixed-wing aircraft (jet and propeller aircraft) use VAFB for a variety of purposes, including delivery of space or missile vehicle components, launching of space vehicles at high altitude (*e.g.*, the Pegasus), and emergency landings. All aircraft are required to remain outside of the 305-m (1,000-ft) bubble around pinniped rookeries or haul-out sites, except when performing a life-or-death rescue mission, when responding to a security incident, or during an aircraft emergency. There have been no observed impacts to pinnipeds from fixed-wing aircraft operations during launch monitoring or pinniped surveys.

Helicopter Operations

The number of helicopter operations at VAFB decreased in 2008 with the deactivation of the VAFB helicopter squadron. However other squadrons and units continue to use VAFB for purposes which include, but are not limited to, transit through, exercises, and launch mission support. All helicopters are required to remain outside of the 305-m (1,000-ft) bubble around pinniped rookeries or haul-out sites. Exceptions may occur when performing a life-or-death rescue mission, when responding to a security incident, or during an aircraft emergency. There have been no observed impacts to pinnipeds from helicopter operations during launch monitoring or pinniped surveys.

1.4 History of Incidental Take Authorizations for the USAF at VAFB

On May 4, 1984 (49 FR 19098), the USAF requested a small take authorization for takings incidental to launches of the space shuttle from Vandenberg. Launches were expected to begin in late 1985. On April 7, 1986, NMFS issued final regulations that allowed the USAF to harass marine mammals incidental to space shuttle launches from VAFB.

The USAF did not continue development on its space shuttle program and instead decided to use the Titan IV as an alternate launch vehicle at VAFB. On June 10, 1990, NMFS received a request from the USAF for take of six pinniped species incidental to launches of Titan IV space vehicles at VAFB. An Advance Notice of Proposed Rulemaking was published in the *Federal Register* on July 30, 1990 (55 FR 30943), and a proposed rule was published on January 16, 1991 (56 FR 1606). Four letters were received commenting on the proposed authorization. These comments were addressed in the final rule published on August 21, 1991 (56 FR 41628). This rule remained in effect until September 23, 1996.

On September 30, 1997, NMFS received a new application from the USAF for the taking of marine mammals incidental to space vehicle launches on VAFB for a period of five years. It was planned that these regulations would replace annual incidental harassment authorizations (IHAs) issued to the USAF under section 101(a)(5)(D) of the MMPA. These authorizations had been issued for marine mammal takings incidental to launches by Lockheed-Martin launch vehicles (62 FR 40335, July 28, 1997), McDonnell Douglas Aerospace Delta II rocket launches (61 FR 59218, November 21, 1996), Taurus launches (62 FR 734, January 6, 1997), and Titan II and Titan IV launches (61 FR 64337, December 4, 1996). IHAs for the latter three activities were reissued on December 19, 1997 (see 62 FR 67618, December 29, 1997) and remained in effect until the above mentioned regulations became effective and annual LOAs could be issued. On November 14, 1997 (62 FR 61077) and July 21, 1998 (63 FR 39055), NMFS notified the public of this request and offered a total of 75 days for public comment. Several comments were received from the public which were addressed in the final rule authorizing the taking of seals and sea lions incidental to missile and rocket launches, aircraft flight test operations, and helicopter operations at VAFB for a period of five

years (64 FR 9925, March 1, 1999). NMFS issued two one-year LOAs to the USAF for launches at VAFB on April 2, 1999 (64 FR 17145, April 8, 1999) and May 31, 2000 (65 FR 37361).

On February 5, 2001, the 30th SW requested a modification of the LOA. The letter requested modifications to the launch schedule and revisions to the LOA's current monitoring requirement, specifically: (1) to eliminate the number of launches specified for each type of launch vehicle (Titan II, Titan IV, Lockheed-Martin, Delta II, Taurus, Atlas, and Minotaur) to more accurately reflect the year-to-year variability of launch vehicle type; (2) to clarify that space launches occur from both South and North VAFB; (3) to increase the observation period prior to launches from 48 hours before any planned launch time; (4) to include monitoring over a 2-week period during the pupping season following any launches of government and commercial space vehicles, not just following Titan II and Titan IV launches (as the then-current LOA required); and (5) to change the criterion for monitoring pinnipeds on the NCI from when sonic booms are predicted to be "focused" or greater than 2 psf to criterion for monitoring pinnipeds on the NCI when predicted sonic booms are greater than 1 psf. A final modification request by the USAF to conduct observations on harbor seals and other pinniped activity only during the harbor seal pupping season (March-June), as opposed to during any launch, was determined by NMFS to be inconsistent with the implementing regulations. On March 19, 2001 (66 FR 15406), NMFS published a notice of proposed modification and annual renewal and provided for a 30-day public comment period on the action. During the public comment period, no comments were received, and NMFS determined that a new LOA was warranted. This LOA, with the above-mentioned modifications, was issued on May 23, 2001 (66 FR 29774, June 1, 2001).

On May 17, 2001, NMFS received a request from the USAF for a modification to the monitoring requirements in the five-year implementing regulations. This request was published in the *Federal Register* on September 14, 2001 (66 FR 47905). During the 30-day public comment period, no comments were received. The requested modification would reduce the then current monitoring requirement to perform biological monitoring during all space vehicle launches at VAFB to only those launches during the Pacific harbor seal pupping season (March-June). This request was based on a scientific research program and the bioacoustic monitoring of space vehicle launches conducted from 1997 through 2001 at VAFB (SRS Technologies, 2001). During the pupping season, biological monitoring remains important in verifying that female harbor seals spend the necessary time on the haul-out establishing the female-neonate bond, including nursing of their pups. On January 14, 2002 (67 FR 2820, January 22, 2002), NMFS determined that monitoring during the molting season was not necessary because research and monitoring over the previous four years indicated that molting Pacific harbor seals entering the water because of a disturbance were not adversely affected in their ability to molt and did not become subject to thermoregulatory stress and modified the implementing regulations.

On August 22, 2002, the USAF requested an amendment to the LOA issued to it on May 31, 2002 (67 FR 38939, June 6, 2002) to include launches of the GBI and ABV. On May 6, 2003 (68 FR 25347, May 12, 2003), NMFS amended the USAF LOA to include the

GBI and ABV missiles as the modification would not result in an increase in the number of missile launches from North VAFB, and no additional impacts, individually or cumulatively would occur. This rulemaking remained in effect until December 31, 2003.

On September 2, 2003, NMFS received an application from the USAF requesting new regulations under section 101(a)(5)(A) of the MMPA for the take of marine mammals incidental to space vehicle and test flight activities from VAFB. NMFS published a notice of receipt of application in the *Federal Register* on September 19, 2003 (68 FR 54894), and a notice of proposed rulemaking on December 3, 2003 (68 FR 67629), which allowed for a combined 45 days of public comment. NMFS received only one comment letter during the proposed rulemaking stage. The new five-year implementing regulations became effective on February 6, 2004. NMFS issued annual LOAs to the USAF to conduct its space vehicle and test flight activities from VAFB on February 25, 2004 (69 FR 9810, March 2, 2004), March 4, 2005 (70 FR 11616, March 9, 2005), March 17, 2006 (71 FR 14853, March 24, 2006), March 13, 2007 (72 FR 13251, March 17, 2007), and March 11, 2008 (73 FR 14453, March 18, 2008). The current implementing regulations and LOA expire on February 6, 2009.

1.5 Other EA/EIS that Influence the Scope of this EA

The USAF and other Federal agencies have prepared a number of EISs and EAs for activities currently active or planned for the future at VAFB. Several of these documents are mentioned in section 1.3 of this chapter and references provided in both the Literature Cited section and Appendix A of this EA. Where referenced herein, portions of these NEPA documents are incorporated by reference, as authorized by 40 CFR 1502.21 of NEPA. In addition, the USAF prepared a Final EA in 1997 that addressed the issuance of regulations and LOAs for the USAF's activities from VAFB. On March 1, 1999 (64 FR 9925), NMFS adopted the 1997 EA as provided for by the Council on Environmental Quality (CEQ) regulations. NMFS wrote its own EA in 2004 as the NEPA analysis for the promulgation of five-year regulations and the issuance of annual LOAs. This EA updates the information contained in the USAF 1997 EA and NMFS' 2004 EA to include the new launch vehicles described in section 1.3 of this document, new information on the abundance and distribution of pinnipeds on VAFB and the NCI, and new information on potential impacts to marine mammals based on the 10 years of monitoring that has taken place since the completion of the 1997 USAF Final EA (USAF, 1997c) and the 2004 NMFS EA (NMFS, 2004).

NMFS is the lead agency for the purposes of this EA to evaluate the impact of the proposed action to authorize the incidental harassment of marine mammals at VAFB. This EA applies to both the current and future (2009-2014) USAF applications and NMFS issuance of LOAs for activities at VAFB that have the potential to incidentally harass marine mammals.

1.6 Scoping Summary

On July 25, 2008, NMFS published a notice of receipt of application for an LOA in the *Federal Register* (73 FR 43410) and requested comments and information from the public for 30 days. NMFS received comments from the Marine Mammal Commission (Commission) and one private citizen. The Commission supports NMFS' decision to publish proposed regulations for the specified activities provided that the research, mitigation, and monitoring activities described in the application and the current regulations are incorporated into the rule. NMFS incorporated the research, mitigation, and monitoring into the proposed rule. The private citizen's comment opposed the issuance of an authorization without any specific substantiation for why such an authorization should not be issued.

On December 19, 2008, NMFS published a proposed rule in the *Federal Register* (73 FR 77577) and requested comments from the public for 15 days. A draft of this EA was made available to the public for comment concurrently with the proposed rule. NMFS received comments from the Commission and one private citizen. Neither of these comment letters addressed issues related specifically to the Draft EA or the NEPA process for this action. The comments received on the proposed rule notice will be addressed in the final rule *Federal Register* notice.

1.7 Statutory and Regulatory Framework

1.7.1 Marine Mammal Protection Act

Under the MMPA, the taking of marine mammals without an authorization from NMFS is prohibited. 16 U.S.C. § 1371. The term "take" under the MMPA means "to harass, hunt, capture, kill or collect, or attempt to harass, hunt, capture, kill or collect." 16 U.S.C. § 1362(13). For purposes of "military readiness activities," harassment is defined as:

> (i) any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered [Level B harassment].

16 U.S.C. § 1362(18)(B).

In order to obtain an exemption from the MMPA's prohibition on taking marine mammals, a citizen of the U.S. who engages in a specified activity (other than commercial fishing) within a specified geographic region must obtain an incidental take authorization (ITA) under section 101(a)(5)(A) or (D) of the MMPA. An ITA shall be granted if NMFS finds that the taking will have a negligible impact on the affected species or stock(s) and will not have an unmitigable adverse impact on the availability of

the species or stock(s) for subsistence uses. NMFS will prescribe, where applicable, the permissible methods of taking and other means of effecting the least practicable adverse impact on the species or stock and its habitat (i.e., mitigation) and shall set forth requirements pertaining to monitoring and reporting. ITAs may be issued as either (1) LOAs or (2) IHAs, the latter applicable when there is no potential for serious injury and/or mortality or where any such potential can be negated through required mitigation measures.

As part of the MMPA authorization process, applicants are required to provide detailed mitigation plans that outline what efforts will be taken to reduce negative impacts to marine mammals and their availability for subsistence use to the lowest level practicable. In addition, ITAs require that operators conduct monitoring, which should be designed to result in an increased knowledge of the species and an understanding of the level and type of takings that result from the authorized activities. Under the MMPA, NMFS further requires that monitoring be designed to provide information and data verifying (or disputing) that the taking of marine mammals are, in fact, negligible and there are no unmitigable adverse impacts on the availability of marine mammals for subsistence uses.

1.7.2 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) states:

> "Each Federal agency shall, in consultation with and with the assistance of the Secretary [of the Interior/Commerce "Secretary"], insure that any action authorized, funded, or carried out by such agency…is not likely to jeopardize the continued existence of any endangered species or threatened species, or result in the destruction or adverse modification of habitat of such species, which is determined by the Secretary…to be critical…"

16 U.S.C. § 1536(a)(2).

The USAF consulted with NMFS on whether launches of Titan II and IV at SLC-4 would jeopardize the continued existence of species listed as threatened or endangered. NMFS issued a Biological Opinion on this activity to the USAF on October 31, 1988, concluding that launchings of the Titan IV (the largest launch vehicle at VAFB) were not likely to jeopardize the continued existence of the Guadalupe fur seal. The USAF reinitiated consultation with NMFS after the Steller sea lion was added to the list of threatened and endangered species (55 FR 49204, November 26, 1990). However, since the Steller sea lion had not been sighted on the NCI between 1984 and the time of the consultation, it was determined that these launchings were not likely to affect Steller sea lions. Additionally, on September 18, 1991, NMFS concluded that the issuance of an ITA to the USAF to take marine mammals incidental to Titan IV launches was not likely to jeopardize the continued existence of Steller sea lions or Guadalupe fur seals. Finally, because launches of rockets and missiles other than the Titan IV are unlikely to produce sonic booms that will impact the NCI and because listed marine mammals were not expected to haul out either on the VAFB coast or on the NCI during the five-year period, NMFS determined in 1999, that the issuance of regulations governing the taking of

marine mammals incidental to missile and rocket launches and aircraft operations was unlikely to affect listed marine mammals (64 FR 9925, March 1, 1999).

The NMFS OPR Permits, Conservation and Education Division consulted with the NMFS OPR Endangered Species Division on the issuance of ITAs under section 101(a)(5)(A) of the MMPA in 2003 prior to issuing the current regulations, which expire in February, 2009. That consultation concluded that the USAF activities and the promulgation of regulations and issuance of LOAs by NMFS to the USAF were Not Likely to Adversely Affect species listed as threatened or endangered under the ESA (NLAA finding). The activities proposed to be authorized under new regulations are not substantially different from those described in the 2003 consultation. Additionally, there is no new information revealing effects of this action that may affect listed species or designated critical habitat in a manner or to an extent not previously considered; the identified action has not been modified in a manner that causes an effect to listed species or critical habitat that was not previously considered; and no new species have been listed or critical habitat designated that may be affected by the proposed action. Therefore, there has not been a reinitiation of consultation under section 7 of the ESA since none of the reinitiation triggers have been met.

In addition to the section 7 consultations with NMFS Endangered Species Division, the USAF has previously conducted several consultations with the U.S. Fish and Wildlife Service (USFWS) for the activities described in section 1.3 of this EA. None of the Biological Opinions issued by the USFWS to the USAF for its activities from VAFB resulted in jeopardy opinions. Additionally, the Biological Opinions concluded that there would not be any adverse modifications to critical habitat of listed species.

1.7.3. Coastal Zone Management Act

The Coastal Zone Management Act (CZMA), 16 U.S.C. § 1451 *et seq.*, provides assistance to states, in cooperation with Federal and local agencies, for developing land and water use programs for their respective coastal zones. A state's coastal zone extends seaward to 5.6 km (3 nm; except for the Texas and Florida Gulf Coasts). Federal license or permit activities and Federal financial assistance activities that have reasonably foreseeable coastal effects must be fully consistent with the enforceable policies of state coastal management programs. As part of NOAA's approval of a State's coastal management program, the State prepares a list of Federal license or permit activities which affect coastal uses or resources which the State wishes to review for Federal consistency purposes. The USAF conducts separate consultations with the California Coastal Commission for each launch activity, as each one is considered a separate Federal action. The USAF prepares individual NEPA documents for each of these actions (see Appendix A), and compliance with the CZMA is addressed during the NEPA process. Past consultations between the USAF and the California Coastal Commission have indicated that activities from VAFB similar to those described in this document are consistent to the maximum extent practicable with the enforceable policies of the California Coastal Act.

1.7.4 National Marine Sanctuaries Act

The National Marine Sanctuaries Act (NMSA), 16 U.S.C. § 1436 *et seq.*, prohibits the destruction of, loss of, or injury to any sanctuary resource, and any violation of regulations or permits issued pursuant to the statute or accompanying regulations. 16 U.S.C. 1436. In addition, Section 304(d) of the NMSA requires Federal agencies to consult with the Secretary of Commerce, through the National Oceanic and Atmospheric Administration (NOAA), on Federal agency actions, internal or external, to any national marine sanctuary that are likely to destroy, cause the loss of, or injure any sanctuary resource. 16 U.S.C. § 1434(d). Under Section 304(d), if NOAA determines that the action is likely to destroy, cause the loss of, or injure sanctuary resources, NOAA shall recommend reasonable and prudent alternatives that can be taken by a Federal agency to protect sanctuary resources. The Federal agency may choose not to follow these alternatives provided the reasons are submitted in writing. However, if the head of a Federal agency takes an action other than an alternative recommended by NOAA and such action results in the destruction of, loss of, or injury to a sanctuary resource, the head of the agency shall promptly prevent and mitigate further damage and restore or replace the sanctuary resource in a manner approved by NOAA. Regulations for each designated national marine sanctuary specifically address military and defense activities.

NMFS preliminarily determined that the proposed action of promulgating regulations and issuing subsequent LOAs to the USAF for its specified activities was not likely to destroy, cause the loss of, or injure any national marine sanctuary resources. On December 8, 2008, NMFS contacted the National Ocean Service's Office of National Marine Sanctuaries regarding NMFS' proposed action of promulgating regulations and issuing LOAs for the USAF activities described in section 1.3 of this document. On December 12, 2008, the Office of National Marine Sanctuaries determined that no further consultation with NMFS was required on its proposed action.

1.8 Scope of the Analysis

This EA addresses the proposal of NMFS to reissue an authorization and regulations under section 101(a)(5)(A) of the MMPA and the alternatives to the proposed action. These regulations, if issued, would authorize the harassment of four species of marine mammals incidental to space vehicle and test flight activities conducted by the USAF from VAFB. These regulations, if implemented, for the period between approximately February, 2009, and February, 2014, would allow NMFS to issue annual (or more frequently than annual, if warranted) LOAs to the USAF. The current regulations and LOA for these activities expire on February 6, 2009.

Chapter 2 ALTERNATIVES

Chapter 2 of the 1999 USAF Final EA described the proposed action and two alternatives to that action in detail. Additionally, alternatives to the USAF's proposed action regarding use of various launch vehicles at VAFB have been discussed in the NEPA documents listed previously and in Appendix A of this EA. For information supporting the USAF's proposed action and the alternatives to that proposed action and the impacts on marine and terrestrial life and the human environment that would result from implementation of the proposed action and alternatives, please refer to those documents. However, for the promulgation of regulations and issuance of LOAs to the USAF at VAFB, NMFS considered and analyzed five alternatives in its 2004 EA. The five alternatives that were previously considered by NMFS are: (1) The No Action Alternative; (2) The Preferred Alternative: Issuance of Five-year Regulations and Annual LOAs to the USAF with Required Mitigation, Monitoring, and Reporting Measures; (3) Issuance of Five-Year Regulations and Annual LOAs with Additional Mitigation and Monitoring Measures; (4) Issuance of Regulations for a Period of Time Less than Five-years or Issuance of Annual IHAs under Section 101(a)(5)(D) of the MMPA; and (5) Issuance of Five-year Regulations and LOAs without Implementation of Mitigation Measures.

NMFS is considering and analyzing the first four alternatives from the 2004 EA in this EA. With the exception of the mention of small numbers in the description of Alternative 2 and the fact that now only four species of marine mammals are being considered for taking instead of six, Alternatives 1 through 4 in chapter 2 of NMFS' 2004 EA are hereby incorporated by reference.

NMFS considered whether other alternatives could meet NMFS' purpose and need and support the USAF required mission. An alternative that would allow for the promulgation of five-year regulations and the issuance of annual LOAs with no required mitigation was considered but eliminated from consideration, as it would not be in compliance with the MMPA. For that reason, this alternative is not analyzed further in this document.

Chapter 3 AFFECTED ENVIRONMENT

The purpose of this chapter is to provide baseline information for consideration of the alternatives and describes the environment that might be affected by the proposed action and alternatives. This chapter describes the physical, biological, and socioeconomic environments in the action area.

3.1 Physical Environment

3.1.1 Vandenberg Air Force Base

VAFB is composed of approximately 99,000 acres of land and approximately 64.4 km (40 mi) of coastline on the coast of central California, within Santa Barbara County (see Figure 1). VAFB is located approximately halfway between San Diego and San Francisco. It is the headquarters of the 30th SW, USAF. The proposed action area includes both coastal and offshore areas from Point Sal to the Ventura/Los Angeles County line, the Santa Barbara Channel, and the NCI.

3.1.2 Northern Channel Islands

The NCI are located approximately 50 km (31 mi) south of the southern point on VAFB (see Figure 4, inset). Three islands, San Miguel, Santa Cruz, and Santa Rosa, make up the main NCI, with SMI being the primary site for pinniped rookeries. The NCI are part of the Channel Islands National Park and the Channel Islands National Marine Sanctuary. The LOA application submitted by the USAF (30 SW, 2008c) contains a more detailed description of the environmental setting on the NCI, including the locations of the main haul-out sites on the various islands. That information is incorporated here by reference.

3.2 Biological Environment

3.2.1 Marine Mammals

The Southern California Bight, including the Channel Islands, supports a diverse assemblage of marine mammals: 29 species of cetaceans (whales, dolphins, and porpoises) and six species of pinnipeds (seals and sea lions). Harbor seals (*Phoca vitulina*), California sea lions (*Zalophus californianus*), northern elephant seals (*Mirounga angustirostris*), and northern fur seals (*Callorhinus ursinus*) breed there, with the largest rookeries on SMI and San Nicolas Island. General information on the current status of marine mammal species found in the waters off California can be found in Carretta *et al.* (2007), which is available on the Internet at: http://www.nmfs.noaa.gov/pr/pdfs/sars/po2007.pdf. Please refer to that document for general information on these species. In addition, section 3.2 of the USAF 1997 Final EA (USAF, 1997c) provides a brief description of the marine mammal species inhabiting the waters off VAFB. This information is incorporated herein by reference. NMFS' 2004 EA (NMFS, 2004) also includes information on the six pinniped species found on and around VAFB and the NCI.

The marine mammal species most likely to be found on VAFB and the NCI and therefore most likely to be affected by the proposed activities described in this EA are the Pacific harbor seal, California sea lion, northern elephant seal, and northern fur seal. Steller sea lions and Guadalupe fur seals are sometimes sighted on the NCI but are not likely to be affected by the space vehicle and test flight activities. Information in this EA updates the information provided in the USAF 1997 Final EA (USAF, 1997c) and NMFS' 2004 EA (NMFS, 2004) for these species.

3.2.1.1 Pacific Harbor Seal

Status: The California population of harbor seals is considered a separate stock from harbor seals in Oregon and Washington (Carretta *et al.*, 2001). Not all harbor seals, including pups, are on shore at one time; therefore, correction factors that take into account the number of harbor seals at sea during the molting season are used to calculate the total population. Correction factors vary from 1.21 to 2 (Hanan, 1996; Boveng, 1988; Huber, 1995; SRS Technologies, 2001). Based on the most recent harbor seal counts (Lowry et al., 2005) and a revised correction factor by Hanan of 1.3, the estimated population of harbor seals in California is 34,233 (Carretta *et al.*, 2007). Using Hanan's (1996) correction factor of 1.2, the minimum size of the California harbor seal population is 31,600 (Carretta *et al.*, 2007). Net production rates appeared to be decreasing from 1982 to 1994 and the population may be approaching its environmental carrying capacity (Carretta *et al.*, 2007). In contrast, the harbor seal population at VAFB had been increasing at a rate of 12.7 percent annually but may be stabilizing now with little growth in the last four years (MSRS, 2008a). The California stock of harbor seals is not considered threatened or endangered under the ESA and is not depleted or considered a strategic stock under the MMPA (Carretta *et al.*, 2007).

Distribution: Harbor seals are found hauled out in estuaries, on offshore islands and mainland coves, beaches and offshore rocks and reefs along the California coast. Harbor seals occur both in remote locations (*e.g.*, Channel Islands), as well as in populated areas (San Francisco Bay and La Jolla), but generally avoid populated areas that are prone to disturbance. Haul-out behavior is also influenced by tide and swell in some locations, weather conditions, and prey availability. Harbor seals generally forage locally (within 50 km (31 mi)) as opposed to elephant seals that are long distance foragers (as far as 2,000 km (1,243 mi)).

Seasonal Distribution: Harbor seals forage locally; therefore there is no long-term migration or the foraging sojourns seen in other pinniped species. The population of harbor seals hauling out begins to increase during the pupping season (January through June). The start of pupping season varies with latitude, with southern California starting in January and central California in March and April. The number of seals hauled out reaches its peak during May through July when seals haul out more often and for longer periods to molt.

Distribution on VAFB: The most common marine mammal inhabiting the VAFB coastline is the Pacific harbor seal. They are local to the area, rarely traveling more than

50 km (31 mi) from the haul-out site. They haul out on small offshore rocks or reefs and sandy or cobblestone cove beaches. Although harbor seals can be found along much of the VAFB coastline, there are four main haul-out sites where they congregate: three on north VAFB and one on south VAFB. On north VAFB, harbor seals primarily use the offshore rocky area near Spur Road, the Purisima Point reef, and the offshore rocky area of Lion's Head (Figure 3). As many as 110 seals may haul out at Spur Road, and as many as 45 seals may haul out at Purisima Point (SRS Technologies, 2003b). Based on monthly counts conducted in 2005 through 2007, only one to two pups were observed at the Spur Road and Purisima Point haul-out sites. As many as 17 seals may haul out at Lion's Head, with as many as three pups (Thorson *et al.*, 2004). These three sites are mostly to completely under water at higher tides (above 1.2 m (3.9 ft)), preventing seals from hauling out at those times.

The main haul-out area on south VAFB, from the VAFB Harbor north to South Rocky Point beach, is comprised of many sand and cobblestone coves and rocky ledges, with most seals found between Harbor Seal Beach and South Rocky Point (approximately 1.5 km (0.9 mi) of coastline; Figure 2). The raised rocky ledge of Flat Iron Rock provides an area to haul out during most tides (except for very high tides combined with high swells and wind); therefore, this area is used more often and by more seals than any other VAFB haul-out site. Weaned pups, juveniles and some adult females use Weaner Cove, just to the north of Flat Iron Rock, throughout most of the year. During periods of high winds, seals may move from Flat Iron Rock into the more protected Weaner Cove. Peak numbers, as many as 515 seals hauled out at one time (SRS Technologies, 2003b), usually occur at the south VAFB haul-out site in the afternoon (1100 to 1600 Pacific Time), but the number of seals present is also influenced by a combination of high tides and large swells, high temperature, or strong winds (SRS Technologies, 2003b). During the pupping season (March through June), as many as 49 mother-pup pairs can be found hauled out in the area just north of Harbor Seal Beach and at Weaner Cove, making these areas the main pupping sites on VAFB (SRS Technologies, 2003b). During the molting season (May through July), adult and some juvenile harbor seals primarily use the Flat Iron Rock area, while weaned pups, juveniles, and a few adult females use the coves just north and south of Flat Iron Rock (SRS Technologies, 2002).

As many as 515 harbor seals haul out daily on south VAFB and as many as 155 seals on north VAFB (SRS Technologies, 2003b). The population on VAFB increased from 1997 through 2002; from 2003 through 2006 there was little change, and a decrease was seen in the population in 2007. It is possible that the El Niño in 2007, while mild, may have led to the lower counts of harbor seals. There was also a strong domoic acid event along the central California coast which may have affected population numbers. The total population of harbor seals on north and south VAFB in 2002 was calculated at 1,115 seals using ground counts during the molting season and a correction factor of 1.7 times the ground count based on radio telemetry.

Scientists began a research program at VAFB in 1997 (NMFS Scientific Research Permits No. 859-1373 and No. 859-1680-01) to determine the short and long-term effects of space vehicle launch noise and sonic booms on affected marine mammals. Haul-out

behavior was determined by capturing and attaching radio frequency transmitters to the hind flippers of 41 harbor seals. Twenty-four seals were tagged in the Rocky Point area of south VAFB, and 17 were tagged at Point Conception (control site; Figure 1). The tagged seals ranged in age from pups (4 months) through adults. A radio receiver-scanner and electronic data logger were stationed on the cliffs above each haul-out site, and recorded the presence of any radio tagged seal every 15 minutes while the seals were hauled out of the water. The time of arrival, time of departure, and time on shore could be calculated from the data collected by the telemetry system.

The main influence on the daily haul-out patterns of harbor seals on south VAFB was the time of day ($r^2 = 0.72$; n = 423) rather than tide height ($r^2 = 0.23$; n = 423), as the peak number of seals hauled out occurred daily between 1100 and 1700 hours. Haul-out behavior was also influenced by combinations of high tide and large swell, or high temperature and no wind. Either of these combinations may cause seals not to haul out at all or to leave the haul-out site early. Seals remained on shore for 8.1±1.6 hours (range 1.2 - 14.7 hours). There was no significant difference in the time of day or duration of hauling out between south VAFB and Point Conception (t-test, P>.05).

Site fidelity, which is defined herein as an individual's continued use of the same haul-out area for at least six months, was high at both south VAFB and Point Conception. The mean site fidelity at VAFB was 77 percent (adults 84 percent, juveniles 72 percent, and pups 63 percent), and at Point Conception it was 71 percent (adults 81 percent, juveniles 74 percent, and pups 53 percent). The trend of increasing site fidelity with age is common in all harbor seal populations, as young seals cannot compete for haul-out space with adults and move to other less preferred haul-out sites (Kovacs *et al.*, 1990; Suryan and Harvey, 1998). There have been four juveniles tagged at Point Conception that have moved to VAFB, but no juveniles have moved from VAFB to Point Conception.

The total population of harbor seals at VAFB in 2002 was estimated to be 1,115 (850 on south VAFB and 265 on north VAFB; SRS Technologies, 2003a), using telemetry data to correct for seals that were at sea during the census. A correction factor of 1.7 times the ground count was used. From 2000 through 2007 there were three to seven SLV launches per year (average of 4.4 SLV launches annually), and there appeared to be only short-term disturbance effects to harbor seals as a result of launch noise. The harbor seal population increased from 1997 to 2002 at an annual rate of 12.7 percent; however, the number of total harbor seals on south VAFB was lower in 2007 (356 seals) than 2006 (511 seals). The only decrease in the population during the 1997 to 2002 period occurred during the 1998 El Niño season, when there was a 13.6 percent decrease from the previous year. The number of harbor seal pups observed increased at a rate of 26.7 percent annually through 2003, except during the El Niño events. The number of pups on south VAFB continued to increase from 2004 through 2006 (high of 53 pups) but fell again in 2007 (38 pups). Pup production grew at a rate of 7.9 percent at Point Conception through 2006 except during El Niño events. Point Conception has limited area where females and pups can haul out without being harassed by other seals or exposed to high tides and swells. There are more haul-out areas for females with pups at

VAFB; therefore, only an El Niño type disturbance, which includes weather and food availability effects, should affect pup production at VAFB.

Distribution on NCI: At least 700 harbor seals used SMI, 1,000 used Santa Cruz Island, and 900 used Santa Rosa Island, during the 2002 aerial counts (Lowry and Carretta, 2003). These counts are just of harbor seals hauled out on shore and do not reflect the total population using that area. The harbor seal is the main pinniped species inhabiting Santa Cruz Island and one of two main pinnipeds found on Santa Rosa Island. The harbor seal population on the NCI appears to be stable with little change from 1990 through 2002 (Lowry and Carretta, 2003).

3.2.1.2 California Sea Lion

Status: The California sea lion, *Zalophus californianus*, includes three subspecies: *Z. c. wollebaeki* (on the Galapagos Islands); *Z. c. japonicus* (in Japan, but now thought to be extinct); and *Z. c. californianus*. The subspecies *Z. c. californianus* extends from Baja California, Mexico to southwestern Canada, although breeding only occurs from the Gulf of California in Mexico through southern California. The geographic breeding regions are used to separate this subspecies into three stocks. The U.S. stock begins at the California/Mexico border and extends north to Canada (Forney *et al.*, 2000a) with the major rookeries at San Miguel and San Nicolas Islands. The California sea lion is not considered threatened or endangered under the ESA and is not depleted or considered a strategic stock under the MMPA (Carretta *et al.*, 2007).

The population of sea lions in the U.S. stock is calculated using the number of pups counted in July and the proportion of pups on shore (22.8 to 23.9 percent of the population). With El Niño events (1983, 1984, 1992, 1993, 1998, and 2003) removed from 1975 – 2005 time series data, pup counts have increased at an annual rate of 5.6 percent (Carretta *et al.*, 2007). The current population estimate is 238,000 (Carretta *et al.*, 2007). A minimum population size was determined from counts of all age and sex classes ashore at major rookeries and haul-outs during the 2005 breeding season and was estimated at 141,842 (Carretta *et al.*, 2007).

Distribution: The breeding range of the California sea lion's California stock extends from the Mexican border north to Año Nuevo Island in central California. San Miguel and San Nicolas Islands are the main breeding rookeries for the California sea lion with approximately 23,000 pups born annually.

Seasonal Distribution: The breeding season begins in late May with pupping completed by early July. Females arrive on the beach, give birth within several days of arriving, and mate about seven days after birth. Females then go to sea for several days to forage and periodically return to nurse their pup. This pattern continues for 8 to 12 months when the next pup is born. Adult males remain on territory through the breeding season and then leave in late July to forage, with most animals moving north. Juveniles may also move north, and large numbers of juveniles and sub-adult males may be found on haul-outs in the fall during the molt.

Distribution on VAFB: Fewer than 100 sea lions are found seasonally on VAFB. Sea lions may sporadically haul out to rest when foraging or transiting through the area but generally spend little time there. Areas used for hauling out include South Rocky Point, Point Arguello, and Point Pedernales on VAFB and Point Sal just north of VAFB (Figure 1).

In 2002, small numbers of sea lions hauled out on the VAFB boat harbor jetty during a period when large numbers of bait fish had moved in close to shore in that area. Large numbers of pinnipeds and cetaceans were seen in the area and some sea lions used the jetty as a temporary haul-out site during fish runs and for several days afterward. During the 2003 California sea lion pupping season, five sea lion pups were born at the Rocky Point haul-out site but were abandoned soon after birth (SRS Technologies, 2004b). This may have been a result of the El Niño conditions or the prevalence of domoic acid poisoning that existed in 2003, which affected sea lions at that time. No sea lion pups were born on VAFB from 2004 through 2007.

Distribution on NCI: SMI is one of the major California sea lion rookeries, along with San Nicolas Island, with about 23,000 pups born each year. California sea lions occur at Point Bennett, along the south side of the island, to Cardwell Point on the east. Most of the sea lions on the south and east end of SMI are non-breeding (juvenile or molting) animals. This area is composed of high cliffs with small sandy coves where several hundred seals haul out. Some California sea lions pup on Santa Rosa Island, but it has not been established as a rookery yet. Because sonic booms from VAFB launches usually do not impact Santa Cruz and Santa Rosa Islands, it is expected that launches from VAFB will mainly affect SMI only, where pup production is stable at 23,000 pups annually.

3.2.1.3 Northern Elephant Seal

Status: The California breeding stock of the northern elephant seal begins at the U.S.-Mexico border with breeding continuing north to the south-east Farallon Islands. The total population of the California stock of northern elephant seals was estimated at 124,000 in 2005, based on a pup count of 35,549 and using a multiplier of 3.5 for a growing population (Carretta *et al.*, 2007). The minimum population size for northern elephant seals can be estimated very conservatively as 74,913, which is equal to twice the observed pup count (to account for the pups and their mothers) plus 3,815 males and juveniles counted at the Channel Islands and central California sites in 2005 (NMFS unpublished data). On SMI, as many as 17,000 pups are born each year, and as many as 40,000 total elephant seals are hauled out during the peak of the breeding season in January. The northern elephant seal is not listed as threatened or endangered under the ESA and is not depleted or considered a strategic stock under the MMPA (Carretta *et al.*, 2007).

Distribution: The breeding distribution of the California stock of the northern elephant seal extends from the Channel Islands, mainly San Miguel and San Nicolas Islands, north to the south-east Farallon Islands. Northern elephant seals utilize both offshore islands (San Miguel, San Nicolas, Año Nuevo, and south-east Farallon Islands) and mainland

sites (Point Piedras Blancas, Año Nuevo, and Point Reyes) for breeding, molting, and resting. Females migrate north to forage, staying south of 45^{o} latitude and moving off the continental shelf, while males migrate to the Gulf of Alaska and Aleutian Islands. Juveniles also tend to move north but not as far as the adults.

Seasonal Distribution: The breeding season extends from December through March. Females leave to forage and return to molt from April through June. Males return to molt in July through August. Juveniles return to molt in April through June, and many haul out again in the fall to rest. Molting or resting elephant seals use the traditional breeding sites but also use sites to the north, including areas in Oregon and Washington.

Distribution on VAFB: As many as 188 northern elephant seals may be found seasonally on VAFB. Weaned elephant seal pups making their first foraging trips occasionally haul out for one to two days at VAFB before continuing on their migration. Table 7 details the numbers of elephant seals seen at VAFB from 2003 through 2007. Numbers during spring molts varied with the highest numbers observed during the molt in 2004 but have since then decreased significantly to only six seals in 2007. The highest fall haul-out count (144 animals) was recorded during the first year of occurrence, in 2005, and the lowest was observed in 2007 with only two seals. No adults have been observed at VAFB, and no elephant seals were present at VAFB during the 2003 through 2007 winter breeding seasons. As of January 2008, no adult elephant seals had shown up for the breeding season. The nearest regularly used elephant seal haul-out site (non-breeding) is at Point Conception, 25 km (15.5 mi) south of VAFB (Figure 1). As many as 35 juvenile and sub-adult male seals haul out there.

Table 7. Elephant seal observations at VAFB for 2003-2007

Year	Spring Molt Count	Fall Haul-out Count
2003 [1]	98	--
2004 [2]	188	--
2005 [3]	96	144
2006 [4]	32	18
2007 [5]	6	2

Notes:
1. SRS Technologies, 2003b.
2. SRS Technologies, 2004a.
3. SRS Technologies, 2006.
4. SRS Technologies, 2007.
5. ManTech SRS Technologies Inc., 2008a.

Distribution on NCI: Elephant seals primarily use SMI and Santa Rosa Island for breeding and hauling out to rest or to molt. As many as 12,000 elephant seal pups are born on SMI, and as many as 1,500 elephant seal pups are born on Santa Rosa Island (Lowry, 2002). The main rookeries of northern elephant seals are found at Point Bennett on the west end of SMI (Figure 4) and from Crook Point to Cardwell Point, with small numbers along the north coast. Most of the elephant seals on the south and east end of SMI are non-breeding (juvenile or molting) animals. Elephant seals rarely haul out on Santa Cruz Island, except when sick or injured. They are one of the two main pinniped species inhabiting Santa Rosa Island.

3.2.1.4 Northern Fur Seal

Status: Fur seals are mostly found on the Pribilof Islands in the Bering Sea. In 1997, the total population of the San Miguel stock was calculated at 12,272 based on a pup count of 3,068 and an expansion factor of 4. In 1998, an El Niño year, the San Miguel stock pup count decreased by 79.6 percent to only 627 pups but had increased to 1,084 pups in 1999. The population on the island has been steadily increasing with the exception of 1983 and 1998, both El Niño years. The San Miguel stock was estimated to be 9,424 individuals in 2005, based on a count of 2,356 pups (Carretta *et al.*, 2007). The minimum population size is estimated as twice the maximum number of pups born in 2005 (to account for the pups and their mothers) plus the maximum number of adult and sub-adult males counted for the 2005 season, which results in a very conservative estimate of 5,096 northern fur seals at San Miguel Island (Carretta *et al.*, 2007). The San Miguel stock of the northern fur seal is not considered threatened or endangered under the ESA and is not depleted or considered a strategic stock under the MMPA (Carretta *et al.*, 2007).

Distribution: Northern fur seals occur from southern California north to the Bering Sea and west to the Okhotsk Sea and Honshu Island, Japan. Of the seals in the U.S. outside of the Pribilof Islands, approximately one percent of the population is found on Bogoslof Island in the southern Bering Sea and San Miguel Island off southern California (Carretta *et al.*, 2007). Fur seals are sighted at sea. Injured or sick fur seals occasionally strand along the central and northern California coast.

Seasonal Distribution: SMI is the only breeding area of San Miguel stock. Northern fur seals pup from June through July and breed from June through August on SMI. Mothers alternate periods of foraging at sea and returning to nurse the pup for approximately 4 months, when the pup is weaned. Some pups and juveniles may be present throughout the year at SMI, but males leave after the breeding season (late July), and females leave after weaning the pup (October).

Distribution on VAFB: There are no reports of northern fur seals on VAFB.

Distribution on NCI: Northern fur seals are only found on the west end of SMI at Point Bennett and Castle Rock just offshore of SMI. There are approximately over 4,000 fur seal pups born on SMI each year.

3.2.1.5 Steller Sea Lion

Status: Steller sea lions range from Japan through Alaska and down the west coast of the U.S. into California. Using the most recent 2002-2005 pup counts available by region from aerial surveys across the range of the eastern stock, the eastern stock total population is estimated to be 48,519 or 54,989, and a minimum population is estimated at 44,584 (not corrected for animals at sea) (Angliss and Outlaw, 2008). The last comprehensive census in California was completed in 1996, and 2,042 Steller sea lions were counted including pups and non-pups. The Steller sea lion population in California,

especially in southern and central California, has declined from historic numbers by 50 percent during 1980-2004 (Angliss and Outlaw, 2008). Currently, the population in northern California appears stable; however, pup production has been declining since 1990 at a rate of 5 percent annually at Año Nuevo Island (central coastal California) since 1990 (Angliss and Outlaw, 2008). Overall, the Steller sea lion eastern stock has been increasing in the areas of Southeast Alaska, British Columbia, and Oregon but declining in California. The eastern U.S. stock of Steller sea lions is considered threatened under the ESA and is designated as depleted and a strategic stock under the MMPA (Angliss and Outlaw, 2008).

Distribution: Steller sea lions range from Japan, through the Aleutian Islands, southeast Alaska, south to British Columbia, and California. The population is broken into two stocks, the western U.S. stock extending west from Cape Suckling, Alaska (144^{o} W) and the eastern U.S. stock extending east and south from Cape Suckling. Año Nuevo Island, in central California, is the southernmost breeding rookery, although historically, they bred at SMI prior to 1980. Currently, Steller sea lions are rarely seen in the NCI.

Seasonal Distribution: Steller sea lions pup in May through July at the Año Nuevo rookery in central California. Females alternate between foraging periods at sea, returning to the rookery to nurse their pup. Females continue this pattern until the pups are weaned at about 6 to 11 months. Adult males remain on the rookery throughout the breeding season and then leave by September, migrating north to forage. Small numbers of juveniles and sub-adult males may be present at the rookery throughout the year.

Distribution on VAFB: There are no reports of Steller sea lions on VAFB.

Distribution on NCI: A single observation of a sub-adult male Steller sea lion on SMI was made in the spring of 1998 prior to the breeding season (Thorson *et al.*, 1999a). Previously, the last observation of a Steller sea lion was made in the mid-1980s.

3.2.1.6 Guadalupe Fur Seal

Status: Gallo (1994) estimated the Guadalupe fur seal population at 7,408 in 1993, by multiplying the number of pups by a factor of 4. Based on counts from several researchers since 1988 at different times of the year, Gallo calculated an exponential increase of 13.7 percent annually (Gallo, 1994). A single pup was born on SMI in 1997, but no others since. The Guadalupe fur seal is listed as threatened under the ESA and as depleted and a strategic stock under the MMPA (Forney *et al.*, 2000b).

Distribution: Guadalupe fur seals breed primarily on Isla Guadalupe and Isla Benito del Este in Baja California, Mexico. Observations of single fur seals are not uncommon on San Miguel and San Nicolas Islands. Melin and DeLong (1999) reported one mother and pup at SMI. In the U.S., a few Guadalupe fur seals are known to inhabit California sea lion rookeries in the Channel Islands (Stewart *et al.*, 1987).

Seasonal Distribution: Guadalupe fur seals give birth in June through July and may nurse their pup for as long as 11 months. Guadalupe fur seals are generally non-migratory, but small numbers may move up to California and occasionally to SMI.

Distribution on VAFB: There are no reports of Guadalupe fur seals on VAFB.

Distribution on NCI: Zero to two Guadalupe fur seals are seen each year at SMI, generally in the summer (Melin and DeLong, 1999).

3.2.2 Fish and Other Marine Life

A description of fish and other marine life have been provided in NEPA documents prepared by the USAF and other Federal agencies. A list of these documents can be found in Appendix A of this EA. Please refer to those documents for a full discussion on these biological resources. It is highly unlikely that fish or other marine resources will be affected by space vehicle and test flight activities because of the location of the activity and the fact that most sound generated by these activities will mainly reflect off the water surface (see section 4.2.2.2 later in this document).

3.3 Socioeconomic Resources

Socioeconomic resources found in and around VAFB and the NCI include recreation (such as whale watching and pleasure boating), oil and gas exploration and production, commercial shipping, commercial and sport fishing, military activities, and dredging. A description of these resources is addressed in chapter 3.3 of the USAF Final EA (USAF, 1997c). That information is incorporated herein by reference.

Chapter 4 ENVIRONMENTAL CONSEQUENCES

This chapter outlines the effects or impacts to the aforementioned resources on VAFB and the NCI from the proposed action and alternatives. Significance of those effects is determined by considering the context in which the action will occur and the intensity of the action. The context in which the action will occur includes the specific resources, ecosystem, and the human environment affected. The intensity of the action includes the type of impact (beneficial versus adverse), duration of impact (short versus long term), magnitude of impact (minor versus major), and degree of risk (high versus low level of probability of an impact occurring).

The impacts on the human environment from space vehicle and test flight activities at VAFB and alternatives to those activities were addressed in several NEPA documents prepared by the USAF (see Appendix A). This EA covers the environmental consequences of the promulgation of five-year regulations and the issuance of annual LOAs from 2009-2014 and the alternatives to that proposed action. A primer on noise, methods of measurement, and how noise impacts are evaluated can be found in the USAF 1997 Final EA (USAF, 1997c) on these activities or in Appendix B of this document. Additional discussion on noise impacts on marine resources can be found in the USAF 1997 Final EA (section 4.2), which is incorporated into this chapter by reference. Impacts other than noise on atmospheric and biological resources due to launch activities, including chemical reactions, dispersion of launch vehicle exhaust products and toxic and hazardous materials have been addressed in the previously mentioned NEPA documents. Please refer to those documents for the complete discussion.

The terms “effects” and “impacts” are used interchangeably in preparing these analyses. The CEQ’s regulations for implementing the procedural provisions of NEPA, also state, “Effects and impacts as used in these regulations are synonymous” (40 CFR §1508.8). The terms “positive” and “beneficial”, or “negative” and “adverse” are likewise used interchangeably in this analysis to indicate direction of intensity in significance determination.

4.1 Effects of Alternative 1 (No Action)

Under the No Action Alternative, NMFS would not promulgate regulations or issue annual LOAs to the USAF for the proposed activities. In this case, the USAF would decide whether or not it would want to continue with the space launch and test flight activities, which are authorized by the Secretary of Defense and the Secretary of the Air Force, not NMFS. If the USAF chooses not to conduct the activities, then there would be no effects to marine mammals. If the USAF decides to conduct some or all of the activities without implementing any mitigation measures, then if the activities occur when marine mammals are present in the action area, there is the potential for behavioral disturbance, injury, or mortality of marine mammals, especially if the launches occur during the pupping season. If the USAF decides to implement mitigation measures similar to those described in Chapter 5 of this EA, then the impacts would most likely be similar to those described for Alternatives 2 and 3 below.

If, to avoid the incidental taking of marine mammals without an IHA or LOA, the USAF determined not to continue launch activities, NMFS expects that the impacts would be similar to those addressed by the USAF's "No Action Alternative" found in the previously referenced NEPA documents (see Appendix A). Essentially, this sub-alternative would prevent the USAF from fulfilling its military and commercial missions at VAFB.

4.2 Effects of Alternative 2 (Preferred Alternative)

Under this alternative, NMFS would promulgate regulations and issue annual (or more frequent, if warranted and requested) LOAs to the USAF for its space vehicle and test flight activities from VAFB with required mitigation, monitoring, and reporting requirements as discussed in Chapters 5 and 6 of this EA. If the mitigation and monitoring described later in this EA are undertaken, no serious injury or mortality of marine mammals is expected and therefore would not have an impact on the reproductive or survival ability of affected species: Pacific harbor seals, California sea lions, northern elephant seals, and northern fur seals. No marine mammals listed as threatened or endangered under the ESA are likely to be impacted by either the USAF action or NMFS' proposed action.

4.2.1 Effects on the Physical Environment

Pinnipeds are known to inhabit haul-out sites and rookeries on VAFB and the NCI. It is anticipated that the only effects will be short-term behavioral disturbance to the pinnipeds themselves. No impacts to marine mammal habitat are expected from NMFS' proposed action of promulgation of regulations and issuance of LOAs. Effects on the physical environment as a result of the USAF proposed action can be found in the previously mentioned USAF NEPA documents.

4.2.2 Effects on the Biological Environment

4.2.2.1 Effects to Marine Mammals

The activities that would be covered under proposed regulations create two types of noise: continuous/intermittent (but short-duration) noise, due mostly to combustion effects of aircraft and launch vehicles, and impulsive noise, due to sonic boom effects. Launch operations, particularly the operation of launch vehicle engines, are the major source of noise considered to have a potential to affect pinnipeds that are hauled out on or in the vicinity of VAFB. Generally, noise is generated from four sources during launches: (1) Combustion noise from launch vehicle chambers; (2) jet noise generated by the interaction of the exhaust jet and the atmosphere; (3) combustion noise from the post-burning of combustion products; and (4) sonic booms. Launch noise levels are highly dependent on the type of first-stage booster and the fuel used to propel the vehicle. Therefore, there is similarity in launch noise production within each class size of launch vehicles.

Behavioral Effects on Hauled Out Pinnipeds

The noise generated by Vandenberg activities will result in the incidental harassment of pinnipeds, both behaviorally and in terms of physiological (auditory) impacts. The noise and visual disturbances from SLV and missile launches and aircraft and helicopter operations may cause the animals to move towards the water or enter the water. The percentage of seals leaving the haul-out increases with noise level up to approximately 100 decibels (dB) ASEL, after which almost all seals leave, although recent data have shown that an increasing percentage of seals have remained on shore. Using time-lapse video photography, it was discovered that during four launch events, the seals that reacted to the launch noise but did not leave the haul-out were all adults. This suggests that they had experienced other launch disturbances and had habituated to it in that they reacted less strongly than other younger seals.

The louder the launch noise, the longer it took for seals to begin returning to the haul-out site and for the numbers to return to pre-launch levels. In two past Athena IKONOS launches with A-weighted SELs of 107.3 and 107.8 dB at the closest haul-out site, seals began to haul-out again approximately 16 to 55 minutes post-launch (Thorson *et al.*, 1999a; 1999b). In contrast, noise levels from an Atlas launch and several Titan II launches had A-weighted sound exposure levels ranging from 86.7 to 95.7 dB at the closest haul-out, and seals began to return to the haul-out site within 2 to 8 minutes post-launch (Thorson and Francine, 1997; Thorson *et al.*, 2000). Seals may begin to return to the haul-out site within 2 to 55 minutes of the launch disturbance, and the haul-out site has usually returned to pre-launch levels within 45 to 120 minutes.

However, based on research that has been conducted at VAFB since 1997 under scientific research permits issued to VAFB pursuant to Section 104 of the MMPA, population dynamics of harbor seals have not been negatively impacted as a result of SLVs and other military activities from VAFB. (See section 3.2.1.1 above for a more detailed discussion of the results of this research.) With the exception of years when El Niño events have occurred, the harbor seal population has increased at a steady rate on VAFB.

The main concern on the NCI is potential impacts from sonic booms created during launches of space vehicles from VAFB. Sonic booms are impulse noises, as opposed to continuous (but short-duration) noise such as that produced by aircraft and rocket launches. The initial shock wave during a sonic boom propagates along a path that grazes the earth's surface due to the angle of the vehicle and the refraction of the lower atmosphere. As the launch vehicle pitches over, the direction of propagation of the shock wave becomes more perpendicular to the earth's surface. These direct and grazing shock waves can intersect to create a narrowly focused sonic boom, about 0.6 km (1 mi) of intense focus, followed by a larger region of multiple sonic booms. During the period of 1997 to 2002, there were no sonic booms above 2 psf recorded on the NCI. In the pinnipeds observed, small sonic booms between 1 to 2 psf usually elicited a heads up response or slow movement toward and entering the water, particularly for pups. In 2006, due to an equipment malfunction, there was uncertainty about the peak

overpressure from the Delta IV NROL-22 launch, which could have ranged between 0.77 and 3.36 psf. During the 1996 Titan IV K-22 launch, sonic booms of 1 to 9.2 psf reached SMI and caused many sea lions and some elephant seals to enter the water near the loudest sonic boom (Stewart *et al.*, 1996). The primary concern during a launch that results in a sonic boom is that there could be a stampede of all or most of the animals at a haulout site. During a stampede, it is more likely that pups would be trampled to death by larger, older animals. However, the mitigation measure requiring the USAF to avoid conducting launches (especially those expected to produce a sonic boom), whenever possible, during the pupping season helps to avoid such situations. There were no injuries or mortalities as a result of the 1996 Titan IV K-22 sonic boom or the reactions by pinnipeds on SMI.

Effects on Hearing Sensitivities

In order to determine if harbor seals experience changes in their hearing sensitivity as a result of launch noise, SRS Technologies conducted Auditory Brainstem Response (ABR) testing on 18 harbor seals for four Titan IV launches, one Taurus launch, and one Delta IV launch. Following standard ABR testing protocol, the ABR was measured from one ear of each seal using sterile, sub-dermal, stainless steel electrodes. A conventional electrode array was used and low-level white noise was presented to the non-tested ear to reduce any electrical potentials generated by the non-tested ear. A Bio-logic Systems Corporation evoked potential computer produced the click and 8 kilohertz (kHz) tone burst stimuli through standard audiometric headphones. Over 1,000 ABR waveforms were collected and averaged per trial. Initially the stimuli were presented at sound pressure levels (SPLs) loud enough to obtain a clean reliable waveform and then decreased in 10 dB steps until the response was no longer reliably observed.

Once a response was no longer reliably observed, the stimuli were then increased in 10 dB steps to the original SPL. By obtaining two ABR waveforms at each SPL, SRS Technologies was able to quantify the variability in its measurements.

Good replicable responses were measured from most of the seals, with waveforms following the expected pattern of an increase in latency and decrease in amplitude of the peaks, as the stimulus level was lowered. One seal had substantial decreased acuity to the 8 kHz toneburst stimuli prior to the launch. The cause of this hearing loss was unknown, but was most likely congenital or from infection. Another seal had a great deal of variability in waveform latencies in response to identical stimuli. This animal moved repeatedly during testing, which may have reduced the sensitivity of the ABR testing on this animal for both the click and 8 kHz tone burst stimuli. Two of the seals were released after pre-launch testing but prior to the launch of the Titan IV B-34 launch, as it was delayed for many days, and animals are held for a maximum of five days.

Detailed analysis of the changes in waveform latency and waveform replication of the ABR measurements for the 14 seals showed that there were no detectable changes in the seals' hearing sensitivity as a result of exposure to the launch noise. However, the delayed start (1.75 to 3.5 hours after the launches) for ABR testing could allow for the

possibility that the seals may have recovered from TTS in hearing before testing began. However, no long-term hearing loss from the launch noise was found in the tested animals (SRS Technologies, 2003a; MSRS, 2008b). Based on the fact that TTS was not detected in the 14 seals on which ABR testing was conducted hours after the launches occurred, NMFS has determined that Permanent Threshold Shift (PTS) is highly unlikely to occur as a result of the launch activities.

Sonic booms created by the larger space launch vehicles may impact marine mammals on the NCI, particularly SMI. Based on previous monitoring of sonic booms created by SLVs on SMI (Thorson *et al.*, 1999a: 1999b), it is estimated that up to approximately 25 percent of the hauled out pinnipeds may be disturbed on SMI, if a sonic boom were to occur over the island.

With respect to impacts on pinniped hearing, NMFS previously determined that VAFB launch and missile activities, including sonic booms, could have an impact on the hearing of pinnipeds (63 FR 39055, July 21, 1998). These impacts would be limited to TTS, lasting between minutes and hours, depending on exposure levels. Subsequent information from ABR testing on harbor seals following Titan IV, Taurus, and Delta IV launches indicates that no PTS resulted from these launches. These results, therefore, are consistent with NMFS' previous conclusions in its prior rulemakings.

Summary

As a result, NMFS and the USAF do not anticipate a significant impact on any of the species or stocks of marine mammals from launches from VAFB. For even the largest launch vehicles, such as Delta IV, the launch noises and sonic booms can be expected to cause no more than a startle response and flight to water for those harbor seals, California sea lions and other pinnipeds that are hauled out on the coastline of VAFB and on the NCI. The noise may cause TTS in hearing depending on exposure levels, but, based on over 10 years of monitoring and additional related research studies, PTS is not anticipated.

Based on the analysis provided for this alternative and with the incorporation of the mitigation and monitoring measures outlined in Chapters 5 and 6 of this EA, the proposed activities are expected to effect the least practicable adverse impact on the affected marine mammal species or stocks and will have a negligible impact on the affected species or stocks. The provision requiring that the activity not have an unmitigable adverse impact on the availability of the affected species or stock for subsistence uses does not apply for this action since no subsistence activities of marine mammals occur in the proposed action area.

4.2.2.2 Effects to Fish and Other Marine Life

The level of underwater sound from any type of launch vehicle or aircraft depends on the altitude, aspect, and strength of the noise source (Richardson *et al.*, 1995). The angle at which a line from the aircraft to the receiver (i.e., animal) intersects the water's surface is therefore important. At angles greater than 13 degrees from the vertical, much of the

incident sound is reflected and does not penetrate into the water. This is especially true with calm seas, deep water, or shallow water with a non-reflective bottom (Richardson *et al.*, 1995). Some airborne sound penetrates water at angles greater than 13 degrees from the vertical when rough seas provide water surfaces at suitable angles (Lubard and Hurdle, 1976).

The similarity of all launch vehicle trajectories is such that none would cause an impingement angle approaching 14 degrees. The only conceivable vehicles that could cause such an effect would be a supersonic missile approaching target impact or an aircraft in level flight at speeds over Mach 4 or diving at somewhat lower speeds.

Therefore, fish and other marine life, including cetaceans or submerged pinnipeds, are unlikely to be affected since noise generated by space vehicle launches and aircraft operations will mostly reflect from the water's surface and not penetrate into water depths. Any sounds that do penetrate will be momentary (as the aircraft or missile passes overhead) and of low SPLs as attenuation reduces those SPLs.

4.2.3 Effects on Socioeconomic Resources

It is not expected that promulgating regulations and issuing LOAs to the USAF for the specified activity will negatively impact any of the socioeconomic resources in and around VAFB. The USAF and the commercial industry relying on the VAFB for launch capacity would be negatively impacted if the regulations were not issued, as it would be difficult for them to conduct the activities without violating the MMPA. If the space vehicle and test flight activities were not conducted, that could have a negative impact on military preparedness and national security. Section 4.3 of the USAF 1997 Final EA (USAF, 1997c) contains a complete discussion on the impacts to the socioeconomic environment.

4.3 Effects of Alternative 3

Under Alternative 3, NMFS would issue regulations that would include additional mitigation and monitoring measures beyond what would be required under Alternative 2 (Preferred Alternative). Although additional mitigation measures can be identified (such as modifying launch azimuths and direction to limit pinniped exposure to noise, prohibiting launches during certain periods of time, such as low tide when pinnipeds are ashore, and not launching at night), these measures are unlikely to be able to be implemented at all times by the USAF because they would either not meet mission requirements (and possibly result in mission payloads not reaching proper orbit) or put the launch vehicle over populated areas, with significant consequences if there was a failure of the launch vehicle. For example, launches from one of the SLC-2 launch complexes, SLC-2W, cannot follow a direct route on their final southward course because of offshore oil production platforms. In addition, the USAF notes that there are a myriad of operations and monitoring that are needed to launch a rocket. As such, the launch dates (and times) are scheduled months or years in advance. As the launch date approaches, small anomalies often appear that create short-term alterations to the launch

schedule. For these reasons, these additional mitigation measures are viewed as impractical.

Additional monitoring measures such as aircraft, boat, and personnel monitoring during launches could also be considered. However, these measures cannot be implemented as they are not in conformance with range safety procedures. For personnel safety, these procedures prohibit aircraft, boat, and personnel from the vicinity of the launch.

NMFS' evaluation of additional mitigation and monitoring measures beyond those described in Chapters 5 and 6 of this EA are considered in the context of the least practicable adverse impact standards specific to military readiness activities, which includes consideration, in consultation with the Department of Defense, of personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity. While requiring some of the additional mitigation and monitoring measures suggested in this section would provide minor benefits to the human environment (e.g., modifying launch azimuth or additional aerial or vessel monitoring), those benefits do not outweigh the practicability standard of the MMPA.

In comparison to Alternative 2, the types of potential effects on hauled out pinnipeds under this alternative would remain the same, including disturbance of hauled out pinnipeds and temporary displacement of some or all of the hauled out marine mammals for a short period of time and a potential for TTS during certain launch activities. No injury or mortality would be expected under this alternative. Since no additional mitigation measures were identified that would be considered to meet the "least practicable adverse impact" standard under the MMPA, Alternative 3 essentially was considered but eliminated, as no suitable additional mitigation measures were identified that were considered practicable for reduction in effects to marine mammals.

4.4 Effects of Alternative 4

Under Alternative 4, NMFS would promulgate regulations for a period of less than five years or issue annual IHAs to the USAF for the specified activities. All of the mitigation, monitoring, and reporting requirements that would be implemented under Alternative 2 would be included in the authorization issued if Alternative 4 were selected. Impacts to marine mammals, fish and other marine life, and the physical environment would be the same as that discussed for Alternative 2. However, there would most likely be increased costs to both the USAF and NMFS if this alternative were selected because of the need to process ITAs on a more frequent basis. This would require that staff spend additional time each year or two to issue the authorizations and could cause delays in the launch schedule.

4.5 Estimation of Take

It is estimated that marine mammals, specifically hauled out pinnipeds, may be taken by harassment on both VAFB and the NCI during each launch depending on the SLC and launch trajectory. The take estimates presented here are applicable to Alternative 2,

although the same level of take would be estimated annually under Alternative 4, although the method of authorization and period of applicability would be different. Note that no additional mitigation measures were identified in Alternative 3, therefore a separate take estimate was not developed, and this alternative was not carried fully through this EA. Animals could also possibly be taken as a result of aircraft operations. The number of SLV and missile launches per year at VAFB is variable, and launch planning is a fluid process. Launch delays, which can last from one day to significant periods of time such as a year or more, can result from complex engineering issues that arise during the launch process. Delays are also an inevitable part of a process that is, in part, dependent on acceptable meteorological conditions.

Although these issues are a recognized part of launch planning, VAFB's Range Scheduling Office schedules and tracks launches several years in advance. Manifests that predict approximately four years in advance are updated on a weekly basis. Table 8 summarizes information from the February 1, 2008, manifest, which provides a good estimate for upcoming years, with the understanding that launches may be added or eliminated in the future. However, the USAF requests to conduct a maximum of 30 launches per year from VAFB to accommodate any potential changes in the manifests.

Table 8. Estimated numbers of launches from 2009 through 2014

Fiscal Year	Estimated # of SLV Launches	Estimated # of ICBM and Missile Launches	Total
2009	11	6	17
2010	5	5	10
2011	3	4	7
2012	7	4	11
2013	7	6	13
2014	4	7	11

Notes: Based on 30 SW 2008a and b.

As described in section 1.3 of this document, the specific launch vehicles may change over the course of the proposed five-year regulations as NEPA analyses are completed. This EA evaluates the proposed level of activity and type of launches based on current and projected information. To the extent that specific launch vehicles may change, the USAF would be required to report such new vehicles to NMFS, and NMFS would evaluate a particular vehicle (e.g., missiles) to ensure that the vehicle fit within the parameters of the regulations that are proposed to be set forth for the five year action. Thus, the transition of individual craft is not expected to change the impact assessment as set forth in this description of action and alternatives, and all activities would be required to fall within the general description of specified activities and estimates of marine mammal take described in this EA and considered for authorization in the rulemaking analyzed herein. Note that specific monitoring requirements for such new vehicles are presented in Chapter 6.

4.5.1 Estimated Takes at VAFB

Pacific harbor seals: As many as 600 harbor seals per launch may be taken by Level B harassment. Depending on the type of rocket being launched, the time of day, time of the year, weather conditions, tide and swell conditions, the number of seals that may be taken will range between 0 and 600. Launches and aircraft operations may occur at any time of the year so any age classes and gender may be taken.

California sea lions: As many as 200 sea lions per launch may be taken by Level B harassment. Sea lions at VAFB are usually juveniles of both sexes and sub-adult males that haul out in the fall during the post breeding dispersal. Births generally do not occur at VAFB, but five pups were observed at VAFB in 2003, an El Niño year, although all were abandoned by their mothers and died within several days of birth. Sick or emaciated weaned pups may also haul out briefly. The number of sea lions that may be taken by harassment will range between 0 and 200.

Northern elephant seals: As many as 200 elephant seals per launch may be taken by Level B harassment. Weaned elephant seal pups, juveniles, or young adults of both sexes, may occasionally haul out at VAFB for several days to rest or as long as 30 days to molt. Injured or sick seals may also haul out briefly. The number of elephant seals that may be taken by harassment will range between 0 and 200.

Northern fur seals: There are no reports of northern fur seals at VAFB. Therefore, it is unlikely that any fur seals will be taken.

4.5.2 Estimated Takes on the NCI

Sonic booms created by SLVs may impact marine mammals on the NCI, particularly SMI. Missile launches utilize westward trajectories so do not cause sonic boom impacts to the NCI. The PCBoom sonic boom modeling program will continue to be used to predict the area of sonic boom impact and magnitude of the sonic boom on the NCI based on the launch vehicle, speed, trajectory, and meteorological conditions. Prior to each SLV launch, a predictive sonic boom map of the impact area and magnitude of the sonic boom will be generated. Based on previous monitoring of sonic booms created by SLVs on SMI (Thorson *et al.*, 1999a: 1999b), it is estimated that as much as approximately 25 percent of the marine mammals may be disturbed on SMI (Thorson *et al.*, 1999a; 1999b). Most sonic booms that reach SMI are small (<1 psf), although larger sonic booms are possible, but rarely occur. A conservative take estimate of as much as 25 percent of the animals present is used for each species per launch. The numbers taken will depend on the type of rocket, location of the sonic boom, weather conditions that influence the size of the sonic boom, and the time of day and time of year. For this reason, ranges are given for the estimated take of marine mammals by harassment.

Pacific harbor seals: As many as 200 harbor seals of all age classes and sexes may be taken by Level B harassment per launch on the NCI. The number of harbor seals that may be taken will range between 0 and 200.

California sea lions: As many as 5,800 sea lion pups and 2,500 juvenile and adult sea lions of either sex may be taken by Level B harassment on the NCI per launch. The number of sea lions that may be taken will range between 0 and 8,300.

Northern elephant seals: As many as 3,000 northern elephant seal pups and 10,000 northern elephant seals of all age classes and sexes may be taken by Level B harassment per launch on the NCI. The number of elephant seals that may be taken will range between 0 and 13,000.

Northern fur seals: As many as 300 northern fur seal pups and 1,100 juvenile and adult northern fur seals of both sexes may be taken by Level B harassment per launch at SMI. The number of fur seals that may be taken will range between 0 and 1,400.

4.6 Cumulative Impacts

Cumulative impact is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-federal) or person undertakes such other actions" (40 CFR §1508.7). Cumulative impacts may occur when there is a relationship between a proposed action and other actions expected to occur in a similar location or during a similar time period, or when past or future actions may result in impacts that would additively or synergistically affect a resource of concern. These relationships may or may not be obvious. Actions overlapping within close proximity to the proposed action can reasonably be expected to have more potential for cumulative effects on "shared resources" than actions that may be geographically separated. Similarly, actions that coincide temporally will tend to offer a higher potential for cumulative effects.

Actions that might permanently remove a resource would be expected to have a potential to act additively or synergistically if they affected the same population, even if the effects were separated geographically or temporally. Note that the proposed action considered here would not be expected to result in the removal of individual pinnipeds from the population or to result in harassment levels that might cause animals to permanently abandon preferred haul-out locations, so concerns related to removal of viable members of the populations are not implicated by the proposed action. This cumulative effects analysis considers these potential impacts, but more appropriately focuses on those activities that may temporally or geographically overlap with the proposed activity such that repeat harassment effects warrant consideration for potential cumulative impacts to the affected four marine mammal species and their habitats.

Cumulative effects refer to the impacts on the environment that result from a combination of past, present, and reasonably foreseeable projects and human activities. Such activities that are likely to affect the human environment near VAFB and the NCI include scientific research activities, geophysical related seismic surveys, commercial and recreational fishing, commercial marine traffic, and military training and testing activities. The following describes projects and activities based in and along the coast of California near

VAFB and the NCI that may, but would not necessarily, result in potential cumulative adverse impacts to the biological and physical environment.

4.6.1 Marine Mammal Research and Geophysical Seismic Surveys

Marine mammal research and geophysical seismic survey cruises operate within the Pacific Ocean along the California coast. While some marine mammal surveys introduce no more than increased vessel traffic impacts to the environment, seismic surveys use various methods (*e.g.*, airgun arrays) to conduct research. The use of airguns during seismic surveys does not impact pinnipeds while they are hauled out, only when they are in the water. Other studies that involve biopsy sampling and tagging might result in Level B or even Level A harassment to marine mammals. Currently there are seven active research permits along the California coastline that allow activities that have the potential to result in either Level A or Level B harassment[2] (*e.g.*, vessel/aerial surveys, photo-identification, collection of sloughed skin, tagging, capture and handling, etc.). Many of these permits only allow the incidental harassment of California sea lions, Pacific harbor seals, northern elephant seals, and northern fur seals during studies of other marine mammal species in the vicinity. While there are currently no geophysical seismic surveys occurring in southern California waters, NMFS has authorized about five such surveys along the Pacific coast of the U.S. in the last few years, so it is reasonable to assume that some level of similar survey activity might occur over the proposed five-year duration of the USAF proposed regulations. Results from research studies conducted in the area indicate that the activities only have temporary, short-term impacts on the behavior of the animals. The activities do not result in the injury or mortality of the animals.

4.6.2 Other Scientific Research Activities

Research on other animal species, such as seabirds, occurs along the California coastline. Currently, there are two active IHAs for the incidental harassment of pinnipeds during scientific research studies: one for seabird research and one for black abalone research. Although the researchers are not conducting studies targeting pinnipeds, there is the possibility that California sea lions, Pacific harbor seals, northern elephant seals, or northern fur seals (as well as other pinniped species not subject of this proposed USAF action) could be incidentally harassed when the researchers are present near haul-out sites or rookeries. Both of these studies are being conducted on islands north of SMI and the other islands near VAFB. The most common responses of the pinnipeds noted to date include brief startle reactions as noted by lifting of the head or movement of less than one meter (three feet) and flushing into the water. These activities have not resulted in any injury or mortality of pinnipeds.

[2] The definition of harassment is slightly different for scientific research than for military readiness activities. For non-military readiness activities, the MMPA defines harassment as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild ["Level A harassment"]; or (ii) has 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, breathing, nursing, breeding, feeding, or sheltering ["Level B harassment"].

4.6.3 Commercial and Recreational Fishing

Commercial and recreational fishing constitute a significant use of the ocean area near VAFB and the NCI. There are 519 recognized California marine fish species. According to the California Department of Fish and Game (CDFG), in 2006, three of the top commercial species by landing in the Santa Barbara area were northern anchovy, Pacific sardine, and squid. The commercial landings brought into the Santa Barbara area in 2006 were valued at nearly 19 million dollars (CDFG, 2007). In addition, recreational and charter fishing activities are popular along the waters of southern California. These activities could result in by-catch of marine mammals, entanglement in fishing gear, and reduced prey availability for marine mammals.

4.6.4 Commercial Marine Traffic

Santa Barbara does not have a major commercial shipping port. However, there are three major ports south of the proposed action area. The Port of Los Angeles is the busiest port in the U.S. (by volume of cargo). The Port of Long Beach is the second busiest U.S. port. Taken together, these two ports (which are contiguous) would constitute the fifth busiest port in the world. The Port of San Diego is also an important commercial cargo port. Cruise ships make daily use of these port facilities. In 2006, San Diego recorded 219 cruise ship calls (619,000 passengers), while Los Angeles recorded 1.2 million cruise passengers served. Together, these three ports recorded about 8,500 vessel (cargo and cruise ship) calls in 2006. Ship strikes are potential sources of serious injury or mortality to large whales; however, the occurrence of ship strikes of pinnipeds is rare. Effects to pinnipeds from large commercial vessels are believed to be limited to acoustical harassment, which could decrease foraging success and predator detection.

4.6.5 Ocean Pollution

Environmental contaminants in the form of waste materials, sewage, and toxins are present in, and continue to be released into, the oceans off southern California. Polluted runoff, or non-point source pollution, is considered the major cause of impairment of California's ocean waters. Storm water runoff from coastal urban areas and beaches carries waste such as plastics and Styrofoam into coastal waters. Sewer outfalls also are a source of ocean pollution in southern California. Sewage can be treated to eliminate potentially harmful releases of contaminants; however, releases of untreated sewage occur due to infrastructure malfunctions, resulting in releases of bacteria usually associated with feces, such as *Escerichia coli* and *enterococci*. Bacteria levels are used routinely to determine the quality of water at recreational beaches, and as indicators of the possible presence of other harmful microorganisms. Marine mammals sometimes mistake plastics and other marine debris as food and ingest the garbage, which can ultimately lead to mortality because of malnutrition, choking, or other problems.

4.6.6 Delta IV/Evolved Expendable Launch Vehicle Support Activities

In order to support the Delta IV/Evolved Expendable Launch Vehicle (EELV) launch activity from SLC-6 at VAFB, the USAF hired a contractor to conduct harbor maintenance dredging at VAFB. Other harbor activities in support of the Delta IV/EELV include *Delta Mariner* operations, cargo unloading activities, and kelp habitat mitigation. Pacific harbor seals and California sea lions may be taken by Level B behavioral harassment incidental to these activities. Northern elephant seals also have the potential to be taken but in even smaller numbers than harbor seals and sea lions.

Delta Mariner associated noise sources are ventilating propellers used for maneuvering vessel into position and a popping sound the cargo bay door makes when disengaged (no actual measurements have been taken outside the vessel). Dredging the harbor involves considerable activity and the use of noisy, heavy equipment. Noise intensity decreases proportional to the square root of the distance from the source. A dredging crane at the end of the dock producing 88 dBA of noise would still be quite noisy (approximately 72 dBA) at the nearest beach or the end of the breakwater, roughly 76 m (250 ft) away. Cargo unloading activities create sound when the CBC is removed from the *Delta Mariner* through use of the Elevating Platform Transporter (EPT). The EPT produces approximately 85 dBA, measured less than 6.1 m (20 ft) from the engine exhaust, when the engine is running at mid speed. Prior to movement, the EPT operator sounds the horn to alert personnel in close proximity to the EPT that it is about to operate. The EPT operation procedure requires two short beeps of the horn (approx. 1/3 sec. each) prior to starting the ignition. Sound level measurements for the horn ranged from 84-112 dBA at 7.6 m (25 ft) away and 62-70 dBA at 61 m (200 ft) away. To accommodate the *Delta Mariner*, the harbor will need to be dredged, removing up to 5,000 cubic yards of sediment per dredging. Dredging will involve the use of heavy equipment, including a clamshell dredge, dredging crane, a small tug, dredging barge, dump trucks, and a skip loader. Measured sound levels from this equipment are roughly equivalent to those estimated for the wharf modification equipment: 43-81 dBA at 76 m (250 ft).

NMFS has issued annual IHAs for these activities every year, beginning in 2002. The current IHA is valid from August 20, 2008, through August 19, 2009. The primary impacts to marine mammals from these activities are expected to be short-term behavioral reactions in response to the acoustic and visual stimuli produced by the heavy machinery used. The activities are short-term and nature and would not disturb or displace marine mammals for long periods of time. NMFS anticipates that no injury or mortality will result from these actions. No cargo unloading or *Delta Mariner* operations have occurred since 2004. The last harbor dredging activity occurred in December, 2002. Monitoring of harbor seals and sea lions during two previous dredging events and wharf modification activities showed that they responded to sudden noises or unexpected visual stimuli with a head alert initially and occasionally would flush from the haul-out. Sea lions appeared to be much less sensitive to disturbance, even when they were close to the

activity. Visual events that invoked harbor seal responses included the crane boom swinging suddenly and shadows caused by equipment that was backlit during nighttime dredging activities. The seals and sea lions continued to frequent the harbor area during the construction activities despite the presence of noise and activity.

4.6.7 Military Readiness Activities

The term "military readiness activities", as defined in PL 107-314, Section 315(f), includes "training and operations of the Armed Forces that relate to combat" and constitute "adequate and realistic testing of military equipment, vehicles, weapons, and sensors for proper operation and suitability for combat use." The NDAA of FY 2004 (PL) amended the MMPA definition of "harassment" as applied to military readiness activities, and discussions of potential Level A and Level B harassment in this subsection are in accordance with those specific definitions.

In addition to the proposed space vehicle and test flight activities from VAFB, the U.S. Navy (Navy) is conducting activities within the vicinity of the proposed action area, and these activities are proposed to be continued and expanded. These current and proposed naval operations include missile launch operations from San Nicolas Island (SNI) and training activities in the Southern California (SOCAL) Range Complex. These activities are described below.

Missile Launch Operations from SNI

The Naval Air Warfare Center Weapons Division (NAWCWD) is the Navy's full-spectrum research, development, test, and evaluation center of excellence for weapons systems associated with air warfare, aircraft weapons integration, missiles and missile subsystems, and assigned airborne electronic warfare systems. NAWCWD is a multi-site organization that includes the Point Mugu Sea Range. NAWCWD began a launch program for missiles and targets from several launch sites on SNI in 2001 and plans to continue these activities. The purpose of these launches is to support test and training activities associated with operations on the NAWCWD Point Mugu Sea Range. The Sea Range is used by the U.S. and allied military services to test and evaluate sea, land, and air weapon systems; to provide realistic training opportunities; and to maintain operational readiness of these forces.

The vehicles are launched from one of several fixed locations on the western end of SNI and fly generally westward through the Point Mugu Sea Range. Launches involve supersonic and subsonic vehicles. NAWCWD plans to launch up to 40 vehicles from SNI per year, but this number can vary depending on operational requirements. Up to 10 launches per year may occur at night. Nighttime launches will only take place when required by the test objectives, *e.g.*, when testing the Airborne Laser system. For this system, missiles must be launched at night when the laser is visible.

Impacts on marine mammals involve both acoustic and non-acoustic effects. Acoustic effects relate to sound produced by the engines of all launch vehicles and, in some cases, their booster rockets. Potential non-acoustic effects could result from the physical

presence of personnel during placement of video and acoustical monitoring equipment. However, careful deployment of monitoring equipment is not expected to result in any disturbance to pinnipeds hauled out nearby. Any visual disturbance caused by passage of a vehicle overhead is likely to be minor and brief as the launch vehicles are relatively small and move at great speed. Only Level B behavioral harassment of Pacific harbor seals, California sea lions, and northern elephant seals is expected as a result of these activities. There is a small chance that a pup might be injured or killed during a stampede of pinnipeds on the shore during a vehicle launch, but this has not been documented in videotaped records of pinniped groups during launches at SNI in 2001–2007 (Holst *et al.*, 2005a, b; 2008). The 2008 comprehensive technical report, which covered activities between August, 2001, and March, 2008, indicates that pinniped behavioral responses to launch sounds were, with the exception of some responses by Pacific harbor seals, usually brief and not severe (Holst *et al.*, 2008). According to Holst *et al.* (2008), northern elephant seals exhibited little reaction to launch sounds: raising of the head; moving a short distance; or on rare occasions, entering the water. Sea lions either raised their heads before quickly returning to pre-launch behavior or moved short distances and rarely entered the water after a launch (Holst *et al.*, 2008). Within seconds of a launch, the harbor seals usually rushed into the water and did not return to the haul-outs for several hours. However, video recordings indicate that most returned by the next day (Holst and Lawson, 2002).

NAWCWD received two IHAs for these activities in 2001 and 2002. NMFS then issued regulations to cover these activities in 2003 (68 FR 52132; September 2, 2003), which expired on October 2, 2008. Between August, 2001, and February, 2008, NAWCWD conducted 77 launches from the western end of SNI, with no more than 25 launches in any one year. NMFS has received an application from the Navy to continue missile launch operations on SNI and is considering rulemaking for the 2009-2014 time frame.

SOCAL Range Complex

The SOCAL Range Complex is situated off the coast of southern California generally between Dana Point and San Diego and encompasses three primary components: ocean operating areas (OPAREAs), special-use airspace (SUA), and San Clemente Island (SCI). Extending more than 600 nm (1,111 km) southwest into the Pacific Ocean, the SOCAL Range Complex encompasses over 120,000 nm^2 (411,600 km^2) of sea space, 113,000 nm^2 (387,500 km^2) of SUA, and over 42 nm^2 (144 km^2) of land area (i.e., SCI). The Navy's mission is to organize, train, equip, and maintain combat-ready naval forces capable of winning wars, deterring aggression, and maintaining freedom of the seas. The Navy executes this responsibility by establishing and executing training programs, including at-sea training and exercises, and ensuring naval forces have access to the ranges, OPAREAs, and airspace needed to develop and maintain skills for the conduct of naval operations. Activities involving research, development, test, and evaluation for naval systems are an integral part of this readiness mandate.

Within the SOCAL Range Complex, the Navy plans to conduct training activities that will utilize active tactical sonar sources that fall primarily into the category of Anti-submarine Warfare exercises and proposes to conduct training and related activities that

require underwater detonations. These activities will include the use of mid- and high-frequency active sonar (and may include activities involving underwater detonations) within the vicinity of the proposed action area for the USAF's space vehicle and test flight activities. The proposed SOCAL Range Complex Activities may cause various impacts, including primarily Level B harassments, to marine mammal species in the study area. Impacts from the active sonar and underwater detonations will occur while the animals are in the water, whereas impacts from the USAF's activities will occur while the animals are hauled out. NMFS issued five-year regulations to the Navy for the activities in the SOCAL Range Complex on January 14, 2009 (74 FR 3882, January 21, 2009).

4.6.8 Conclusion

The commercial, scientific, military, and recreational activities, as described above, which occur in the Pacific, would not occur on VAFB or the NCI during the proposed activities due to safety concerns. Furthermore, given the small scale and infrequent occurrence of the proposed activity, and its anticipated minimal environmental effects, the proposed space vehicle and test flight activities, as described in the application, would not contribute significantly or measurably to the overall environmental effects of other human activities along the California coast. While certain activities could occur that may result in behavioral disturbance of pinniped species in the vicinity and general time frame during which a launch activity may occur at VAFB, it is not expected that the animals would experience more than short-term disturbance or displacement as a result of any of the activities described above. Other commercial, scientific, military, and recreational activities in the vicinity are not expected to have an additive effect on the condition of the pinniped species. Additionally, none of the activities are anticipated to result in injury or mortality of marine mammals. Therefore, NMFS has determined that the proposed activities would not produce any significant cumulative impacts to the human environment.

Chapter 5 MITIGATION MEASURES

As required under the MMPA, NMFS considered mitigation to effect the least practicable adverse impact on marine mammals and has developed a series of mitigation measures, as well as monitoring and reporting procedures (Chapter 6), that would be required under annual LOAs.

The following measures are designed to eliminate the potential for serious injury or mortality and to minimize harassment to marine mammals found at VAFB and on the NCI, as well as to avoid any possible sensitizing or predisposing of pinnipeds to greater responsiveness towards the sights and sounds of a launch. These measures would be required under Alternatives 2 (Preferred Alternative) and 4. (As described earlier, no new mitigation measures were developed for Alternative 3; therefore, this alternative was not carried fully through this analysis as it was not meaningfully different than Alternative 2.) Should other mitigation measures be deemed necessary for future space launch and test flight activities, these would be analyzed by NMFS and implemented after consultation and agreement with the USAF. These additional mitigation measures would be contained in annual LOAs.

All aircraft and helicopter flight paths must maintain a minimum distance of 1,000 ft (305 m) from recognized seal haul-outs and rookeries (e.g., Point Sal, Purisima Point, South Rocky Point), except in emergencies or for real-time security incidents (e.g., search-and-rescue, fire-fighting) which may require approaching pinniped haul-outs and rookeries closer than 1,000 ft (305 m). For missile and rocket launches, unless constrained by other factors including, but not limited to, human safety, national security or launch trajectories, holders of LOAs must schedule launches to avoid, whenever possible, launches during the harbor seal pupping season of March through June. NMFS also proposes to expand the requirement so that the USAF must avoid, whenever possible, launches which are predicted to produce a sonic boom on the NCI during harbor seal, elephant seal, and California sea lion pupping seasons.

If post-launch surveys determine that an injurious or lethal take of a marine mammal has occurred or there is an indication that the distribution, size, or productivity of the potentially affected pinniped populations has been affected, the launch procedure and the monitoring methods must be reviewed, in cooperation with NMFS, and, if necessary, appropriate changes must be made through modification to an LOA, prior to conducting the next launch of the same vehicle under that LOA.

Chapter 6 MONITORING AND REPORTING REQUIREMENTS

Under the Preferred Alternative (Alternative 2), as well as Alternative 4, NMFS would require the USAF to undertake the following monitoring activities on VAFB and the NCI. The reporting requirements described in section 6.2 would also be implemented under the two fully considered action alternatives (2 and 4).

6.1 Monitoring

As part of its application, the USAF provided a monitoring plan, similar to that in the current regulations (50 CFR 216.125), for assessing impacts to marine mammals from rocket and missile launches at VAFB. This monitoring plan is described, in detail, in their application (30 SW, 2008c). The USAF will conduct the following monitoring under the regulations.

The monitoring will be conducted by a NMFS-approved marine mammal biologist experienced in surveying large numbers of marine mammals. Monitoring at the haul-out site closest to the launch facility will commence at least 72 hours prior to the launch and continue until at least 48 hours after the launch.

6.1.1 Monitoring for VAFB

Biological monitoring at VAFB will be conducted for all launches during the harbor seal pupping season, 1 March to 30 June. Acoustic and biological monitoring will be conducted on new space and missile launch vehicles during at least the first launch, whether it occurs within the pupping season or not. Also, the remaining third, of the three initial Delta IV launches, will be monitored, and ABR testing of seals in close proximity to the launch is planned. The testing will be authorized under a scientific research permit issued under Section 104 of the MMPA. Such work was most recently conducted under Permit No. 859-1680-01, which expired on January 1, 2009. The USAF has submitted an application to NMFS for issuance of a new scientific research permit to continue the ABR tests on harbor seals, as well as other research projects. NMFS is currently reviewing this application. If appropriate, NMFS will issue a new scientific research permit to the USAF in early spring 2009. Currently, the next Delta IV launch is planned for sometime in 2010 (D. York, 30 SW, VAFB, pers. comm.).

Monitoring will include multiple surveys each day that record, when possible, the 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 such as tide, wind speed, air temperature, and swell will also be recorded. Time-lapse photography or video will be used during daylight launches to document the behavior of mother-pup pairs during launch activities. For launches during the harbor seal pupping season (March through June), follow-up surveys will be made within two weeks of the launch to ensure that there were no adverse effects on any marine mammals. A report detailing the species, number of animals observed, behavior,

reaction to the launch noise, time to return to the haul-out site, any adverse behavior and environmental conditions will be submitted to NMFS within 90 days of the launch.

6.1.2 Monitoring for the NCI

Monitoring will be conducted on the NCI (San Miguel, Santa Cruz, and Santa Rosa Islands) whenever a sonic boom over 1 psf is predicted (using the most current sonic boom modeling programs) to impact one of the Islands. Monitoring will be conducted at the haul-out site closest to the predicted sonic boom impact area. Monitoring will be conducted by a NMFS-approved marine mammal biologist experienced in surveying large numbers of marine mammals. Monitoring will commence at least 72 hours prior to the launch and continue until at least 48 hours after the launch.

Monitoring will include multiple surveys each day that record the 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 such as tide, wind speed, air temperature, and swell will also be recorded. 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 their reaction to the launch noise noted. Photography or video will be used during daylight launches to document the behavior of mother-pup pairs or dependent pups during launch activities. During the pupping season of any species affected by a launch, follow-up surveys will be made within two weeks of the launch to ensure that there were no adverse effects on any marine mammals. A report detailing the species, number of animals observed, behavior, reaction to the launch noise, time to return to the haul-out site, any adverse behavior and environmental conditions will be submitted to NMFS within 90 days of the launch.

6.2 Reporting Requirements

A report containing the following information must be submitted to NMFS within 90 days after each launch: (1) Date(s) and time(s) of each launch; (2) date(s), location(s), and preliminary findings of any research activities related to monitoring the effects on launch noise and sonic booms on marine mammal populations; and (3) results of the monitoring programs, including but not necessarily limited to (a) numbers of pinnipeds present on the haul-out prior to commencement of the launch, (b) numbers of pinnipeds that may have been harassed as noted by the number of pinnipeds estimated to have entered the water as a result of launch noise, (c) the length of time(s) pinnipeds remained off the haul-out or rookery, (d) the numbers of pinniped adults or pups that may have been injured or killed as a result of the launch; and (4) any behavioral modifications by pinnipeds that likely were the result of launch noise or the sonic boom.

If a freshly dead or seriously injured pinniped is found during post-launch monitoring, the incident must be reported within 48 hours to the NMFS Office of Protected Resources and the NMFS Southwest Regional Office.

An annual report must be submitted to NMFS at the time of a request for a renewal of the LOA. The annual report shall describe any incidental takings under an LOA not reported in the 90-day launch reports, such as the aircraft test program and helicopter operations and any assessments made of their impacts on hauled-out pinnipeds. A final report must be submitted to NMFS no later than 180 days prior to expiration of these regulations. This report must summarize the findings made in all previous reports and assess both the impacts at each of the major rookeries and the cumulative impact on pinnipeds and any other marine mammals from Vandenberg activities.

6.3 Review of the Final Monitoring Report for the Current Regulations

In accordance with the regulations, the USAF submitted a final report for the period covering February 6, 2004, through October 17, 2008. This report includes information from the annual reports submitted to NMFS during this time period, which were reviewed and summarized by NMFS in several *Federal Register* notices announcing issuance of annual LOAs for the activities at VAFB (e.g., 71 FR 14853, March 24, 2006; 72 FR 13251, March 21, 2007; 73 FR 14453, March 18, 2008). During this reporting period, there were a total of 38 launches from VAFB: 20 missile launches and 18 space vehicle launches (MSRS, 2008b). Based on the results presented in this report, NMFS concludes that the previous monitoring and mitigation measures prescribed in the regulations were effective. In addition, actual takes of marine mammals were generally lower than expected due to the implementation of monitoring and mitigation measures. The most commonly noted responses by pinnipeds were head lifts and movement towards or into the water. Although one pup was found dead following a Minotaur Cosmic launch (April 14, 2006), it is uncertain if this death occurred as an indirect result of the launch (e.g., due to trampling by adults that may have been harassed by the launch). It is possible that the carcass washed up on the site, but there is no way to know for certain. A second dead pup was discovered on March 25, 2008, 12 days after a launch of the Atlas V NROL-28 (March 13, 2008). The pup was estimated to be less than one week old and fresh dead when sighted during the post-launch survey (MSRS, 2008b). Therefore, it is not likely that the death occurred as an indirect result of the Atlas V launch. No other injuries or mortalities of pinnipeds were reported from 2004-2008 at VAFB or the NCI.

6.4 Conclusion

The inclusion of the mitigation and monitoring measures described in this EA will ensure the least practicable adverse impact on affected marine mammal species and stocks, will have a negligible impact on the affected species or stocks, and will not have an unmitigable adverse impact on the affected species or stocks for subsistence uses. For military readiness activities (as described in the NDAA), a determination of least practicable adverse impacts on a species or stock includes consideration, in consultation with the Department of Defense, of personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity. The proposed mitigation and monitoring measures presented in this document ensure compliance with these considerations.

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Chapter 8 REFERENCES

30 SW (30th Space Wing). 2008a. 30th SW Approved Launch Manifest, dated 1 February 2008.

30 SW. 2008b. National Launch Forecast (DRAFT). Current FY 2012 through FY 2015. As run on 1 February 2008.

30 SW. 2008c. Application for a Five-year Programmatic Permit for Small Takes of Marine Mammals Incidental to Launching of Space Launch Vehicles, Intercontinental Ballistic and Small Missiles, and Aircraft and Helicopter Operations at Vandenberg Air Force Base, California. 40 pp.

Angliss, R.P. and R.B. Outlaw. 2008. Alaska marine mammal stock assessments, 2007. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-180. 252 pp.

Boveng, P. 1988. Status of the Pacific harbor seal population on the U.S. west coast. Admin. Rep. LJ-88-06. Southwest Fisheries Science Center, National Marine Fisheries Service, P.O. Box 271, La Jolla, CA 92038. 43 pp.

California Department of Fish and Game (CDFG). 2007. Final California Commercial Landings for 2006. State of California, The Resources Agency, Department of Fish and Game.

Carretta, J.V., J. Barlow, K.A. Forney, M.M. Muto, and J. Baker. 2001. Harbor seal (Phoca vitulina richardsi): California stock. National Marine Fisheries Service Stock Assessment Report, NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-317. pp. 8-13.

Carretta, J.V., K.A. Forney, M.S. Lowry, J. Barlow, J. Baker, B. Hanson, and M.M. Muto. 2007. U.S. Pacific marine mammal stock assessments: 2007. U.S. Dep. Commer. NOAA Tech. Memo. NMFS-SWFSC-414. 320 pp.

Fillmore, L., E. Berg, J. Francine, M. Ball, J. LaBonte, P. Thorson, and P. Nieto. 2006. Biological Monitoring of Pacific Harbor Seals on Vandenberg Air Force Base and of Selected Pinnipeds on San Miguel Island, CA and Acoustic Monitoring for the 27 June 2006 Delta IV NROL-22 Launch. SRS Technologies Technical Report submitted to the United States Air Force and the National Oceanic and Atmospheric Administration, National Marine Fisheries Service. October 2006. 49 pp.

Forney, K.A., J. Barlow, M.M. Muto, M. Lowry, J. Baker, G. Cameron, J. Mobley, C. Stinchcomb, and J.V. Carretta. 2000a. California sea lion (Zalophus californianus californianus): U.S. Stock. National Marine Fisheries Service Stock Assessment Report, NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-300. pp. 1-7.

Forney, K.A., J. Barlow, M.M. Muto, M. Lowry, J. Baker, G. Cameron, J. Mobley, C. Stinchcomb, and J.V. Carretta. 2000b. Northern fur seal (Callorhinus ursinus): San Miguel Island Stock. National Marine Fisheries Service Stock Assessment Report, NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-300. pp. 25-29.

Gallo, J.P. 1994. Factors affecting the population status of Guadalupe fur seal, Arctocephalus townsendi (Merriam, 1897), at Isla de Guadalupe, Baja California, Mexico. Ph.D. Thesis, University of California, Santa Cruz. 199 pp.

Hanan, D.A. 1996. Dynamics of abundance and distribution for Pacific harbor seals, Phoca vitulina richardsi, on the coast of California. Ph.D. Thesis, University of California at Los Angeles. 158pp.

Holst, M. and J.W. Lawson. 2002. Behavior of pinnipeds during missile launches. *In*: J.W. Lawson, E.A. Becker, and W.J. Richardson (eds.). Marine mammal and acoustical monitoring of missile launches on San Nicolas Island, August 2001-July 2002. LGL Rep. TA2630-3. Rep. from LGL Ltd., King City, Ontario and Greeneridge Sciences Inc., Santa Barbara, California, for Naval Air Weapons Station, China Lake, CA, and National Marine Fisheries Service, Silver Spring, MD. p.p. 3-1 to 3-27.

Holst, M. and C.R. Greene, Jr., with W.J. Richardson, T.L. McDonald, K. Bay, R.E. Elliott, and V.D. Moulton. 2005a. Marine mammal and acoustical monitoring of missile launches on San Nicolas Island, California, August 2001 – May 2005. LGL Rep. TA2665-5. Rep. from LGL Ltd., King City, Ont., and Greeneridge Sciences Inc., Santa Barbara, CA, for Naval Air Warfare Center Weapons Division, Point Mugu, CA, and Nat. Mar. Fish. Serv., Silver Spring, MD, and Long Beach, CA.

Holst, M., J.W. Lawson, W.J. Richardson, S.J. Schwartz, and G. Smith. 2005b. Pinniped responses during Navy missile launches at San Nicolas Island, California. *In*: D.K. Garcelon and C.A. Schwemm (eds.), Proc. 6th Calif. Isl. Sympos., Ventura, CA, Dec. 2003. Nat. Park Serv. Tech. Publ. CHIS-05-01. Inst. Wildl. Stud., Arcata, CA. p.p. 477-484.

Holst, M. and C.R. Greene, Jr., with W.J. Richardson, T.L. McDonald, K. Bay, R.E. Elliott, and R. Norman. 2008. Marine mammal and acoustical monitoring of missile launches on San Nicolas Island, California, August 2001 – March 2008. LGL Rep. TA4617-1. Rep. from LGL Ltd., King City, Ont., and Greeneridge Sciences Inc., Santa Barbara, CA, for Naval Air Warfare Center Weapons Division, Point Mugu, CA, and Nat. Mar. Fish. Serv., Silver Spring, MD, and Long Beach, CA.

Huber, H. 1995. The abundance of harbor seals (Phoca vitulina richardsi) in Washington, 1991-1993. MS Thesis, Univ. of Washington, Seattle, Washington. 56 pp.

Kovacs, KM., K.M. Jonas, and S.E. Welke. 1990. Sex and age segregation by Phoca vitulina concolor at haul-out sites during the breeding season in the Passamaquoddy Bay region, New Brunswick. Marine Mammal Science. 6:204-214.

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

Lowry, M.S. and J.V. Carretta. 2003. Pacific harbor seal, Phoca vitulina richardsi, census in California during May-July 2002. NOAA Technical Memorandum NMFS.

Lowry, M.S., J.V. Carretta, and K.A. Forney. 2005. Pacific harbor seal, Phoca vitulina richardsi, census in California during May – Jul 2004. Administrative Report LJ-05-06, available from Southwest Fisheries Center, 8604 La Jolla Shores Drive, La Jolla, CA 92307. 38 p.

Lubard, S.C. and P.M. Hurdle. 1976. Experimental investigation of acoustic transmission from air into a rough ocean. Journal of the Acoustical Society of America. 60(5): 1048-1052.

Melin, S.R., and R.L. DeLong. 1999. Observations of a Guadalupe fur seal (Arctocephalus townsendi) female and pup at San Miguel Island, California. Marine Mammal Science. 15:885-888.

MSRS (ManTech SRS Technologies). 2008a. Scientific Research Permit 859-1680-00. Annual Report for 1 January 2007 – 31 December 2007. ManTech SRS Technologies, Inc. Technical Report, submitted to the United States Air Force and National Oceanic and Atmospheric Administration, National Marine Fisheries Service. February 2008. 22 pp.

MSRS. 2008b. Final Report for the 5-Year Programmatic Permit for Taking Marine Mammals Incidental to Space Vehicle and Test Flight Activities from Vandenberg Air Force Base, California. 6 February 2004 through 17 October 2008. ManTech SRS Technologies, Inc. Technical Report, submitted to the United States Air Force and National Oceanic and Atmospheric Administration, National Marine Fisheries Service. October 2008. 73 pp.

NMFS (National Marine Fisheries Service). 2004. Environmental Assessment on the Authorization for the Harassment of Marine Mammals Incidental to Space Vehicle and Test Flight Activities from Vandenberg Air Force Base, California, Under Section 101(a)(5)(A) of the Marine Mammal Protection Act. 72 pp.

Richardson, W.J., C.R. Greene, C.I. Malme, and D.H. Thomson. 1995. Marine Mammals and Noise. Academic Press, Inc. San Diego, CA.

Orbital Sciences Corporation. 2006a. Minotaur I User's Guide. Release 2.1, January 2006.

Orbital Sciences Corporation. 2006b. Fact Sheet on Minotaur I Space Launch Vehicle. 2006.

Space X (Space Exploration Technologies). 2007. Falcon I Launch Vehicle Payload User's Guide. Rev. 6, April 2007.

SRS Technologies. 2001. Modification of the Final Rule: Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Rocket Launches at Vandenberg Air Force Base, California. SRS Technologies Technical Report, submitted to the United States Air Force and the National Marine Fisheries Service. May 2001. 114pp.

SRS Technologies. 2002. Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Rocket Launch at Vandenberg Air Force Base, California for the Period from 1 January to 31 December 2001. SRS Technologies Technical Report submitted to the United States Air Force and the National Marine Fisheries Service, March 2002. 20 pp.

SRS Technologies. 2003a. Scientific Research Permit 859-1373, Final Report, For the Period of 26 June 1997 to 26 June 2002. Submitted to the United States Air Force and the National Marine Fisheries Service, April 2003. 43 pp.

SRS Technologies. 2003b. Letter of Authorization: Taking and Importing of Marine Mammals; Taking Marine Mammals Incidental to Rocket Launches at Vandenberg Air Force Base, California. Annual Report 1 January to 31 December 2002. Submitted to the United States Air Force.

SRS Technologies. 2004a. Annual Report, 1 January to 31 December 2004 Letter of Authorization: Taking and importing marine mammals; taking marine mammals incidental to rocket launches at Vandenberg Air Force Base, California. SRS Technologies Technical Report, submitted to the United States Air Force and National Marine Fisheries Service. 20 pp.

SRS Technologies. 2004b. Annual report for Scientific Research Permit # 859-1680 3 February 2003 to 3 February 2004. SRS Technologies Technical Report, submitted to the United States Air Force and National Marine Fisheries Service. 21 pp.

SRS Technologies. 2006. Letter of Authorization: Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Rocket Launches at Vandenberg Air Force Base, California. Annual Report, 1 January to 31 December 2005. SRS Technologies Technical Report, submitted to the United States Air Force and National Marine Fisheries Service. January 2006. 22 pp.

SRS Technologies. 2007. Letter of Authorization: Taking and Importing Marine Mammals; Taking Marine Mammals Incidental to Rocket Launches at Vandenberg Air Force Base, California. Annual Report, 1 January to 31 December 2006. SRS Technologies Technical Report, submitted to the United States Air Force and National Marine Fisheries Service. February 2007. 32 pp.

Stewart, B.S., P.K. Yochem, R.L. DeLong, and G.A. Antonelis Jr. 1987. Interactions between Guadalupe fur seals and California sea lions at San Nicolas and San Miguel Islands, California. *In*: J.P. Croxall and R.L. Gentry (eds.). Status, biology, and ecology of fur seals. Proceedings of an international symposium and workshop. Cambridge, England, 23-27 April 1984. pp. 103-106. U.S. Dep. Commer., NOAA, NMFS, NOAA Tech. Rept. NMFS 51.

Stewart, B.S., P.H. Thorson, and J.K. Francine. 1996. Behavioral responses of pinnipeds and selected avifauna at Vandenberg Air Force Base and the Northern California Channel Islands to rocket noise and sonic boom during launch of a Titan IV K-22 rocket from SLC-4E, Vandenberg Air Force Base, on May 12, 1996. Hubbs-Sea World Research Institute Technical Report 96-254. 67 pp.

Suryan, R.M. and J.T. Harvey. 1998. Tracking harbor seals (Phoca vitulina richardsi) to determine dive behavior, foraging activity and haul-out use. Marine Mammal Science. 14:361-372.

Thorson, P.H. and J.K. Francine. 1997. Bioacoustic monitoring of the Titan II-G6 launch, South Vandenberg Air Force Base, 4 April 1997. SRS Technologies Technical Report, submitted to the United States Air Force and the National Marine Fisheries Service, June 1997. 23 pp.

Thorson, P., J. Francine, E. Berg, L. Meyers and D. Eidson. 1999a. Acoustic Measurement of the Athena 2 IKONOS-1 Launch on 27 April 1999 and quantitative analysis of behavioral responses for harbor seals on Vandenberg Air Force Base and selected pinnipeds on San Miguel Island, CA. SRS Technologies technical report submitted to Lockheed Martine Astronautics and the National Marine Fisheries Service, July 1999. 45 pp.

Thorson, P.H., J.K. Francine, E.A. Berg, L.E. Meyers, D.A. Eidson, and G.W. Oliver. 1999b. Quantitative Analysis of Behavioral Responses for Selected Pinnipeds on Vandenberg Air Force Base and San Miguel Island, California and Acoustic Measurement of the 24 September 1999 Athena 2 IKONOS-II Launch. SRS Technologies technical report submitted to Lockheed Martin Environmental Services and the National Marine Fisheries Service, November 1999. 35 pp.

Thorson, P.H., J.K. Francine, E.A. Berg, and D.A. Eidson. 2000. Acoustic Measurement of the 18 December 1999 Atlas IIAS AC-141 Launch and Quantitative Analysis of Behavioral Responses for Pacific Harbor Seals on Vandenberg Air Force Base, CA. SRS Technologies Technical Report, submitted to the United States Air Force and the National Marine Fisheries Service, March 2000. 36 pp.

Thorson, P.H., L. Fillmore, and J. Francine. 2004. Quantitative Analysis of Behavioral Responses of Pacific Harbor Seals to the 23 June 2004 Launch of the Minuteman III 185-GM from Vandenberg Air Force Base, CA. SRS Technologies Technical Report, submitted to the United States Air Force and the National Oceanic and Atmospheric Administration Fisheries Office. December 2004. 8 pp.

Thorson, P., E. Berg, and L. Fillmore. 2007. Biological Monitoring and Auditory Assessment of Pacific Harbor Seals on Vandenberg Air Force Base, California and Acoustic Monitoring for the 4 November 2006 Delta IV DMSP-17 Launch. SRS Technologies Technical Report, submitted to the United States Air Force and the National Oceanic and Atmospheric Administration Fisheries Office. March 2007. 41 pp.

U.S. Air Force. 1997a. Final Environmental Impact Statement for the Program Definition and Risk Reduction Phase of the Airborne Laser Program. April 1997.

U.S. Air Force. 1997b. Final Theater Ballistic Missile Targets Programmatic Environmental Assessment, Vandenberg Air Force Base. United States Army Space and Strategic Defense Command. 192 pp.

U.S. Air Force. 1997c. Final Environmental Assessment for the Issuance of a Letter of Authorization for the Incidental Take of Marine Mammals for Programmatic Operations at Vandenberg Air Force Base, California. Prepared by Tetra Tech, Inc. USAF Contract No. F04684-95-C-0045.

U.S. Air Force. 2002. Final Supplemental Environmental Impact Statement Airborne Laser Program Kirtland AFB, White Sands Missile Range/Holloman AFB, New Mexico; Edward AFB, Vandenberg AFB, California. September 2002.

VAFB (Vandenberg Air Force Base). 2007. Vandenberg Air Force Base 2007 General Plan.

APPENDIX A
NEPA Documents for Launch Vehicles, Missiles, and Missile Programs at Vandenberg Air Force Base

Launch Vehicles

Atlas II

U.S. Air Force. 1991. Final Environmental Assessment, Vandenberg Air Force Base, Atlas II Program. August.

Atlas V

U.S. Air Force. 1998. Final Environmental Impact Statement Evolved Expendable Launch Vehicle Program.

U.S. Air Force. 2000. Final Supplemental Environmental Impact Statement for the Evolved Expendable Launch Vehicle Program.

SRS Technologies. 2003. Environmental Assessment for the Atlas V System from SLC-3E, Vandenberg Air Force Base, California. Prepared for the Department of the Air Force, 30th Space Wing. November.

Delta II

U.S. Air Force. 1993. Final Environmental Assessment Delta II Program Modification and Operations at SLC-2W. March.

ENSR Consulting and Engineering. 1996. Environmental Assessment for Launch Rate Increase for Delta II at Vandenberg Air Force Base. ENSR Consulting and Engineering. Huntington Beach, California. Document Number 4523-147-100.

Delta IV

U.S. Air Force. 1998. Final Environmental Impact Statement Evolved Expendable Launch Vehicle Program.

U.S. Air Force. 2000. Final Supplemental Environmental Impact Statement for the Evolved Expendable Launch Vehicle Program.

Falcon

Tetra Tech, Inc. 2003. Public Draft Environmental Assessment for the Falcon Launch Vehicle Program. Prepared for Space Exploration Technologies Corporation. El Segundo, California.

Tetra Tech, Inc. 2003. Environmental Assessment for the Falcon Launch Vehicle Program. Prepared for Space Exploration Technologies Corporation. El Segundo, California. July.

SRS Technologies. 2005. Supplemental Environmental Assessment for the Falcon I Launch Vehicle Program from SLC-4W, Vandenberg Air Force Base, CA. Prepared for the Department of the Air Force, 30th Space Wing. September.

Minotaur

California Commercial Spaceport and Lockhead Environmental Systems and Technologies. 1995. Final Environmental Assessment for the California Spaceport.

Taurus

U.S. Air Force. 1992. Environmental Assessment for Taurus Standard Small Launch Vehicle Program at Vandenberg Air Force Base, California. Engineering Science. Pasadena, California.

U.S. Air Force. 1993. Supplemental Environmental Assessment for Taurus Standard Small Launch Program at Vandenberg Air Force Base, California. The Aerospace Corp. El Segundo, California.

Titan II

U.S. Air Force. 1987. Final Environmental Assessment Titan II Space Launch Vehicle Modifications and Launch Operations. August.

Titan IV

U.S. Air Force. 1988. Final Environmental Assessment Titan IV Space Launch Vehicle Modifications and Launch Operations. February.

U.S. Air Force. 1990. Environmental Assessment Titan IV/Solid Rocket Motor Upgrade Program, Cape Canaveral Air Force Station Florida and Vandenberg Air Force Base, California. February.

Missiles

Minuteman II, III

U.S. Air Force. 1976. Final Environmental Assessment Minuteman and Thor Programs.

Space and Missile Systems Center. 2004. Environmental Assessment for Minuteman III Modification. Prepared for ICBM System Program Office, Ogden Air Logistics Center, Hill Air Force Base, Utah. December.

Peacekeeper

U.S. Air Force. 1988. Peacekeeper Rail Garrison Program Environmental Impact Statement. November.

Missile Programs

Ground Base Interceptor

U.S. Army Space and Missile Defense Command. 2003. Preliminary Final Environmental Impact Statement for the Ground-based Midcourse Defense and Extended Test Range. Volumes I and II. Huntsville, Alabama.

Airborne Laser

U.S. Air Force. 2003. Final Supplemental Environmental Impact Statement for the Airborne Laser at Kirtland, White Sands Missile Range/Holloman Air Force Base New Mexico; Edwards, Vandenberg Air Force Base, California.

Alternate Boost Vehicle

U.S. Air Force. 1998. Final Environmental Impact Statement Evolved Expendable Launch Vehicle Program.

U.S. Army Space and Missile Defense Command. 2002. Environmental Assessment for Alternate Boost Vehicle Verification Tests. Huntsville, Alabama.

Theater Ballistic Missile Targets

U.S. Air Force. 1997. Final Theater Ballistic Missile Targets Programmatic Environmental Assessment. Vandenberg Air Force Base, California.

Ballistic Missile Defense System

Missile Defense Agency. 2007. Programmatic Environmental Impact Statement for Missile Defense Agency's Ballistic Missile Defense System: Volumes 1-3. January.

APPENDIX B
Primer on Noise (Adopted from USAF, 1997)

Noise is most often defined as unwanted sound that is heard by people or wildlife and interferes with normal activities or otherwise diminishes the quality of the environment. Sources of noise may be impulsive (*e.g.*, explosions, furnace solenoid), transient (*e.g.*, the passing of a train or aircraft through a particular area), or continuous (*e.g.*, the hum of distant traffic or the operation of air conditioning equipment). Sources of noise may also have a broad range of sounds and be generally nondescript (*e.g.*, traffic) or have a specific, readily definable sound (*e.g.*, an automobile or train horn). They may be steady (*e.g.*, a fan, motor, or generator) or impulsive (*e.g.*, a pneumatic impact wrench or pile driver). These characteristics all bear on the perception of the acoustic environment.

This section describes how noise impacts are evaluated and provides information on ambient noise levels in environments impacted by noise from operations at VAFB.

Noise Parameters and Methods of Measurement

It is important to discuss terminology used in assessing the properties of sound. The following definitions are from Richardson *et al.* (1995):

> Sound: Form of energy manifested by small pressure and/or particle velocity variations in a continuous medium.
>
> Frequency: Rate at which a repetitive event occurs, measured in hertz (Hz) (cycles per second). The pitch of sound as perceived by humans is directly related to frequency.
>
> Tone: A sinusoidal oscillation at a particular frequency.

A useful model for describing the process by which sound is transmitted and heard is the "sound-path-receiver" model. This model recognizes that any hearing process involves the following:

A source of sound with particular characteristics. These can include variability over time (*e.g.*, transient vs. continuous), the way in which sound energy is distributed in frequency and its strength.

Changes in the sound characteristics as the sound propagates away from the source. Sound propagation is referred to as transmission. The transmission path is the route from the source to the receiver.

A receiver with specific detection capabilities. In this case, the receiver of interest are marine mammals.

Most sound receivers are sensitive to sound pressure, which is measured in micropascals (µPa). A Pascal is a standard unit of pressure. One Pascal is the pressure resulting from a force of 1 newton exerted over an area of 1 square meter (Richardson *et al.*, 1995).

Acoustic intensity is a fundamental measure of propagating sound. It is defined as the acoustical power per unit area and is measured in watts per square meter. The intensity, power, and energy of an acoustic wave are proportional to the average of the pressure squared (mean square pressure). Measurement instruments normally sense pressure, not intensity, which is applicable for measurements in the same medium (*i.e.*, in water or in are) where the constants of proportionality between intensity and pressure are the same. Since acousticians use rations of pressures, or pressures squared, to present sound measurements, it was necessary to adopt a standard reference pressure to us in the denominator of the ration. For airborne sound, it is conventional to use 20 µPa as the reference pressure, since it is the approximate threshold of human hearing at 1 kilohertz (kHz). The unit adopted for underwater acoustics is 1 µPa. The two are different due to the different transmission properties of each media (Richardson *et al.*, 1995).

The human ear responds logarithmically in judging the relative loudness of sound. Therefore, acousticians adopted a logarithmic scale for sound intensities and denoted the scale in decibels (dB). Sound pressure level (SPL) is a measure of dB with a reference pressure as the denominator of the ratio. In the case of underwater sound, the reference pressure is 1 µPa. SPL is calculated this way because it is a measure of intensity, and intensity is proportional to pressure squared. The unit of SPL for underwater sound is, therefore, stated as the number of dB with the reference pressure unit of 1 µPa (dB re 1 µPa), since the recommended practice is to cite the reference unit (Richardson *et al.*, 1995).

Pulsed sounds usually should be measured in terms of energy, not just pressure or power. Pressure and power measures, although often used, are difficult to interpret because for a brief pulse, they depend on averaging time. Energy measures include time as a dimension and are proportional to the time integral of the pressure squared. Therefore dB re 1 µPa is a measure of the average pressure squared over the pulse duration (Richardson *et al.*, 1995).

Sound spectra are important because they are used to describe the distribution of sound power as a function of frequency. An animal's sensitivity to sound varies with frequency, and its response to a sound is expected to depend strongly on the presence and levels of sound in the frequency band (*i.e.*, range of frequencies) to which it is sensitive (Richardson *et al.*, 1995). [Section 3.2 of the USAF 1997 Final EA (USAF, 1997) provides information on sensitivities of marine mammals.]

Airborne noise measurements, in addition to being expressed relative to a reference pressure of 20 µPa, are often expressed as broadband A-weighted sound levels, expressed as dBA. This is a factor that relates to the sensitivity of the human ear. "A-weighted" refers to frequency-dependent weighting factors applied to the sound in accordance with the sensitivity of the human ear to different frequencies. With A-weighting, sound energy at frequencies below 1 kHz and above 6 kHz is de-emphasized. To determine the sound level in dBA, sound power in the A-weighted spectrum is integrated over frequency. Thus, information about the frequency spectrum of airborne noise is not

available in the single dBA number resulting from A-weighting, but different noises can be compared. Such comparisons are meaningful when assessing the effects of noise on humans or animals with a similar range of hearing sensitivity. The dBA data are less relevant to animals that are most sensitive to different frequencies (Richardson *et al.*, 1995).

It is also common to measure airborne impulsive sounds on an energy basis, integrating the squared instantaneous sound pressure over a stated interval or event to obtain the sound exposure level (SEL). A-weighting is implied unless otherwise stated (American National Standards Institute, 1994).

The relationship between sound and the human response to sound is modified somewhat as the overall sound intensities increase. The response of the human ear is increasingly equitable across the frequency. For this reason, the B-weighted sound pressure level (dBB) and the C-weighted sound pressure level (dBC) were developed. The A-weighting approximates the human ear's response below 55 dB. The B-weighting is more appropriate for sounds between 55 dB and 85 dB, while the C-weighting corresponds to the ear's response above 85 dB. The dBC response scale is similar to the flat scale (dB), except at either extremity of the frequency range, where it is discounted (Chappel, 1980; Haber, 1981; NASA, 1989; Page, 1994; Talty, 1988).

The A-weighting scale has gained legal standing for measurements of sound because it approximates the hearing sensitivity of humans at low sound levels. It is a suitable measure of the effects of loudness on speech interference and annoyance. The C-weighted scale is useful for sonic boom analysis because it emphasizes the lower frequencies that predominate in such sounds. Many animals, including harbor seals, respond to a higher range of frequencies than humans (Chappel, 1980; Haber, 1981; NASA, 1989; Page, 1994; Talty, 1988).

Literature Cited

American National Standards Institute. 1994. American National Standards Acoustical Terminology. ANSI S1.1-1994. Standards Secretariat, Acoustical Society of America, New York. 56 pp.

Chappell, M.A. 1980. Possible Physiological Effects of Space Shuttle Sonic Booms on Marine Mammals. *In*: J.R. Jehl and C.F. Cooper (eds.). Potential Effects of Space Shuttle Sonic Booms on the Biota and Geology of the California Channel Islands: Research Reports. Prepared by the Center for Marine Studies, San Diego State University and Hubbs Marine Research Center for the U.S. Air Force Space Division. Contracts F-04701-78-C-0060 and F-04701-78-C-0178, CMS Technical Report 80-1. pp. 195-228.

Haber, J.M. 1981. Parametric Evaluation of Sonic Booms Resulting from the Ascent Phase of STS Launches from VAFB. Dept. of the Air Force WSMC/SEY. Vandenberg Air Force Base, California. Technical Report No. 81-3076-1. Prepared by J.H. Wiggins Company, Redondo Beach, California.

National Aeronautics and Space Administration (NASA). 1989. Final Environmental Impact Statement, Space Shuttle Advanced Solid Rocket Motor Program. John C. Stennis Space Center, George C. Marshall Space Center, National Aeronautics and Space Administration, Washington, DC.

Page, J.A. 1994. Sonic Boom Contour Predictions for LLV-1 and LLV-3 Launches. Report to Lockheed Environmental Systems and Technologies Company by Wyle Laboratories, Arlington, Virginia.

Richardson, W.J., C.R. Greene, C.I. Malme, and D.H. Thomson. 1995. Marine Mammals and Noise. Academic Press, Inc. San Diego, CA.

Talty, J.T. (ed.). 1988. Industrial Hygiene Engineering, 2nd edition. Noyes Data Corporation, Park Ridge, New Jersey.

U.S. Air Force. 1997. Final Environmental Assessment for the Issuance of a Letter of Authorization for the Incidental Take of Marine Mammals for Programmatic Operations at Vandenberg Air Force Base, California. Prepared by Tetra Tech, Inc. USAF Contract No. F04684-95-C-0045.