National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

Supplemental

Environmental Assessment

MODIFICATIONS AND OPERATIONS
OF SPACE LAUNCH COMPLEX - 2W
FOR THE DELTA II LAUNCH VEHICLE
VANDENBERG AIR FORCE BASE, CALIF.
JUNE 1993

SUPPLEMENTAL
ENVIRONMENTAL ASSESSMENT
FOR THE
MODIFICATIONS AND OPERATIONS
OF
SPACE LAUNCH COMPLEX 2W
FOR THE
DELTA II LAUNCH VEHICLE

JUNE 1993

PREPARED FOR
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
GODDARD SPACE FLIGHT CENTER

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FINDING OF NO SIGNIFICANT IMPACT (FONSI)
SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT
MODIFICATIONS AND OPERATIONS OF
SPACE LAUNCH COMPLEX -2W
FOR THE DELTA II LAUNCH VEHICLE
VANDENBERG AFB, CA

AGENCY: National Aeronautics and Space Administration, Goddard Space Flight Center (GSFC)

ACTION: Proposed Delta II Launch Vehicle Program at SLC-2W as described in the baseline Environmental Assessment, modified as described under Background.

BACKGROUND: The baseline Environmental Assessment (EA) was prepared in 1991 for the Delta II Launch Vehicle for the Medium Expendable Launch Vehicle Services (MELVS) program provided by McDonnell Douglas Aerospace to NASA at Vandenberg AFB. The FONSI was signed by the 30th Space Wing (30SPW) on 20 September 1991 and by HQ/USAF SPACECOM on 21 January 1992.

Subsequent to the preparation of that document, and prior to the first planned launch, changes to the program have occurred which have potential environmental impact. The attached supplement is to assess these program changes and their environmental impact.

The changes documented and reviewed in the supplement are as follows:

1. The baseline EA stated that the Delta II would not be launched during the least tern nesting season from mid-April to the end of August. Since then, the western snowy plover has been added to the federal Threatened list under the Endangered Species Act, and its nesting season is from mid-March to mid-September. Formal consultations with the U.S. Fish and Wildlife Service (USFWS) have resulted in a no jeopardy opinion stating that the Delta II is allowed to launch during the combined nesting period, subject to compliance with certain mitigation requirements.

2. The California least tern and snowy plover are addressed throughout the supplemental EA and historical as well as current data and potential impacts are provided.

3. The supplemental Environmental Assessment also updates the baseline EA for the proposed modifications of SLC-2 to current status.

SUMMARY:

The implementation of the Delta II program changes described in this EA Supplement will not significantly impact the natural or man-made environment.

The launch of the Delta II vehicle during the least tern and snowy plover nesting season is not anticipated to cause significant effects on these species. As requested by USFWS, certain mitigation steps will be carried out. These are:

1. Noise measurements and exhaust plume deposition monitoring will be performed during the first launch.

2. Launch during the nesting season will not be performed when the wind is blowing toward the Purisma Point colony to minimize the possibility of acid deposition from the exhaust gases in the colony area. Wind direction will be monitored from SLC-2 or closest weather monitoring location.

3. Visual monitoring of the Southern sea otter population will be performed at the otter colony near Purisma Point shortly before and after the first launch.

4. Provide least tern decoys and habitat shelters (roof tiles), and support a USDA Animal Damage Control study of least tern predation and a non-lethal predator control program.

5. USAF will support a USFWS study into the impacts of noise on avian species, and the least tern/snowy plover monitoring program will be increased in frequency.

6. Fencing will be erected around the Purisma Point nesting area prior to the 1993 nesting season.

FINDINGS: Based on the findings of this Supplemental Environmental Assessment, and mitigation steps undertaken as a result, a finding of no significant impact is made. A Supplement to the Delta II Launch vehicle environmental assessment describing the proposed action is on file at:

Department of the Air Force
30th Space Wing/Environmental Management
Vandenberg Air Force Base, CA 93437

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EXECUTIVE SUMMARY

An Environmental Assessment was prepared identifying and evaluating potential environmental impacts associated with the minor modifications and subsequent operation of Space Launch Complex-2 West (SLC-2W) at Vandenberg Air Force Base (VAFB) California. (Modification of Space Launch Complex - 2W, Medium Expendable Launch Vehicle Services, Vandenberg Air Force Base, Calif., September 1991). The original EA allowed for two launches per year with no launches during the California least tern nesting season.

This Supplemental Environmental Assessment (SEA) addresses the potential impacts associated with launches during the California least tern nesting season as well as the recently listed snowy plover. Addressed are all areas including acoustics and exhaust plume depositions. The changes to the Sept. 91 EA are shown in bold type as well as excerpts for continuity.

Although no significant impacts are predicted, mitigating measures to be employed as part of the proposed launch include: no launch with winds in the direction of the nesting area; monitoring of acoustic noise data from first available launch from VAFB; monitoring of exhaust plume deposition from first available launch from VAFB; establishment of habitat shelters; predator monitoring and control; and monitoring of the Purisima Point nesting area during the launch.

SECTION 1

INTRODUCTION

The purpose of this DRAFT Supplemental Environmental Assessment (SEA) is to present the data for the potential impacts of a proposed action subsequent to modification and operation of Space Launch Complex 2W (SLC-2W) for the Delta II launch vehicle at Vandenberg Air Force Base (VAFB), California. **Specifically, this SEA mainly addresses the launch noise and launch emissions impact from the Delta II launched from SLC-2W on the California least tern, the Western snowy plover, the California brown pelican and the Southern sea otter.**

1.1 ENVIRONMENTAL PROCESS

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

This assessment includes operational and physical data on the Delta II Rocket and references other related assessments from VAFB and CCAFS. This document provides consolidated information for review by the USFWS and the USAF to assist in the exchange of technical information for the consultation process. Other general data is provided in the SLC-2 EA dated Sept 1991.

1.2 PURPOSE AND NEED FOR ACTION

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

The National Aeronautics and Space Administration (NASA), Goddard Space Flight center (GSFC), has tasked McDonnell Douglas Aerospace (MDA), by contract NAS5-30722, with providing Medium Expendable Launch Vehicle Services (MELVS) to carry medium class payloads to the required orbit from VAFB, California. In order to provide these services, the existing launch facility at SLC-2W at VAFB requires modification to launch a vehicle capable of carrying medium class payloads.

The purpose of the modification and operations from SLC-2W at VAFB is to fulfill the following needs: 1)Maintenance of existing capability to support timely and reliable launch of critical NASA satellites from a location from which highly inclined and polar orbits can be achieved; 2)Provision of launch capability for payloads in the 7,500 pound class to highly inclined orbits; 3) Maintenance of assured access to space by providing launch capability for the Delta II space launch vehicle.

VAFB is the only US launch site location from which polar orbits and high inclination orbits can be safely achieved without overflights of land masses. Polar launch orbits provide coverage of the entire planet, as required for weather and earth resources surveillance, communications relay, defense, navigational systems and other scientific purposes. **A FONSI for the Sept 1991 EA was granted for pad modifications and launches outside the least tern nesting season. This SEA addresses the proposed launches which will not significantly affect the environment at VAFB but allow launches during the least tern and snowy plover nesting season.**

SECTION 2

PROJECT DESCRIPTION

This section outlines the existing facilities and operations at SLC-2W.

2.1 HISTORICAL OPERATION

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

2.2 EXISTING FACILITIES AND OPERATIONS

SEA is updated to reflect the initial EA modifications and includes a brief explanation of the facilities.

Space Launch Complex 2 is located on Vandenberg Air Force Base, located in northern Santa Barbara County, California. SLC-2W is located on the northwest part of VAFB north of the Santa Ynez river near the ocean in the costal dune scrub habitat on Burton Mesa near Purisima Point.

SLC-2W is one of six launch pads built in the 1958 time frame for training purposes for the Air Force for launching Thor rockets. **This pad was subsequently modified to launch Thor Agena, Thor Delta, and Delta I launch vehicles.** A total of 24 Thor missiles and 26 Delta rockets have been launched from SLC-2W. **Since the inception of VAFB as a launch site, there have been a total of 294 THOR and Delta launches. The highest launch rate was over 21 launches per year average over a 10 year span.**

The SLC-2W launch facility is inside a fenced area providing a safe work place for both flight hardware processing and launch activities and is currently being configured to launch a standard Delta II launch vehicle. SLC-2W consists of a launch pad and various structures that support launch operations including: Mobile service tower, Fixed umbilical tower, Blockhouse, Horizontal processing facility, Solid rocket motor facility, and facilities for vehicle assembly, fueling, preflight checkout, and launch.

2.2.1 Launch Pad

The launch pad consists of the launch mount, the first stage liquid oxygen (LOX) and fuel storage tanks, second stage aerozine-50 (A-50) and nitrogen tetroxide (N_2O_4) storage tanks, nitrogen (N_2) and helium (He) pressure storage vessels, a heat exchanger, and the deluge water storage tank. The flame duct beneath the Delta main engine uses 6,000 gpm water deluge system for sound suppression during launch. The present flame duct water containment area is constructed of sealed concrete with a capacity of approximately 100,000 gallons.

2.2.2 Mobile Service Tower (MST)

The modified MST is a 178 foot enclosed tower mounted on wheels which provides access to the vehicle, a white room for payload environmental control, adjustable levels for payload access, exterior and interior cranes for flight hardware hoisting, and an elevator and stairway. A 20 ton exterior bridge crane is used to hoist the vehicle stages into position on the launch mount.

2.2.3 Fixed Umbilical Tower (FUT)

The FUT is positioned in front of the MST and provides second stage and payload electrical umbilicals, spacecraft air conditioning and second stage guidance cooling air ducts, filters, and panels, second stage propellant and pressurization umbilicals, nets to protect umbilicals after separation at lift-off, and a lightning rod to protect the launch vehicle.

2.2.4 Blockhouse

The blockhouse, building 1622, contains a control room with the consoles for the launch vehicle checkout and launch, a telemetry station for vehicle parameter recording and readout, communications and video control center for the pad, an electronics calibration area, and a quality control area for launch vehicle procedures and documentation.

2.2.5 Horizontal Processing Facility

The HPF (Building 1615) is adjacent to the launch pad and is used for first and second stage horizontal processing, ordnance installation and checkout prior to on-pad erection.

2.2.6 Solid Rocket Motor Facility

The SRMF (Building 1670) is where the first stage solid motors are received and inspected, the motors built up, the propellant grain is inspected, systems are leak checked, and the destruct ordnance systems are installed. The building has room to store and process a total of 18 motors. The SRMF is currently rated for safe storage of 400,000 pounds of Class 1.3 (mass-burn) explosives. This capacity is equivalent to 18 Castor IV, 17 Castor IVA, or 15 Graphite Epoxy Motors (GEMS).

2.2.7 Additional Facilities

Other facilities at the launch pad include the operations building (Building 1628) with office space for MDA and customer personnel, blueprint files, conference room and document reproduction facilities. Building 1620B is a high-energy proof test facility used for initial acceptance testing and required periodic testing for fixtures used in hoisting flight hardware, complete with a 500 ton vertical and a 250 ton horizontal capability.

2.3 COMPARISON OF DELTA I AND DELTA II VEHICLES

Future scheduled launches from SLC-2W will require an upgraded Delta vehicle referred to as a Delta II. The Delta II is a taller vehicle (12 foot) than the Delta I previously launched from SLC-2W. The differences between the vehicles was the reason for the launch pad modifications. The differences between the two launch vehicles is described in the following paragraphs.

2.3.1 Overall Vehicle

The Delta II is taller, carries more propellant, and has a slightly modified main engine nozzle than the Delta I. The Delta II is 123 feet 5 inches tall, 12 feet 1 inch taller than the Delta I. A fully fueled Delta II weighs approximately 513,000 pounds, which is about 70,000 pounds heavier than a fueled Delta I. The Delta I main engine nozzle expansion ratio increases from 8:1 to 12:1 on the Delta II vehicle. The Delta II consists of five major assemblies: first stage, interstage, second stage, third stage and payload fairing.

2.3.2 First Stage

The first stage is composed of the liquid RP-1 fuel tank, liquid oxygen tank, center body section, and main engine. The height increase in the overall vehicle is due to the increased first stage height. The fuel tank length in the Delta II is 4.7 feet longer, accommodating about 9,950 gallons (66,685 pounds) of RP-1 (a high grade kerosene); the oxidizer tank is 7.3 feet longer, accommodating approximately 16,140 gallons (146,070 pounds) of LOX.

2.3.3 First Stage - Solid Rocket Motors (SRMs)

Both the Delta I and the Delta II are equipped with nine small solid rocket motors, mated to the base of the first stage. The SRMs provide additional energy during lift-off. The Delta II is augmented with Graphite Epoxy Motors (GEMs): the Delta I uses Castor IVA motors. Each GEM contains approximately 25,800 pounds of propellant and weighs a total of about 28,600 pounds, and each Castor IVA motor contains about 23,300 pounds of propellant and weighs a total of approximately 25,650 pounds. The GEMs are each approximately six feet taller than Castor IVA motors, necessitating certain changes to the internal structure of the MST and FUT.

The chemical composition of the two solid rocket motor types is similar with major components of each propellant containing ammonium perchlorate, aluminum powder, hydroxyl terminated polybutadiene, dimethyl diisocyanate, which accounts for over 95% of the constituents in both propellant formulations. Only the minor constituents of the propellants)e.g., burn rate catalysts and curing agents) differ somewhat. For example, the castor IVA propellant contains dioctyl adipate (about 1% by weight), while the GEM propellant contains dioctyl sebecate (about 3% by weight). There are also several other minor constituents in the GEM propellant (e.g., maleic anhydride, ferric oxide, and isophorone diisocyanate) at levels considerably less than 1 % by weight.

The chemical composition of one CASTOR IVA solid is as follows:

Hydroxyl terminated polybutadiene and dimeryl diisocyanate	2386.42 pounds
Propylene imine - adduct of isophthalic acid	66.91 pounds
Dioctyl adipate	223.02 pounds
Aluminum powder	4460.60 pounds
Ammonium perchlorate	15166.04 pounds
TOTAL	23,303 pounds

The chemical composition of one GEM solid is as follows:

Hydroxyl terminated polybutadiene	1651.98 pounds
Dimeryl diisocyanate	258.00 pounds
Dioctyl sebecate	903.00 pounds
2.2 - methylene - bis (4-methyl-6-t-butylphenol) di- and tri- nonylphenol	129.00 pounds
Maleic anyhdride, tryphenyl bismuth	25.80 pounds
Propylene imine, adduct of isopthalic acid	129.01 pounds
Ammonium perchlorate	17806.90 pounds
Aluminum powder	4903.28 pounds
Isophorone diisocyanate	0.06 pounds
Ferric oxide	0.07 pounds
TOTAL	25,807.1 pounds

2.3.4 Interstage

The 15.5 foot interstage extends from the top of the first stage to the second stage miniskirt and bears loads from the second stage, third stage, and fairing to the first stage. It contains fairing exhaust vents and separation rods/springs. There is no difference between the Delta I and Delta II interstages.

2.3.5 Second and Third Stages

The second and third stages are essentially the same for the Delta I and Delta II vehicles and activate on orbit. Both second stages contain Aerojet pressure fed engines, using aerozine-50 as the fuel and nitrogen tetroxide as the oxidizer. Both have a nitrogen gas redundant attitude control system for pitch and yaw control during powered flight, and both have the Delta Inertial Guidance system (DIGS) to control the vehicle during first and second stage flight.

The third stage consists of a payload attach fitting, a Thiokol Star-48 solid rocket motor, and a spin table. The payload attach fitting provides the structural interface between the spacecraft and the SRM that provides provides the boost for final injection into transfer orbit. The upper stage also includes an ordnance sequencing system for event timing, a spacecraft separation system, and a telemetry system.

2.3.6 Payload Fairing

The Delta II can accommodate a payload fairing diameter of either 8 feet, 9.5 feet or 10 feet depending on spacecraft requirements. The 8 and 9.5 foot fairings separate into 2 pieces, and the 10 foot fairing into three pieces on command from the second stage guidance system using a contamination-free separation joint. An acoustical blanket system inside the fairing provides environmental protection for the spacecraft during vehicle ascent. The Delta I had a payload fairing diameter of 8 feet.

2.3.7 Flight Characteristics

The flight profiles for the Delta I and Delta II are very similar. At lift-off from the launch pad, the first stage propellant engine and six of the GEM SRMs are ignited. The six GEMs burn out at approximately 56 seconds, and the remaining three GEMs are ignited at approximately 64 seconds, by which time the vehicle has achieved an altitude of approximately 10 nautical miles (nmi) and 7 - 8 nmi down range. At approximately 86 seconds with an altitude of approximately 15 nmi, the six spent SRMs are jettisoned, in two sets of three separated by approximately one second. The remaining three SRMs burn out at approximately 123 seconds and are subsequently jettisoned.

The Delta II continues to be powered by the first stage until main engine cut-off (MECO) at approximately 256 seconds, followed by vernier engine cut-off (VECO) at approximately 273 seconds, and first and second stage separation at 273 seconds. In order to minimize weight, the fairing is jettisoned at 290 seconds, and the first secondary engine cut-off (SECO-1) takes place at approximately 616 seconds. The vehicle then coasts until approximately 2100 seconds when the second stage engine in space is ignited for about a 20 second burn. The vehicle is stabilized and the third stage/spacecraft separated. At about 2250 seconds, the third stage is ignited, burns approximately 90 seconds and places the spacecraft into the desired orbit. The third stage/spacecraft is stabilized and the spacecraft is separated at approximately 2450 seconds.

2.4 PROPOSED MODIFICATIONS

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

The launch facilities, specifically the MST and FUT, are in the final stages of being modified to accommodate the greater vehicle height and operations of the Delta II launch vehicle.

2.4.1 Mobile Service Tower (MST)

The MST has been modified to accommodate the Delta II launch vehicle. Specifically, a 12 foot spacer-truss has been added beneath the existing MST base girders. This spacer-truss was fabricated off-site and brought to SLC-2W ready to assemble and install. The 15 ton exterior crane was replaced with a 20 ton hoist.

Other modifications include relocating several levels, increasing the opening size of the doorway at level 6, moving the MST-FUT catwalk to the opposite side of the MST, adding a new lower level for solid motor attachment access, reworking the access stairs, new weather curtains, electrical power modifications, and other miscellaneous items.

2.4.2 Fixed Umbilical Tower (FUT)

All modifications are to the upper two thirds of the FUT and are structural in nature. The top of the FUT was extended 8 feet to provide access to the fairing air conditioning (A/C) duct for the taller vehicle. Other modifications to the FUT include new A/C duct access platforms, relocated DIGS and spacecraft A/C ducts, a relocated second stage propellant boom, relocated catch nets, a relocated lightning rod, a repositioned MST-crossover cat walk, and additional access ladders. Following MST and FUT modifications, the MST will be moved back to the forward park position at the launch mount. All equipment removed to facilitate the modifications will be reinstalled in the MST.

2.4.3 RP-1 Fuel Storage Area

The existing spill area and containment dike around the RP-1 tank area has been enlarged to accommodate a new 15,000 gallon storage tank to meet applicable VAFB, county, state and Federal requirements for above ground fuel storage and rainwater containment and removal. An ATC was coordinated and approved through the Santa Barbara APCD.

2.4.4 Gas Storage Area

The Delta II first stage requires additional helium, necessitating expansion of the second stage helium storage. A new 297 ft^3 storage vessel has been located in the helium storage area on SLC-2W. Supports will be added to accommodate the new tank. A six foot high reinforced concrete wall has been built along the side of the high pressure storage area that faces the vehicle. The wall will protect the gas storage tanks from direct solid rocket motor exhaust impingement.

2.4.5 Solid Rocket Motor Facility

The Solid Rocket Motor Facility was modified to accept the Graphite Epoxy Motors by increasing the building hoist to 20-ton capacity.

2.4.6 Other Modifications

The N2O4 and A-50 systems will remain unchanged. The first stage liquid oxygen system modifications are limited to the launch mount area.

All areas which will be involved in the modifications have been previously paved with asphalt or concrete. Similar MST tie-down piers, catch basins, and pedestals have been in existence since 1970. The proposed changes will be adjacent to or in the proximity of these existing structures.

2.5 Alternatives

This Supplemental Environmental Assessment (SEA) is the same as the initial Environmental Assessment (EA) dated September 1991. There have been no changes in the original alternative actions or conclusions.

SECTION 3

EXISTING ENVIRONMENTAL BASELINE

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991 with additional information provided.

This section details the existing environmental baseline at the SLC-2W site on VAFB in terms of air and water quality, the noise environment, presence of any threatened or endangered plant or animal species, the existence of any archaeological resources, land use and economics, and the aesthetics of the area.

3.1 Biotic Resources - Flora and Fauna

The topographic and geologic diversity of VAFB and adjacent lands creates an environment exhibiting high species diversity as well as a high degree of endemism. VAFB is located in the transition zone between the cool moist conditions of northern California and the semi-desert conditions of southern California. Many species of plants and animals are observed to reach their northern or southern limits in this area.

3.1.1 VAFB Flora

Although much of the vegetation on VAFB has been disturbed by human activity during the past century, natural vegetation communities do occur. These communities include southern foredunes, coastal scrub, central dune scrub, chaparral, coast live oak woodland, grassland, southern bishop pine forest, tanbark oak forest, and various wetlands, among others. Bishop pine, tanbark oak forests and the Burton Mesa Chaparral on VAFB are ecologically important because of their rarity in Santa Barbara County. Many of these communities are quite limited in areal extent (USAF EA SLC-7, 1989).

Disturbances to vegetation communities include grazing and fire, construction of fire breaks, installation of communications and utility lines, and other activities associated with military training. Introduced species, such as ice plant (Mesembryanthemum crystallinum), mission veldt grass, (Ehrharta calycina) and Pampas grass (Cortaderia jubata), are dominant in disturbed areas, and frequently replace native plant species.

Native shrubs characteristic of the coastal dune scrub habitat found in the vicinity of SLC-2W include mock heather (Ericameria ericoides), dune lupine (Lupinus chamissonis), California sage brush (Artemisia californica), deerweed (Lotus scoparius), and dune mint (Monardella crispa) (EPA, 1990). Herbaceous vegetation of concern known to occur in coastal dune habitat in the vicinity of VAFB include: the La Graciosa thistle, the surf thistle, and the coast spectacle pod. The dune mint is a Federal Category 2 endangered species. Dune mint is also on the California Native Plant Society (CNPS) List 1B (plants rare and endangered in California and elsewhere) (ES Inc. BA Titan IV/Centaur, 1990). Arthur Smith (July 27, 1991) conducted a morphological and seasonal comparison of the dune mint, Monardella crispa, and a close relative, Monardella undulata var. frutescens and concluded they were different species (both species are Federal Category 2 candidates). The La Graciosa thistle, Cirsium loncholepis has historically been found on VAFB, but is now apparently extirpated. Although VAFB has provided historical habitat for this species, a recent Nature Conservancy study (Hendrickson, Beth, October 17, 1990) reported that this species was not growing in its historical range during the time the study was conducted. Cirsium loncholepis is a state listed threatened species and is a Federal Category 1 species.

The surf thistle, Cirsium rhothophylum, and the coast spectacle pod, Dithyrea maritima are known to occur near SLC-2W. Zelder and Frazier, (NCR, June 3, 1991), studied these species on VAFB during June of 1991 and found that in both species, the populations as a whole appear to be stable, although the status of mini-populations on individual dunes are variable because of the active nature of dune habitat. Cirsium rhothophylum and Dithyrea maritima are both California listed threatened species; the former is listed as a Federal Category 1 species and the latter is listed as a Federal Category 2 species.

3.1.2 SLC-2W Flora

Vegetation within the facility boundary of SLC-2W is very sparse with some dune mint (Monardella crispa) present. Little or no vegetation occurs within the area involved in the project, as this portion of the facility has existing structures, paved roads and parking areas. Non-native species, mentioned above, occur in some dune areas away from structures or paving.

3.1.3 VAFB and SLC-2W Fauna

Common mammalian species occurring at VAFB include mule deer, coyote, bobcat, jackrabbits, cottontails, skunks, ground squirrels, and numerous nocturnal rodents. Reptiles and amphibians are represented by several snakes, the Pacific treefrog, western toad, and the California legless lizard, among others. Bird species are diverse on VAFB, such as redtailed hawks, America kestrels, black-shouldered kites, and numerous common land birds. Shore birds are abundant on all sandy beaches. California brown pelicans and the California least tern occur at several locations along the coast (USAF EA, SLC-7, July 1989). **The federally listed threatened species, the Western snowy plover and several Federal Category 2 species including red-legged frogs, and southwestern pond turtles, are known to exist in the area. The red-legged frogs and the southwestern pond turtles do not, however, exist in the project area as they require a semi-aquatic environment. The Western snowy plover is considered a year around resident of VAFB. A harbor seal population haul-out site occurs at Purisima Point. This is identified in the National Marine Fisheries Service census as a breeding rookery in their annual harbor seal census. The Southern sea otter is found at various rocky areas along the VAFB coastline (USAF VAFB PLAN, August 1989). A small colony of sea otters was found near Purisima Point in 1990 and was still intact in 1992. Brown pelicans do not breed on VAFB, but are transient visitors to the coast.**

3.2 Threatened and Endangered Species

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991. Some additional information is provided in sections 3.2.2.1 , 3.2.3.2, 3.2.3.3, and 3.2.3.4.

3.2.2.1 CALIFORNIA LEAST TERN

3.2.2.1.1 Life History

The California least tern (Sterna antillarum browni) was classified as endangered by the USFWS in 1970 (35 FR 8495, June 2, 1970; 35 FR 16047, October 13, 1970). The tern is a migratory bird found in the California coastal region. The population decline of this bird can be attributed to its colonial nesting habitat along sandy beaches, areas easily disturbed by human activity. Development and recreational use of the California coast has led to the loss of nesting habitat. Foraging and roosting habitats have been destroyed by the dredging and filling of coastal wetlands (Wilbur, 1974a). Native predators like coyote and raccoon and introduced, non-native predators such as rats, cats, and

red foxes also have contributed to the decline of this species. The breeding and nesting occurs between mid-April and the end of August (USAF, 1987).

The least tern is a migratory species that begins to arrive in the vicinity of the project area during late April and early May. Following breeding, they depart, and by late August and early September the species is virtually gone from the region (Lehman, 1982). Although the winter distribution of this subspecies is currently unknown, it is thought that California least tern probably winters in southern Mexico and Central America (Wilbur, 1974a). Only sketchy information is available for winter sitings in Mexico (Zembal, 1984).

Although the least tern is a fairly common summer resident along the north coast of Santa Barbara county from the Santa Ynez River mouth north to the mouth of the Santa Maria River (Lehman 1982), it is a rare but regular transient and post-breeding visitor to near shore habitats in the project area. The historical breeding range for the least tern was from the San Francisco Bay Area, California, south to southern Baja California, Mexico. The current breeding range along the California coast is similar to the historical one but with far fewer birds. (See Figure 1).

3.2.2.1.2 Habitat Requirements

Least terns are colonial nesters that require sandy areas free of nest predators (i.e., cats, crows, rats, raccoons, etc.). In the past, least terns have used sandy ocean beaches for nesting. Because of human activity in some beach areas, least terns have recently resorted to open areas of sand, dirt, or dried mud near lagoons or estuaries (USFWS, 1980). In populated areas such as San Diego Bay, least tern habitat is found next to runways (Lindberg Field, North Island).

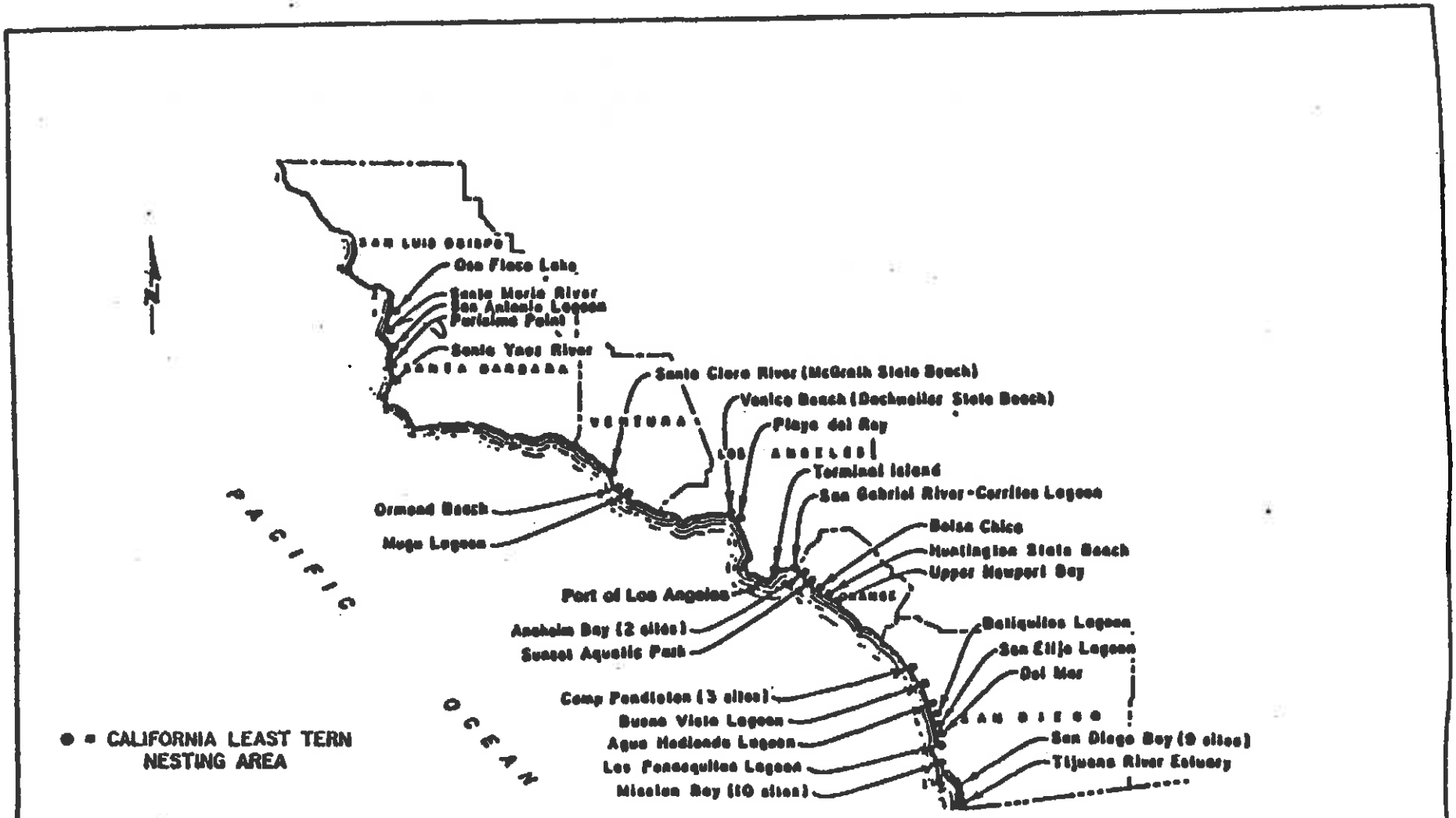
Foraging surveys have been conducted on a site-specific basis within the Los Angeles-Long Beach Harbors (Massey and Atwood, 1982; 1984). Although the results of these surveys are not definitive, best available information indicates that foraging usually takes place primarily in shallow ocean water in the vicinity of the mouths of major rivers and within 2 miles of the nesting areas (Atwood and Minsky, 1983). They feed on small fish in nearshore ocean waters, estuaries, and associated freshwater ponds.

3.2.2.1.3 California Central Coast Population

During the last five years, the California least tern population has ranged from 954 breeding pairs in 1987 down from 1046 pairs in 1984. The estimate for 1987 places the Santa Barbara County least tern population at 40 to 45 nesting pairs (Collins 1988). The Central California Coast breeding colonies located from the Guadalupe /Mussel Rock Dunes south to VAFB Surf location produced a total of 40 nests in 1989, 42 nests in 1990, 50 nests in 1991 and 55 nests in 1992 (Nature Conservancy, Perry 1992).

3.2.2.1.4 Presence in the Project Area

The least tern has historically established nesting colonies on VAFB in the coastal foredunes at the mouths of the Santa Ynez and San Antonio Lagoons and at the dunes near Purisima Point. Two sites were observed on VAFB during the 1992 breeding season, one at Purisima Point and one located 1-2 kilometers north of Purisima Point (Nature Conservancy, 1992). The terns also congregate at the



SOURCE: EB, 1985a

FIGURE 1
CALIFORNIA LEAST TERN OCCURRENCE IN THE PROJECT AREA

mouth of the Santa Ynez River before migrating south. In northern Santa Barbara County and southern San Luis Obispo County, least terns have been recorded breeding at six localities during the 1980s: Pismo Beach, Oso Flaco Lake, Guadalupe Dunes near the mouth of the Santa Maria River, the mouth of the San Antonio Creek, Purisima Point and the mouth of the Santa Ynez River. In general, the nesting success at these six colonies in the project region has been low due to cold windy conditions prevalent at several of the dune locations (e.g., Guadalupe Dunes and Purisima Point), high water levels in the Santa Ynez river estuary, fluctuations in the availability of suitable prey, and presence of predators (e.g., coyotes, etc) at some of the colony sites.

Although the nesting colonies in Santa Barbara and San Luis Obispo counties are small (1-30 nesting pairs) and contain only approximately 5.8% to 12.3% of the species total estimated state-wide population, they are, nevertheless, significant in that they represent the only currently active areas between Ventura County and the San Francisco Bay. These colonies are important to the geographic breeding range of the species.

Despite the fact that the least tern nesting colony at the mouth of the Santa Ynez River is intermittent and quite small, large numbers of least terns have been recorded using this area following the nesting season. The Santa Ynez River apparently is a key area for feeding, roosting, and for post-fledgling congregation of adults and juveniles (Bevier, 1983). Preliminary observations from banding studies of least terns recorded northward movements of post-breeding birds from Venice Beach in southern California to the mouth of the Santa Ynez River. In most years, this area is used by 20 to 25 adults and fledglings for foraging and roosting following the breeding season.

The VAFB colony at Purisima Point had mixed success in 1992. With a total of 26 nests, 41 total eggs and a total count of 26 chicks, the fledgling count was only 4. The 1992 breeding season was greatly affected by the high rate of natural predation. A total of six nests were lost due to confirmed predation and another five were abandoned. The abandonment may have been due to such reasons as El Nino having a detrimental affect on the colonies in producing a lack of food. High winds of early June also were detrimental in covering nests with sand and possibly leading to the abandonment of nests by adult terns (Nature Conservancy, Perry 1992).

Data from 1978 through 1992 on the least tern nesting and foraging activity in the vicinity of the project area, including a comparison of past launches from the project area, are shown in Figure 2. The closest observed nesting area is located at least 2400 feet away from the launch point of the Delta II vehicle as shown in Figure 3. Figure 3 also details the launch vehicle flight path, typical wind direction, normal ground exhaust cloud and elevations for reference.

3.2.2.2 WESTERN SNOWY PLOVER

3.2.2.2.1 Life History

The Pacific coast population of the Western snowy plover (Charadrius alexandrinus nivosus) was federally listed as a threatened species on March 5, 1993. The breeding season of the coastal population extends from mid March through mid September. The Western snowy plover is defined as those individuals that nest adjacent to or near tidal waters, and includes all nesting

CALIFORNIA LEAST TERN POPULATION (VAFB AREA)

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Δ SLC-2W LAUNCHES (NASA)		Δ 5 Mar. Landsat C			Δ 5 Aug. DE	Δ 25 Jan. IRAS							Δ 18 Nov. COBE			
		Δ 24 Oct. Nimbus G			Δ 6 Oct. SME	Δ 26 May EXOSAT										
◊ SLC-10 LAUNCHES (USAF)		◊ 30 Apr. THOR			Δ 16 July LANDSAT D											
			◊ 6 June THOR													
				◊ 14 July THOR												
	(50 to 150 PERSONNEL ON SLC-2) (50 to 100 PERSONNEL ON SLC-10)								SLC-2 IN MINIMUM MAINTENANCE SHUTDOWN MODE (NO LAUNCHES). LIMITED PERSONNEL APPROXIMATELY 20			SLC-2 REACTIVATED TO LAUNCH COBE. APPROXIMATELY 140 PERSONNEL				
▫ PURISIMA POINT (Closest to SLC-2W)																
Breeding Pairs (Est.)	5	28	25-30	30	15-20	14	17-22	15-20	0	14	3	22	10	14	26	
Fledglings (Est.)	7	25	18-22	12	1	9	1	2-3	0	0	1	2	3	13	4	
▫ SAN ANTONIO CR.																
Breeding Pairs (Est.)	9	4	2	4	6	14	15-19	13-15	3	2	7	3	0	1	*	
Fledglings (Est.)	6	4	0	4	2	10	1	4-5	0	0	3	0	0	2	*	
▫ SANTA YNEZ RIVER MOUTH																
Breeding Pairs (Est.)			-	-	-	8	0	0	8-10	4	0	3	0	1	-	
Fledglings (Est.)			-	-	-	4	0	0	0	6	0	0	0	0	-	
▫ GUADALUPE DUNES																
Breeding Pairs (Est.)			15-18	25	12	7	8-12	10-12	12-14	20-25	10-12	15-20	32	36	29	
Fledglings (Est.)			15	5-10	3	3	2	9-11	?	34-37	?	3	7	27	8-10	
(Nesting Season - April thru August)	* SITE 1-2 KM NORTH OF PURISIMA POINT INCLUDED IN PURISIMA POINT															
(FOR REF.) ESTIMATED BREEDING PAIRS TRI-COUNTY AREA			119-141	145-150	73-84	73	61-82	114-125	86-90	70-80						

FIGURE 2 CALIFORNIA LEAST TERN POPULATION (VAFB AREA)

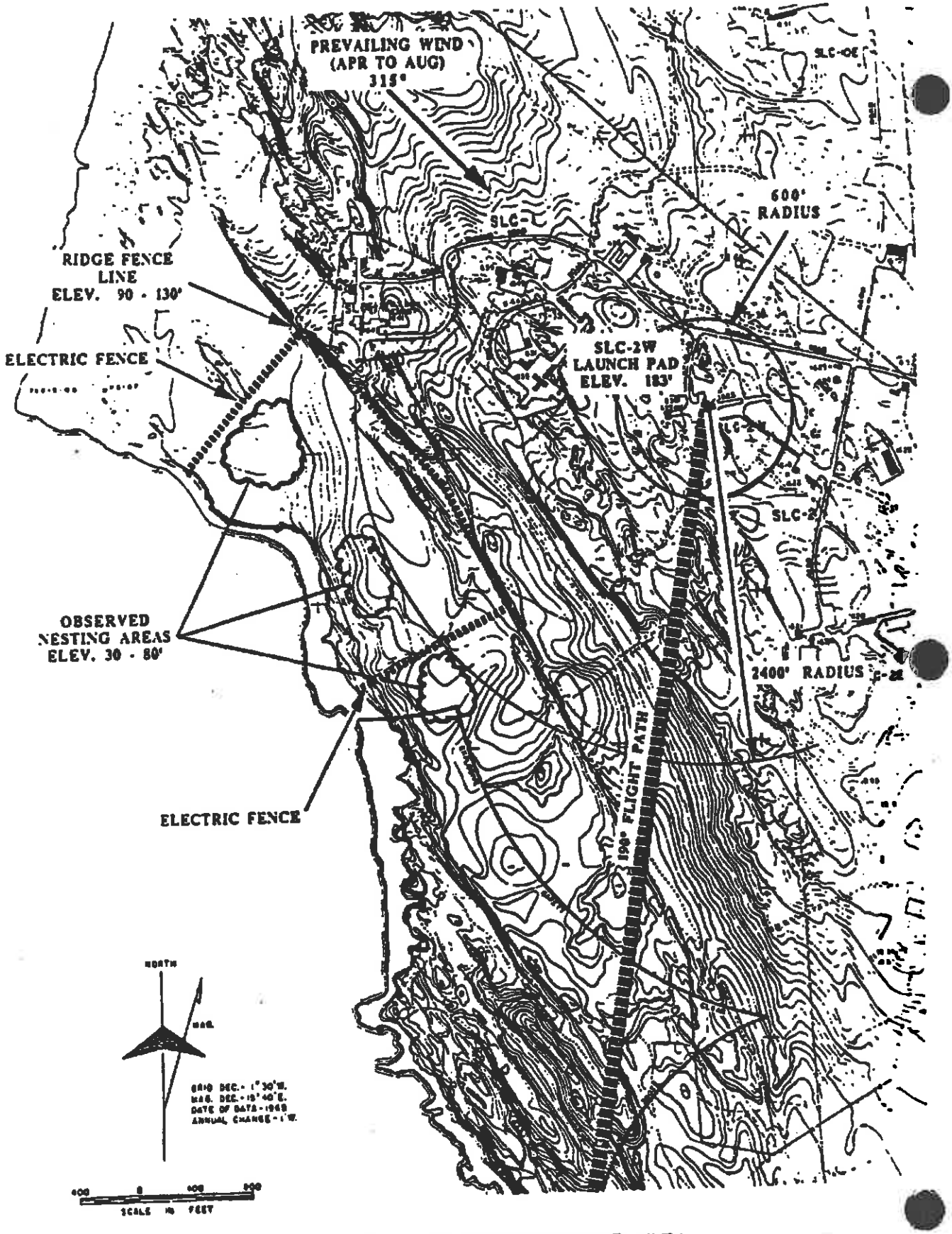


FIGURE 3 SLC-2W AND SURROUNDING AREA

colonies on the mainland coast, peninsulas, off shore islands, adjacent bays and estuaries. The Pacific coast population is genetically isolated from western snowy plovers. The Pacific population breeds primarily on coastal beaches from Washington to southern Baja California, Mexico. A total of 20 plover breeding areas occur in coastal California and 8 of the areas, including Point Sal to Point Conception, which includes VAFB and Purisima Point, support 78 per cent of the California coastal population (Page et al, 1991). Statewide surveys between 1977 and 1980 indicated up to 10,200 breeding plovers in Washington, Oregon, California and Nevada. Recent surveys of these states (and also Utah) in 1988 and 1989 provided further information on the species distribution and abundance and showed a possible decline in numbers. In 1988 and 1989 the breeding population size in Washington, Oregon, California and Nevada was estimated to be about 7900 birds and in Utah about 1700. Most plovers (about 7700) were at interior sites, some (about 1900) were coastal. Although adult snowy plovers on the California coast experienced a decline from 1565 total adults in 1977-1980 (Page and Stenzel, 1981) to 1386 adults in 1989, the Vandenberg population from Point Sal to Point Conception was relatively unchanged with 119 adults in 1977-1980 and 116 adults in 1989 (Page et al., Spring 1991).

3.2.2.2.2 Habitat Requirements

Snowy plovers frequent sandy beaches and the mouths of rivers for nesting and foraging (Lehman, 1982). In Santa Barbara County, winter populations are larger than summer populations due to an influx of birds from inland breeding localities. They have been observed nesting on sandy beaches along the mainland between Point Sal and Point Conception.

Nesting habitat is unstable and ephemeral as a result of unconsolidated soil characteristics influenced by high winds, storms, wave action and colonization by plants. Other less common nesting habitat includes salt pans, coastal dredged spoil disposal sites, dry salt ponds, and salt pond levees. Sand spits, dune backed beaches, unvegitated beach strands, open areas around estuaries, and beaches at river mouths are the preferred coastal habitat for nesting. Snowy plovers forage on invertebrates in the wet sand and amongst surf-cast kelp within the intertidal zone; in dry, sandy areas above the high tide; or in salt pans, spoil sites, and along the edges of salt marshes (Federal Register, Vol. 58, No. 42 Mar 1993). The central coast provides suitable habitat for the snowy plover and surveys have been conducted at the Morro Bay area, Callendar-Mussel Rock Dunes, Point Sal to Point Conception (VAFB) and the Oxnard Lowlands. The latest survey for these four areas for the 1989 season accounted for 533 adults (G.W. Page, L.E. Stenzel, W.D. Shuford, 1990).

3.2.2.2.3 Presence in the Vicinity of the Project Area

Snowy plovers have been systematically surveyed by observers on foot at VAFB from Minuteman Beach (adjacent to Point Sal) to Purisima Point since 1980. Point Reyes Bird Observatory (Page et al. 1991) have also conducted extensive studies throughout California and include the project area near Purisima Point which is between Point Sal and Point Conception. The western snowy plovers have been surveyed on a monthly basis for most years through 1992 and a summary is presented in the table in Figure 4.

3.2.2.3 CALIFORNIA BROWN PELICAN (USAF EA Atlas II 1991)

COASTAL WESTERN SNOWY PLOVER POPULATION SURVEY (VAFB AREA)

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Δ SLC-2W LAUNCHES (NASA) ◊ SLC-10 LAUNCHES (USAF)		Δ 5 Mar. Landsat C Δ 24 Oct. Nimbus G ◊ 30 Apr. THOR ◊ 6 June THOR ◊ 14 July THOR			Δ 5 Aug. DE Δ 6 Oct. SME	Δ 25 Jan. IRAS Δ 26 May EXOSAT Δ 16 July LANDSAT D Δ 1 Mar. LANDSAT D'							Δ 18 Nov. COBE		
	(50 to 150 PERSONNEL ON SLC-2) (50 to 100 PERSONNEL ON SLC-10)							SLC-2 IN MINIMUM MAINTENANCE SHUTDOWN MODE (NO LAUNCHES). LIMITED PERSONNEL - APPROXIMATELY 20				SLC-2 REACTIVATED TO LAUNCH COBE. APPROXIMATELY 140 PERSONNEL			
▫ JALAMA BEACH (Note 1) Adults	0											1			
▫ SANTA YNEZ RIVER MOUTH (Point Conception reference South Vandenberg) (Note 1) Adults	10											25			
▫ PURISIMA POINT BEACH (Closest to SLC-2W) (Note 1) Adults	109											90			
▫ SAN ANTONIO CREEK TO PURISIMA POINT (Note 2) Adults			• /26	•	•	44/155	28/28	22/22	•	• /6	7/38	15/63	86/86	87/87	64/64
▫ SHUMAN CREEK TO SAN ANTONIO CREEK (Note 2) Adults			• /179	•	•	2/35	26/26	32/103	• /94	42/78	20/210	6/106	70/159	56/119	31/31
▫ MINUTEMAN BEACH TO SHUMAN CREEK (Note 2) Adults			• /23	•	•	6/6	20/20	0/10	• /58	10/95	0/44	0/98	86/222	2/49	64/98

Note 1: Point Reyes Bird Observatory counts were only taken in 1977-78 and 1989 for these locations. (Other survey numbers for North Vandenberg provided by USAF).

Note 2: 1st number indicates highest count observed between May and July; 2nd number indicates maximum number of birds observed during the year - 1st / 2nd.

(Breeding Season - Mid-March thru Mid-September; Nesting thru Eggiaying - Mid-March thru Mid-July)

• NO BREAKDOWN AVAILABLE

FIGURE COASTAL WESTERN SNOWY PLOVER POPULATION SURVEY (VAFB AREA)

3.2.2.3.1 Life History

The California brown pelican (Pelecanus occidentalis californicus) is designated as an endangered species by both the state of California and the federal government. During the late 1960s and early 1970s the brown pelican population in southern California suffered significant reproductive failures (USFWS, 1983). Eggshell thinning caused by pesticide contamination, in particular DDE and DDT, is believed to be the primary factor responsible for reproductive failures and subsequent declines observed in the brown pelican population is southern California (USFWS, 1983). Population fluctuations and reproductive success are also directly related to food availability (USAF EA Atlas II, 1991).

Brown Pelicans are a common year-round visitor to sandy beaches, nearshore waters, and protected bays and harbors in Santa Barbara County (Lehman, 1982; Webster et al., 1980). Their numbers are much reduced during the late winter and early spring, when most birds are at their nesting sites on islands off the coast of southern California and Mexico. Peak abundance occurs from July through December, when birds from Mexico migrate north. Between July and October, 25,000 to 35,000 pelicans occupy the near shore and coastal waters of the Santa Barbara County region (Briggs et al., 1983).

3.2.2.3.2 Habitat Requirements

Brown pelicans generally forage over relatively shallow waters within 15 miles of shore but have been recorded up to 45 miles offshore during calm weather. Brown pelicans must return to land to roost each night. Preferred roosting and loafing areas are provided by offshore rocks and islands, river mouths with sandbars, breakwaters, pilings, and jetties (USFWS, 1983). Pelicans will often rest at a variety of sites during the day but will return to a major nocturnal roost site each night (Briggs et al., 1983). Large numbers of pelicans congregate regularly during the fall and winter at several roost sites in northern Santa Barbara County, including the mouth of the Santa Maria River, Point Sal, Purisima Point, and more rarely, the mouth of the Santa Ynez River. Other important roosting and loafing sites for brown pelicans in northwestern Santa Barbara County include the mouths of Shuman and San Antonio creeks on north VAFB, and on the boathouse breakwater on south VAFB (USAF, 1987). Pelicans are also known to frequent roosts on the northern Channel Islands, at the Santa Barbara Harbor, at the mouth of the Goleta Slough, at Point Mugu, and at the mouth of the Santa Clara River (Lehman, 1982; Briggs et al., 1983; Chambers Group, 1986).

Historically, California brown pelicans nested as far north as Monterey County, and south to the Tres Marias Islands off Nayarit, Mexico. More recently, the Pacific Coast breeding distribution of the brown pelican can be broken into three separate geographical groups: (1) the Channel Islands off southern California southward to Isla Isabela, (2) Isla Tres Marias off Nayarit, Mexico, and (3) Isla Ixtapa off Acapulco, Guerrero, Mexico (USFWS, 1983). As of 1981 the Southern California Bight brown pelican colonies constituted about 6.2% (3000 pairs) of the total west coast breeding population (48,000 pairs; Gress and Anderson, 1983). Despite an overall increase during the last 10 years, the California brown pelican has retained endangered species status because of its low reproductive success and its small U.S. breeding population. Brown

pelicans have been shown to be particularly sensitive to environmental perturbations and to human disturbance (Anderson and Keith, 1980).

Since the early 1970's brown pelican nesting in California has been restricted to the Channel Islands. West Anacapa Island contains the only consistently active pelican colony. West Anacapa Island has been used for nesting by an increasing number of pelicans since 1980, and Scorpion Rock off Santa Cruz Island has been used only intermittently for nesting (Gress and Anderson, 1984). Nesting pairs and fledging rates have increased since the early 1970's, although large fluctuations have occurred (e.g., 62% mortality of young on Santa Barbara Islands; Lewis and Gress, 1987). Brown pelican breeding success and winter populations in the Southern California Bight vary with the abundance of northern anchovy (Anderson et al. 1980, 1982). This is the primary reason for the large variability in numbers of nesting pairs at Anacapa and Santa Barbara Islands. Historically, pelicans in Southern California Bight have competed with commercial fisheries for anchovies (Anderson and Gress, 1984).

3.2.2.3.3 Presence in the Vicinity of the Project Area

The California brown pelican does not nest or breed on VAFB, but is a transient visitor to the area .

3.2.2.4 SOUTHERN SEA OTTER (USAF EA Atlas II 1991)

3.2.2.4.1 Life History

The Southern sea otter is a federally-listed threatened species (USFWS 1990a) and listed as rare and protected by the state of California. The species ranges from Alaska to Baja California; however, only sparsely scattered individuals are found south of Avila Beach (ES, 1990). The sea otter breeding range did extend from near Santa Cruz to approximately Pismo Beach (USFWS, 1987; ES, 1990) But sea otters are consistently sighted along the coast of VAFB. Through introduction efforts and other actions, the sea otter has been observed as far south as the Santa Barbara Channel Islands (USAF EA ATLAS II, 1991). The sea otter inhabits the intertidal and shallow subtidal zones, foraging in both rocky and soft sediment communities, although its preference is for hard- bottom kelp associated regions. Sea otters are not dependent upon land, but can spend their entire lives at sea, usually within 0.5 miles of shore (Benech, 1981; Engineering-Science and SWRI, 1988).

In general, sea otters do not make the extensive migrations characteristic of other marine mammals; however, males are known to move throughout the California range, and even between the northern and southern extent of the species range (Estes and Jameson, 1983; ES, 1980). Females occupy a narrower range than males, possibly an average of 11 miles of coastline throughout their lives (USFWS, 1987; ES, 1990). Sea otters may live up to 20 years and have one young at least every two years (Daugherty, 1985; Engineering-Science and SWRI, 1988). Breeding and pupping occur throughout the year in Alaska and California (Kenyon, 1969; Vandevere, 1970; Engineering-Science and SWRI, 1988); however, the predominant time for births in California is between January and March (USFWS, 1987; Engineering-Science and SWRI, 1988).

The historic abundance of otters in California was estimated at about 16,000 individuals (CDFG, 1976; Engineering-Science and SWRI, 1988). Extensive harvesting until the early 1900's resulted in range reduction and population decrease to less than 50 animals. With the prohibition of harvesting, range expansion has occurred, and recent population estimates are approximately 1,500 otters, excluding pups (MMS, 1985; Engineering-Science and SWRI, 1988). However, it appears that the sea otter population has not changed substantially since the early 1970's and that it may even have declined (USFWS, 1984; Engineering-Science and SWRI, 1988). The lack of population growth and range expansion has been attributed to an increase in mortality (MMS, 1984, 1985; Engineering-Science and SWRI, 1988), and CDFG suggested that accidental take in gill and trammel nets probably contributes significantly to the problem (USFWS, 1985; Engineering-Science and SWRI, 1988). It has also been hypothesized that food may be limiting within the center of the species range (Ames et. al., 1983; Engineering-Science and SWRI, 1988).

3.2.2.4.2 Presence in the Vicinity of the Project Area

The California Sea Otter, once abundant along the entire coast of California, generally does not extend in large population south of San Luis Obispo. Isolated individuals, however, are sighted frequently along the coast of VAFB (Engineering-Science and SWRI, 1988; ES, 1990a). Sea otters have been the focus of recent reintroduction efforts in the southern Channel Islands (USAF EA Atlas II, 1991). In 1990, a small breeding colony was discovered in the vicinity of Purisima Point and was still intact in 1992. Some of the colony may have immigrated from San Nicolas Island (USFWS, 1992).

3.3 Noise

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

3.4 Water Quality

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

3.5 Air Quality

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

3.6 Historical and cultural Resources

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

3.7 Community

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

3.8 Aesthetics

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

3.9 Waste Management

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

SECTION 4

ENVIRONMENTAL IMPACTS & CONSEQUENCES OF THE PROPOSED ACTION

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

4.1 Biotic Resources - Flora and Fauna

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

4.2 Threatened and Endangered Species

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

4.2.1 Facility Construction

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

4.2.2 Operations

No evidence exists of significant long term or cumulative impacts on biota due to Delta II launches (USAF Programmatic- January, 1988). No significant impacts to the California least tern, Southern sea otter, California brown pelican, and the Western snowy plover are predicted to occur as a result of launching the Delta II from SLC-2W. Noise data collected from a Delta II launch at CCAFS is part of the assessment for possible impacts to the listed threatened species of least tern and snowy plover. Noise levels generated by the Delta II will be slightly higher than the Delta I, while air emissions are similar for the two vehicles. Analysis, monitoring and mitigation measures prior to the first Delta II launch have been coordinated with the USAF and USF&WS to assist in determining potential impacts.

4.2.3 Cumulative Impacts

The California least tern nests at Purisima Point from mid April through August (USAF VAFB PLAN, August 1989), and is the species of greatest concern with respect to the proposed action. California Least Terns as well as the snowy plover are exposed to noise from aircraft landings and takeoffs, from trains, and infrequently from launches of other space vehicles. Minimizing the number of launches during the breeding season will also ensure that there are minimal cumulative impacts on the California least tern and snowy plover. Operational constraints limit the maximum launch capability from SLC-2W to 10 launches per year with a demonstrated rate occurring in the 1970s of 6 per year. Based on these facts, the operational maximum quantity of launches during the least tern season could be 4 launches per year, but present contracts and planning and realistic launch rates as reflected in the initial EA are 2-3 launches that may occur during the nesting season per year.

Other threatened and endangered species, such as the Western snowy plover, present at VAFB, are not expected to be impacted by the proposed action. Although cumulative effects are not presently known on these species, the coordinated plans for monitoring and the planned mitigations will provide a database for assessing potential

impacts. Monitoring and mitigation measures have been coordinated with the USAF and the USF&WS and will be in place prior to the first Delta II launch.

4.3 Noise Sources and Impacts

4.3.1 Facility Construction

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

4.3.2 Facility Operations

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

Operational effects on Least Terns and Western snowy Plovers at Purisima Point. Of particular concern with respect to noise is the nesting habitat of the California Least Terns and the Western snowy plovers at Purisima Point. The Purisima Point breeding grounds are located approximately 2,200 feet from SLC-2W (USAF VAFB PLAN, August 1989). Because subsequent Delta II launches from SLC-2W will be operationally held to a minimum during the breeding season, noise impacts will be relatively insignificant. Further, NASA, the USAF and USF&WS plan to provide monitoring of the Purisima Point area during the launch event.

4.3.2.1 Impacts from Launch Noise

Space vehicle launches produce noise and vibrations that could potentially damage terrestrial and freshwater biota in the immediate vicinity of the launch site. Noise and vibration can affect broad areas, but since a launch vehicle gains altitude and accelerates quickly after a launch, these stimuli will be of short term. Vibration amplitudes from the launches have not been measured and their effects on animals are poorly known. This assessment of vibration phenomena will be confined to the effects of noise.

Noise can affect animals 1) in the short term, by causing hearing damage or impairment, by triggering traumatic startles (startles in which the animal damages itself or others), or by masking biologically significant sounds (i.e., sounds made by predators), by driving animals out of favored areas, or by separating them; 2) in the mid-term, by affecting growth and resistance to disease, reducing energetic efficiency, causing mortality, provoking emigration or inducing reproductive failures; 3) in the long-term, by causing changes in distribution and abundance or altering predator - prey interactions, leading to ecological changes (Janssen, 1980).

Delta II space vehicle launches from SLC-2W will be limited, intensive events with sound levels above 100db lasting for approximately 5 seconds.

4.3.2.1.1 DELTA II Launch Noise

Significant sound levels are generated in the operation of rocket engines and launch vehicles. In general, one can classify the principle noise generating mechanisms as being related to: 1) combustion noise radiating from rocket motor chamber; 2) high velocity jet noise generated by the interaction of the rocket

exhaust jet with the atmosphere; 3) combustion noise associated with the post burning of the fuel rich combustion products exhausted into the atmosphere; 4) sonic booms associated with the high velocities of the launch vehicles.

The major noise source in the immediate vicinity of the launch arises as a result of combustion chamber noise, the interaction of the high speed exhaust jet, and the atmosphere and the post burning of the fuel rich combustion products in the atmosphere. The character of the sound may be described as intense in its level and rich in its low frequency components. The sound is relatively brief in duration and, due to the nature of launch activities, will occur relatively infrequently.

Sonic booms may be generated during the lift-off process as the vehicle accelerates to a very high speed. These sounds are the result of flight in excess of the speed of sound which results in very short duration impulses to the atmosphere. The intensity of the sonic booms are a function of the vehicle size, its configuration and its speed. Generally, sonic booms resulting from the vehicles ascending from VAFB occur downrange from the coastline, and, depending upon the trajectory, may cross the channel islands.

Activities associated with rocket propelled vehicle launches are accompanied by significant sound levels. These sounds include energy over a wide range of frequencies from 1 hertz (Hz) to over 100,000 Hz. In particular, sound level readings were recorded of a Delta II launch at Cape Canaveral Air Force Station (CCAFS) in order to characterize the sounds of the vehicle launch for engineering assessment on the launch vehicle components. In assessing impact, these measured and calculated levels were employed with consideration for the frequency of these events along with conjunction and the nature of the areas where the sound would occur. A map of CCAFS in Florida, including the Delta II Complex 17 is included for reference. See Figure 5.

Recent noise measurements from a Delta II launch from CCAFS on 7 July 1992 show a maximum calculated overall sound pressure level (OASPL) of 125.8 db at 3000 feet from LC-17 launch pad (115.1 db-A maximum A-weighted OASPL). For comparison data using identical measuring equipment, preliminary noise measurement data from a Peacekeeper missile launched from Vandenberg on 30 June 1992 indicated a maximum calculated overall sound pressure level of 125.7 db at 4000 feet from the launch pad.

The sound level of the DELTA II launch vehicle for VAFB is expected to be the same as CCAFS data (with some additional attenuation for ground and wind effects) and calculates to be between 100 and 126 db in the nesting area. However that vehicle has not launched from VAFB and no actual measurements or data exists taking either terrain or wind data into account.

4.3.2.1.2 Impact on Terrestrial Birds

Bird hearing is similar across taxa (Dooling, 1982) and generally less sensitive than that of humans. However, there are a few exceptions such as owls, pigeons and doves. Most birds, since they are relatively insensitive to sounds below 100 Hz, are unlikely to experience auditory damage from sonic booms or launch noise. However, no studies have been done to support or refute this notion. Diurnal raptors, such as the peregrine falcon and the bald eagle, are

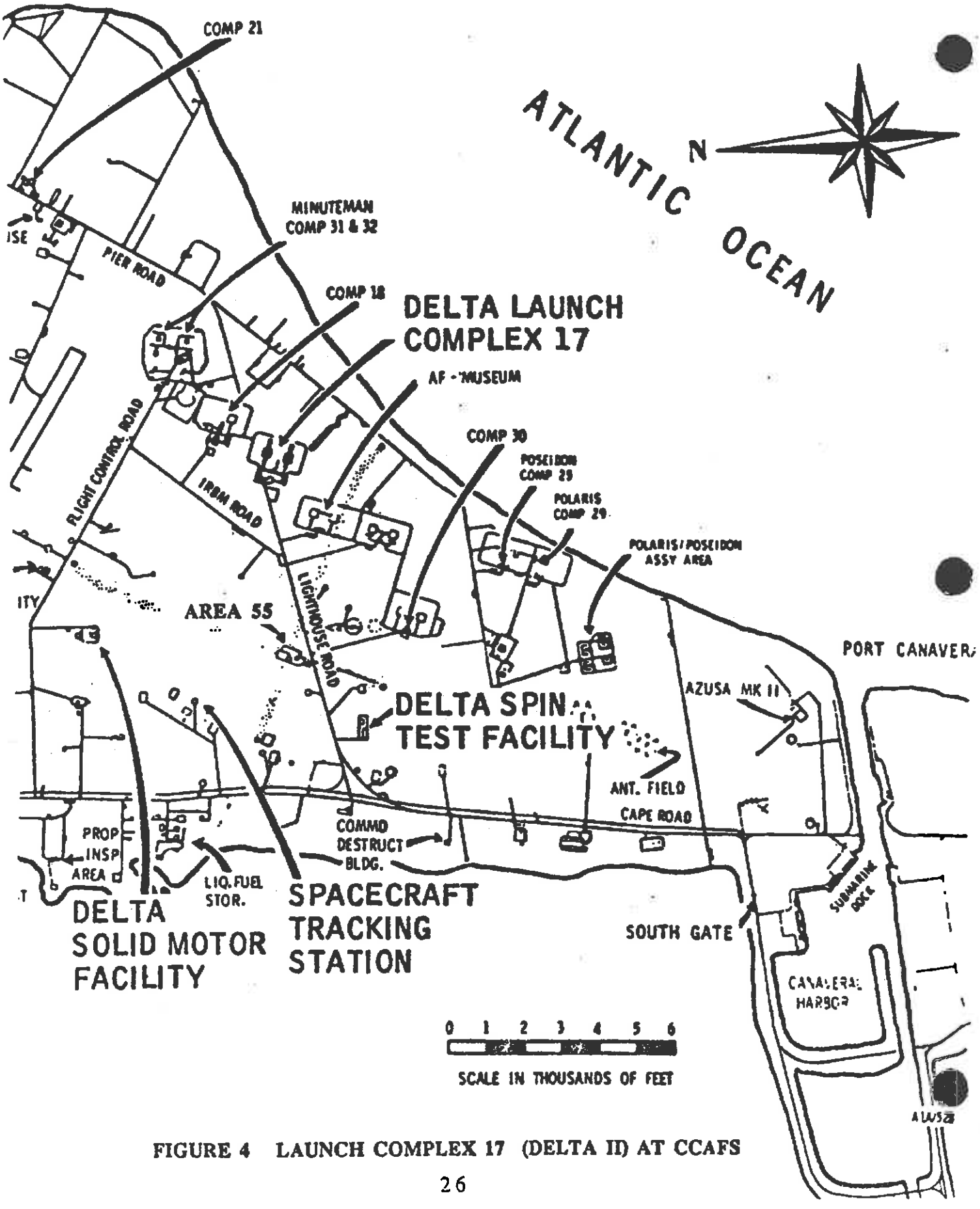


FIGURE 4 LAUNCH COMPLEX 17 (DELTA II) AT CCAFS

not likely to have audition as sensitive as that of the owls, nor is their range of sensitivity as great as the dove's, based on studies of the sparrow hawk (Trainer, 1946). The hearing of these endangered species will not be affected by noise from either the launches or sonic booms over the channel islands. A similar conclusion can be made for marine birds, based on studies of gulls (Counter, 1985). The threshold for temporary auditory damage from exposure to a single sonic boom has been found to occur in the range of 138 db to 169 db (Chappell, 1980).

The effects of helicopter noise on peregrine falcons and golden eagles was studied by Ellis (1981). Effects on nesting success, adult mortality or territory use were not found. Raptors did fly up in response to helicopter overflights (noise levels 82-114 dbA, but settled rapidly, and there was no evidence of opportunistic predation on their nests.

Startle responses in marine birds and mammals are known to occur at impulses of as little as 80 to 90 db SPL (Sound Pressure Level) (Bowles and Stewart, 1980). Mammals and birds will generally run or fly in response to sonic booms and loud overflights (Speich et al., 1987; Bowles and Stewart, 1980). However, despite rather intensive long-term studies, there is no evidence that leaping, self-damage, crushing, or breeding colony abandonment occur with either marine birds or marine mammals as a result of startle response brought on by sonic booms or loud overflights (Bowles and Stewart, 1980; Schreiber, 1980; Black et al., 1984; Speich et al., 1987). Therefore, with the limited duration of noise, significant impacts on the least tern and snowy plover are not expected to result from Delta II launches from SLC-2W.

4.3.3 Cumulative Impacts

Since the frequency of launches at SLC-2W is not expected to increase over historic levels, no cumulative noise impacts are predicted to occur.

4.4 Water Quality

4.4.1 Facility Construction

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

4.4.2 Operations

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

4.4.2.1 Impacts from Launch Exhausts

All current ELVs are powered by chemical boosters. These boosters operate by the combustion of a fuel and oxidizer. Emissions of air pollutants may take place from pre-launch, launch, and postlaunch activities as well as on pad or in-flight accidents. The major source of air pollutants will be during launch. Of these emissions, aluminum oxide, hydrochloric acid and oxides of nitrogen are recognized as potentially hazardous. It is expected that the sparse air pollutant emissions from launch may result in insignificant, short term, and localized impacts to terrestrial fauna in the immediate area of the launch point.

4.4.2.1.1 Delta II Exhaust Emissions

Diffusion models have been developed for the Titan missile program to calculate ground level concentrations of various pollutants present in ground clouds at launch (USAF, 1990). This information can be used to estimate Delta emissions by a conservative scaling of the results by 0.4 since the Delta SRMs contain much less than 40% of the pollutant amount as the Titan. Based on the Titan calculations, maximum 1 - hour hydrogen chloride (HCL) concentrations beyond the distance of the nearest VAFB property boundary are estimated to be well below the National Research Council (NRC) recommended 1-hour short-term public emergency guideline (SPEGL) of the 1 part per million (ppm) for all meteorological scenarios. The NRC recommends that 1-hour average HCL concentrations "in connection with community exposure during space-shuttle launches" not exceed a level of 1 ppm (NRC, 1987). These limits represent levels of HCL to which a healthy person can be exposed without detrimental effects. The current OSHA Permissible Exposure Limit (PEL - 8 hour time weighted average) is 5 ppm. The ground cloud persists for only a few minutes after ignition and is concentrated in the immediate pad area (Applied Biology, 1980). Exposure of the general population to potentially harmful concentrations of harmful concentrations of HCL is not anticipated.

Using the same modeling techniques, it was predicted that levels of CO would not exceed the National Ambient Quality Standards (NAAQS) 8-hour (hr) time weighted average except for brief periods during liftoff (ES&E, 1988). CO levels were predicted not to exceed the NAAQS of 35 ppm (1hr) average outside of the launch complex. Thus, exposure of the general population to levels of CO which exceed NAAQS standards is not anticipated.

Aluminum oxide levels should not exceed 11 milligrams per cubic meter (mg/m^3) at a distance of three miles from the launch site (ES&E, 1988). Aluminum oxide levels were predicted not to exceed the NAAQS for particulate matter 0.15 (mg/m^3) (24 hr average) because of the short intermittent nature of launch events.

Vehicle exhaust emissions associated with the launching of the Delta II include HCL, Al_2O_3, CO and NO_x. NASA Technical Memorandum 83103 states that Space Shuttle launches result in acute vegetation damage due to HCL deposition in an area of approximately 22 hectares near the launch pad (Schmalzer et al, 1985) However direct observations of a Titan IV launch (USAF, 1990) did not find any evidence of wet deposition of HCL outside the pad perimeter and the Delta vehicle produces an even smaller ground cloud. The report does indicate that effects are expected to increase in the near field depending upon launch frequency which dictates vegetation recovery time. The study also states that the effects of contaminants associated with the exhaust clouds on wildlife using areas which receive deposition are currently unknown but may be as significant as observed changes to vegetation.

Such detailed data is not available for the Delta II system. Although the Delta II vehicle produces exhaust contaminants similar to those of the Shuttle and Titan IV vehicles, the Delta II produces a much lower volume of contaminants (a conservative estimate of much less than 40% of the Titan IV). Thus, it is reasonable to assume that the degree of impacts to vegetative communities in the area would be proportionally lower in terms of area affected and intensity of effects.

The Delta II booster calculated release is 10 - 15% more carbon monoxide than previous Delta I boosters. However, exhaust carbon monoxide is not detectable in significant quantities because of the effects of afterburning on conversion of carbon monoxide to carbon dioxide. Neither Delta booster emits oxides of nitrogen. The Delta II booster emits 20 - 30% more hydrogen chloride than the Delta I booster. Hydrochloric acid emissions from the Delta vehicle present the only environmental hazard of any significance. This hazard is, however, moderate, and even under unfavorable meteorological conditions will be confined to restricted areas already historically exposed to HCL.

It is expected that air pollutant emissions from launch may result in insignificant, short-term, and localized impacts to terrestrial fauna. Studies of normal Titan IV launch show that actual operational emissions of Al_2O_3 and HCL generated have not resulted in significant impacts to terrestrial fauna (Engineering Sciences, 1987; ES and SWRI, 1988). These Titan IV launch emissions are greater in quantity than the emissions of the Delta II. For comparison, the Delta II SRM by propellant weight is 80-87% less than Titan IV and 89-93% less than the Shuttle.

A comparison of the solid rocket propellant weights by launch vehicle is shown in the following table. Emissions from these propellants are quantified in various EIS and EA documents for specific vehicles and projects. Normal releases are usually quantified in emissions released below 5000 feet in altitude but vary greatly from vehicle to vehicle depending upon factors such as motor quantities ignited, motor sizes, time in the lower atmosphere, etc. Differences exist, such as 2 or more stages for the Scout, Peacekeeper, Taurus, etc vs 2 large solids for Titan IV or Space Shuttle vs 6 ground ignited small solids for Delta II. This chart compares the total quantities of solid rocket motor propellants each vehicle contains.

SOLID ROCKET PROPELLANT COMPARISON WEIGHTS BY LAUNCH VEHICLE *

VEHICLE TYPE	EACH SRM Propellant Quantity, lbs.	QUANTITY TYPE SRM	TOTAL WEIGHT	REFERENCE
STS	1,111,760	2 Ground Start	2,223,520	NASA 1978
TITAN IVSRMU	680,394	2 Ground Start	1,360,788	USAF SLC-7 EIS
TITAN IV SRM	591,692	2 Ground Start	1,183,384	TITAN IV EA
DELTA I	23,303	6 Ground Start	139,818	MDA
		3 Altitude Start	69,909	MDA
DELTA II	25,807	6 Ground Start	154,842	MDA
		3 Altitude Start	77,421	MDA
TAURUS I	95,810	1 Ground Start	95,810	AIAA-92-1839
	26,748	1 Altitude Start	26,748	AIAA-92-1839
SCOUT	27,885	1 Ground Start	27,885	NASA
	8,208	1 Altitude Start	8,208	NASA

* All vehicles have additional solid or liquid stages that ignite higher in the atmosphere or in space for payload orbit insertion and are not included. The next sequenced altitude start motors are included for reference only.

During launch operations, there is an acidic mist formed by contact of the acoustic dampening water with the solid motor exhaust during ignition that would be deposited regionally around the launch point. This launch cloud extends from the launch point for a radius of 600-900 feet depending on meteorological conditions and would be present for a very short time. Potential effects of a ground cloud are governed by the speed and direction of its movement, local meteorological conditions, and concentration of the chemical constituents in the ground cloud. The ground cloud dissipates rapidly, with conversion of its constituents to CO_2 through interaction of heat, oxygen and water vapor. The ground cloud persists for only a few minutes after ignition and is concentrated in the pad area (Applied Biology, 1980). Long-term impacts from the exhaust ground cloud would not be significant based on the frequency of launch events, expected cloud dissipation and relative insignificance of carbon dioxide over a short period. There could be some acid and metal dust deposited on structures and the ground in the immediate area of the ground cloud, but deposition will be of the same magnitude as previous launches and restricted to already disturbed areas.

In a normal launch, the exhaust products are not released at a single point, but are distributed along the vehicle trajectory. For reference, the Delta II ignites six solids on the ground and at approximately 20 seconds is at an altitude of 5000 feet. The remaining three solids ignite at an altitude of approximately 60,000 feet (See 2.3.7, flight characteristics). Due to the acceleration of the vehicle and the staging process, the quantities emitted per unit length of trajectory are present at ground level and decrease continuously.

In the event of a vehicle failure in flight, the vehicle destruct system typically ruptures the propellant tanks and releases all remaining propellants. The propellants will normally ignite and burn; however, only limited information is available concerning the products formed or the extent to which the propellants are consumed.

The potential impacts associated with Delta launches are part of pre-existing conditions at SLC-2W and no adverse effects are known.

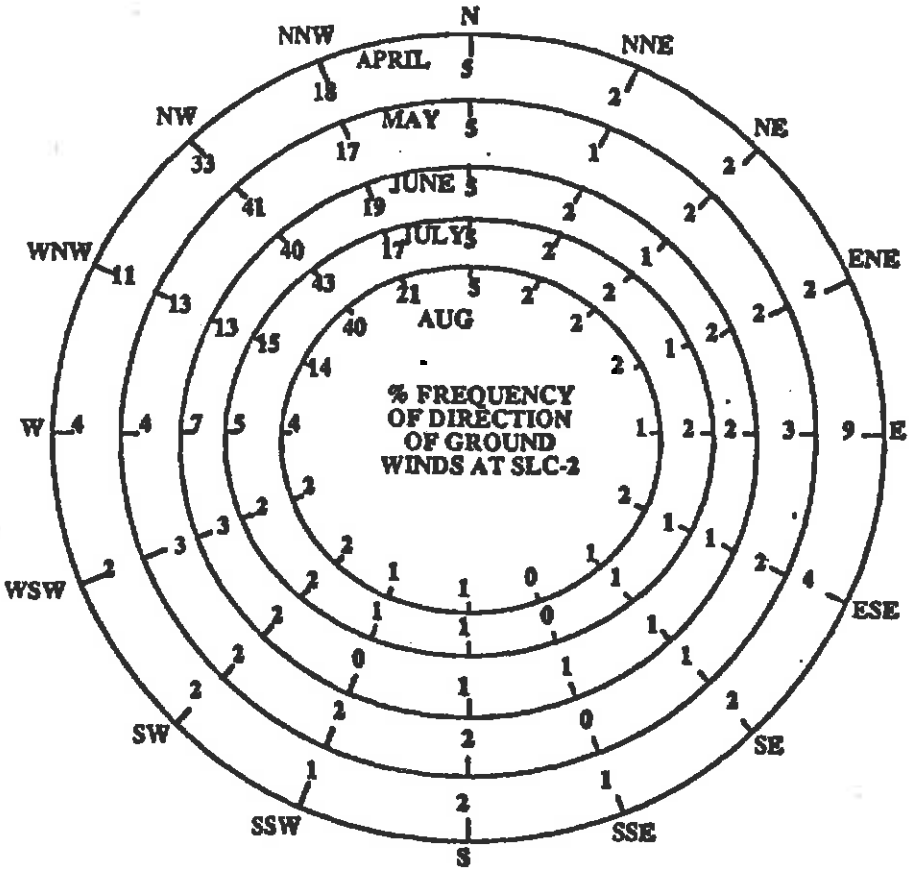
4.4.2.1.2 Impact on Terrestrial Bird Nesting Area

With the prevailing winds from the northwest quadrant, the ground cloud is directed away from the nesting areas on the beach. The wind data obtained from the VAFB Weather Squadron has, during the months of April to August, winds 70-80% of the time and greater than 5 mph 60-70% of the time coming from 315° which is tangential to the breeding area and the launch pad. See Figure 6. The occurrence of a persistent ground cloud is minimized by pre-launch meteorological monitoring to avoid scheduling of launches during unfavorable conditions. Because of these prevailing meteorological conditions and the 600-900 foot radius from the launch point of the launch cloud, it is expected there will be no fallout on the nesting areas from launch caused emissions.

4.5 Air Quality

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

SLC-2W WIND DIRECTIONS FROM TOWER 102 AT 12 FOOT LEVEL (LOCATION 900' NNE OF LAUNCH POINT)



	% FREQUENCY OF WIND SPEED					SPEED (EXTREME)		
SPEED	0-4	5-9	10-14	15-19	20-24	HI	LOW	MEAN
APRIL	23	37	26	11	3	39	0	10.2
MAY	25	38	26	10	1	56	0	9.4
JUNE	27	43	25	5	0	44	0	8.6
JULY	38	44	16	2	0	44	0	7.1
AUG	39	45	14	2	0	21	0	6.7
AVERAGE	30	41	22	6	< 1	41	0	8.4

FIGURE 5 WIND ROSE FOR SLC-2W

4.6 Historical and Cultural Resources

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

4.7 Community Impacts

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

4.8 Aesthetics

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

4.9 Waste Management

This SEA section is the same as in the initial Environmental Assessment (EA) dated September 1991.

SECTION 5

MITIGATION MEASURES

The Modification to the Space Launch Complex 2W for accommodating launches of the Delta II and the Delta II launch operations from SLC-2W are not expected to result in significant impacts to the biological resources of VAFB.

Since detailed information concerning exhaust and noise impacts on certain species is relatively sparse, mitigating measures and studies will be undertaken to further reduce possible impacts. Programs to determine impacts and mitigations currently are being addressed by NASA, USAF and the USFWS.

Coordination between the USF&WS and a variety of agencies has been ongoing to protect and preserve species and to investigate and determine various effects on endangered species from external sources, ie predation, acoustics, emissions, etc.

Recent studies and actual field measurements are ongoing to study rocket effects on wildlife. NASA, the USAF, and Mcdonnell Douglas are participating with other agencies in this combined effort. The resulting documentation and information will assist the USFWS and academia and will result in a better understanding of the local species of least tern and snowy plover not only for their protection but also to supply information to assist in protecting other wildlife species as well.

The mitigation and investigation measures listed below are in place or planned to mitigate potential impacts to the California least tern, snowy plover and Southern sea otter population at VAFB. The USAF/VAFB is the lead agency coordinating these efforts and is developing a least tern and snowy plover management plan which incorporates elements of the mitigations listed.

5.1 Testing

1. Acoustic noise data on a Delta II launch vehicle at CCAFS identical to the Delta II that will be launched from SLC-2W has been measured and presented to the USAF and transmitted to the USFWS for analysis.
2. Acoustic noise data and exhaust plume depositions from another launch vehicle, Peacekeeper, at VAFB has also been measured for comparison and presented to the USAF and USFWS for analysis and correlation.
3. Acoustic noise data will be measured on the first available launch from SLC-2W. Coordination will be accomplished with the USAF, NASA, and USFWS.
4. Exhaust plume deposition will be monitored on the first available launch from SLC-2W. Coordination will be accomplished with the USAF, NASA, and USFWS.
5. The U.S Department of Agriculture, Animal Damage Control, will monitor predation and conduct testing, evaluations and development of ecologically sensitive, non-lethal predator control measures in a unique, relatively pristine ecosystem at VAFB.

5.2 Other Measures

1. Habitat shelters (roof tiles) for the least terns will be established prior to the start of the 1993 nesting season.

3. Least tern decoys will be installed at VAFB prior to the start of the 1993 nesting season.

4. The least tern and snowy plover monitoring program will be increased from present levels.

5. Aircraft will be restricted from flying within 1900 foot of the least tern colony.

6. Emergency fuel jettison point from aircraft will be a minimum of two miles off shore.

7. Base biologist will monitor sea otter population before and after the Delta II launch.

5.3 Agreements

1. USAF will enter into a Memorandum of Agreement with USFWS to protect and enhance the least tern and snowy plover habitat and population at VAFB.

SECTION 6

REFERENCES

Ames, J.A., R.A. Hardy, and F.E. Wendell, 1983,,"Tagging Methods for Sea Otters, Enhydra lutris", Californian Department of Fish and Game, Vol. 69, No. 4.

Anderson, D.W., and J.O. Keith, 1980, "The Human Influence on Seabird Nesting Success: Conservation Implications", Biol. Cons. 18: 65-80.

Applied Biology, 1980; from Biological Assessment for the Titan II and Titan IV Space Launch Vehicle Modifications and Launch Operations Programs, June 1990.

Benech, S.V., 1981, "Observations of the Sea Otter, Enhydra Lutris, Population Between Point Buchon and Rattlesnake Creek, San Luis Obispo, California, January through December 1981", ECOMAR, Inc., VII-6-81.

Atwood, J.L. and D.G. Minsky, 1983, "Least Tern Foraging Ecology at Three Major California Colonies", Western Birds 14: 57-72.

Bevier, L. 1983, "Least Tern Breeding Season In San Luis Obispo, Santa Barbara , and Ventura Counties, 1982, Unpublished Report.

Black, B.B., M. Collopy, H.F. Percival, A.A. Tiller, P.G. Bohall, 1984, "Effects of Low-level Military Training Flights on Wading Bird Colonies in Florida", Prepared by Floridia Cooperative Fish and Wildlife Research Unit, University of Florida, Gainesville, for the USAF, Technical Report 7.

Bowles, A., and B.S. Stewart, 1980, Disturbances to the Pinnipeds and birds of San Miguel Island, 1979 - 1980", In: Potential effects of Space Shuttle Sonic Booms on the Biota and Geology of the California Channel Island: Research Reports, 99-137, J.R. Jehl, Jr., and C.F. Cooper, eds., Prepared for San Diego State University and Hubbs Sea World Research Institute for SAF, Space Division, Technical Report 80-1.

Briggs, K.T., W.B. Taylor, D.B. Lewis, P.R. Kelly, and D.A. Croll, 1983, "Brown Pelicans in Central and Northern California, 1980-1982. Journal of Field Ornithology 54: 353-373.

CDFG, 1976, "A Proposal for Sea Otter Protection and Research and Request for Return of Management of the State of California, Unpub. Report. Vol. I, Text and Summaries.

Chambers Group. Inc. 1986, "Draft Environmental Impact Report/Environmental Impact Statement for Proposed ARCO Coal Oil Point Project, Technical Appendix 6, Terrestrial and Freshwater Biology. Prepared by State Lands Commission, County of Santa Barbara, U.S. Army, Corps of Engineers, L.A. District.

Chappell, 1980; from Biological Assessment for the Titan II and Titan IV Space Launch Vehicle Modifications and Launch Operations Programs, June 1990.

Collins, P.W., "Terrestrial Vertebrate and Marine Bird Biota of the Project Area. In: Environmental Impact Statement for the Space Launch Complex 7 on South Vandenberg AFB", Prepared for Environmental Solutions, Irvine CA.

Counter, 1985; from Biological Assessment for the Titan II and Titan IV Space Launch Vehicle Modifications and Launch Operations Programs, June 1990.

Daugherty, A.E., 1985, "Marine Mammals of California, Third Revision", 12979.

Dooling, 1946; from Biological Assessment for the Titan II and Titan IV Space Launch Vehicle Modifications and Launch Operations Programs, June 1990.

Ellis, D.H., 1981, "Responses of Raptorial Birds to Low-level Military Jets and Sonic Booms", Prepared by the Institute for Raptor Studies for USAF and USFWS.

Engineering Sciences, 1987; from Biological Assessment for the Titan II and Titan IV Space Launch Vehicle Modifications and Launch Operations Programs, June 1990.

Engineering-Science and SWRI (Sea World Research Institute) , 1988, "Biological Assessment for the Titan II and Titan IV Space Launch Vehicle Modifications and Launch Operations Programs", Prepared for USAF Headquarters Space Division, Los Angeles, CA.

Environmental Protection Agency, "Compilation of Air Pollution Emission Factors" 1989.

Environmental Solutions, Inc., "Biological Assessment Titan IV/Centaur Launch Complex" Air Force Headquarters Space Systems Division Report, Vandenberg Air Force Base, California, March 1990.

Estes, J.A., and R.L. Jameson 1983, "Summary of Available Population Information of California Sea Otters" , POCS Technical Paper No. 83-11. Prepared by USFWS for Minerals Management Service, Interagency Agreement No. 14-14-001.

Federal Register, 1993, Volume 58, Number 42, Pacific Coast Western Snowy Plover history, etc., Friday, March 5, 1993.

Foerster, 1987; from Biological Assessment for the Titan II and Titan IV Space Launch Vehicle Modifications and Launch Operations Programs, June 1990.

Gress, F, and D.W. Anderson, 1983, "Reproductive Success of Brown Pelicans in Southern California Bight, 1982", Prepared for the Calif. Dept. Fish and Game, Sacramento, Ca.

Gress, F, and D.W. Anderson, 1984, "Reproductive Success of Brown Pelicans in Southern California Bight, 1984", Prepared for the Calif. Dept. Fish and Game, Sacramento, Ca.

Hendrickson, Beth "Current Status of Populations and Some Ecological Observations: Report of Cirsium loncholepis", Nature Conservancy Report, October 17, 1990.

Ingram, Stephen W., "An Examination Of Castilleja mollis and its Distribution", Report to the Nature Conservancy, (Unpublished Report), July 24, 1991.

Jassen, 1980; from Biological Assessment for the Titan II and Titan IV Space Launch Vehicle Modifications and Launch Operations Programs, June 1990.

Kenyon, K.W., 1969, "The Sea Otter in the Pacific Ocean", U.S. Bureau of Sport Fisheries and Wildlife, North American Fauna, 68:1-352.

Lehman, P. 1982. "The Status and Distribution of the Birds of Santa Barbara County, California, MS Thesis, University of California, Santa Barbara, CA.

Lewis, D.B., and F. Gress, 1987, "Seabird Monitoring in Channel Islands National Park 1986", Prepared for Channel Islands National Park.

Massey and Atwood, 1982: 1984; from Biological Assessment for the Titan II and Titan IV Space Launch Vehicle Modifications and Launch Operations Programs, June 1990.

MMS (Mineral Management Services), 1984, "Biological Assessment for Threatened and Endangered Species of the Southern Santa Maria Basin with Respect to Proposed Oil and Gas Development and Production Offshore Point Conception and Point Arguello, Santa Barbara County, California".

MMS (Mineral Management Services), 1985, "Biological Assessment of Threatened and Endangered Species of the central Santa Maria Basin from Oil and Gas Development and Production Offshore Point Pedernales, Santa Barbara County, California".

National Aeronautics and Space Administration, "Environmental Assessment for Modification of Space Launch Complex - 2W", Vandenberg Air Force Base, California, September 1991.

Nature Conservancy, 1992, "Report on the California Least Tern 1992 Breeding Season Along the Central California Coast", Compiled by Mary S. Perry, February 5, 1992.

Page, G.W. and L.E.Stenzel, 1981, "The Breeding Status of the Snowy Plover in California", Western Birds 12: 1-40.

Page, G.W., L.E.Stenzel, W.D. Shuford, 1991, "Distribution and Abundance of the Snowy Plover on its Western North American Breeding Grounds", J. Field Ornithol., 62(2):245-255.

Page, G.W., F. C. Bidstrup, R. J. Ramer, and L. E. Stenzel, 1986, "Distribution of Wintering Snowy Plovers in California and Adjacent States", Western Birds 17: 145-170.

Perry, M.S. 1992, "Report on the California Least Tern 1992 Breeding Season Along the Central California Coast. A Report to the Nature Conservancy.

Remsen, J.V., Jr., 1978, "Bird Species of Special Concern in California: An Annotated List of Declining or Vulnerable Bird Species", California Department of Fish and Game, Nongame Wildlife Investigations, Wildlife Management Branch Administrative Report Number 78-1.

Schreiber, E.A., and R.W. Schreiber, 1980, "Effects of Impulse Noise on Seabirds of the Channel Islands", n: Potential effects of Space Shuttle Sonic Booms on the Biota and Geology of the California Channel Island: Research Reports, 138-162, J.R. Jehl, Jr., and C.F. Cooper, eds., Prepared for San Diego State University and Hubbs Sea World Research Institute for SAF, Space Division, Technical Report 80-1.

Smith, Arthur E., "A Morphological and Seasonal Comparison of Monardella crispa, Monardella undulata var. Frutescens, and an Introgressant Population of those Species", Report to the Nature Conservancy, July 27, 1991.

Speich, B.M., B.L.Troutman, A.C. Gieger, P.J. Meehan-Martin, and S.J. Jeffries, 1987, "Evaluation of Military Flight Operations on Wildlife of the Copalis National Wildlife Refuge, 1984-1985, Prepared by the Washington Department of Game, Wildlife Management Division for the U.S. Navy, Western Division, Naval Facilities Engineering Command.

Tate, J., Jr., 1986, "The Blue List for 1986", American Birds 40(2): 227-236.

Trainer, J.E., 1946, "The Auditory Acuity of Certain Birds", Ph.D. dissertation, Cornell University, Ithaca, New York.

United States Air Force, " Draft Environmental Impact Statement Construction and Operation of Space Launch Complex 7", Vandenberg Air Force Base, California, July 1989.

United States Air Force, 1987. "Environmental Assessment for Repair and Restoration of Space Launch Complex 4 at Vandenberg Air Force Base". Prepared by Versar, Inc., Columbia, MD for USAF Headquarters Space Division, Vandenberg AFB, CA.

United States Air Force, "Vandenberg Comprehensive Plan, Vandenberg Air Force Base," Vandenberg Air Force Base, Ca., August 1989.

United States Air Force, 1991, "Final Environmental Assessment, Vandenberg Air Force Base Atlas II Program", Prepared by Versar, Inc., 29 August 1991.

United States Air Force, Environmental Assessment for Space Launch Complex 17C, Cape Canaveral Air Force Station, Florida, Preliminary Draft, September 21, 1990

United States Air Force, Environmental Impact Analysis Process, Environmental Assessment, Titan IV Space Launch Vehicle Modification and Operation, Vandenberg Air Force Base, CA., February 1988.

United States Air Force, Programmatic Environmental Assessment of Commercial Expendable Launch Vehicle Programs at Vandenberg Air Force Base, Vandenberg Air Force Base, CA., January 1988.

USFWS, 1993; "Biological Opinion for Missile Launches from Two Sites at Vandenberg Air Force Base, Santa Barbara County, California (1-8-93-F-8)", April 12, 1993.

USFWS, 1980; from Biological Assessment for the Titan II and Titan IV Space Launch Vehicle Modifications and Launch Operations Programs, June 1990.

USFWS, 1989, "Endangered and Threatened Wildlife and Plants: Animal Notice of Review", Notice of Review, 50 CFR Part 17, Federal Register 54(4): 554-579.

USFWS, 1983, "A Recovery Plan for the California Brown Pelican", U. F. Fish and Wildlife Service, Portland, Or.

USFWS, 1992, "Fifth Annual Report, Southern Sea Otter Translocation to San Nicolas Island", August 1991 - July 1992).

Wilbur, S. R. 1974a, "The Literature of the California Least Tern", U.S. Fish and Bureau of Sport Fisheries and Wildlife, Special Scientific Report--Wildlife No. 175, Washington, D.C.

Zelder, Paul H. and Chris Frazier, "The Status of Surf Thistle, Cirsium rhothophylum, and the Coast Specticle Pod, Dithyrea maritima of Vandenberg Air Force Base, California", Nature Conservancy Report, June 3, 1991.

Zembal, 1984; from Biological Assessment for the Titan II and Titan IV Space Launch Vehicle Modifications and Launch Operations Programs, June 1990.

APPENDIX A

DELTA II Program Consultations

United States Air Force and United States Fish and Wildlife Service

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS 30TH SPACE WING (AFSPACECOM)
VANDENBERG AIR FORCE BASE, CALIFORNIA 93437-5000

31 AUG 199?

Dr Linda Dawes
US Fish and Wildlife Service
Southern California Field Station
2730 Loker Avenue West
Carlsbad CA 92008

Dear Dr Dawes

This letter is in response to your letters dated July 10, 1992 and July 22, 1992, and subsequent discussions and field visits concerning the informal consultations on the Taurus and Delta II programs. The US Air Force agrees to accomplish the following actions to mitigate any potential impacts to the California Least Tern and Southern Sea Otter populations at Vandenberg AFB:

a. Launch noise and exhaust plume deposition will be monitored for the spring 1993 Taurus launch and the fall 1993 Delta II launch. Monitoring data will be analyzed after each launch by the US Fish and Wildlife Service to determine potential impacts to endangered species, and a report of findings will be prepared and provided to the Vandenberg Environmental Management Office.

b. Launches will not occur during the California Least Tern nesting period when the wind is blowing toward the Purisima Point Colony.

c. The Air Force agrees to provide funds to the US Fish and Wildlife Service in the amount of $5,000 to fund scientific research on the impacts of noise to avian species.

d. Aircraft will avoid flight within a 1,900 foot radius of any California Least Tern Colony during the nesting period.

e. The Air Force agrees to place the emergency aircraft fuel jettison point a minimum of two nautical miles offshore.

f. The Southern Sea Otter population will be monitored by the base wildlife biologist before and after the above mentioned launches.

g. The Air Force will purchase 50 roof tiles to be used as shelters prior to the 1993 California Least Tern nesting season.

h. The Air Force will provide funds to the US Fish and Wildlife Service in the amount of $1,800 to purchase 125 California Least Tern decoys for placement at Vandenberg AFB.

i. The Air Force will provide funds to the USDA Animal Damage Control in the amount of $20,000 to provide monitoring and a report on the extent of predation, test and evaluate the effectiveness of non-lethal protection measures and recommend predator control techniques at the Purisima Point Colony and if nesting is attempted at the mouth of San Antonio Creek.

j. The Air Force agrees to increase the existing monitoring program to three days a week.

k. The Air Force agrees to remove to ground level the tall wooden pole that is near the Purisima Point Colony being used as a perch by avian predators.

l. The Air Force agrees to enter into a Memorandum of Agreement with the US Fish and Wildlife Service to protect and enhance California Least Tern habitat and populations at Vandenberg AFB. This agreement will result in a formal California Least Tern management program as information is gathered.

We understand that the enhancement of an endangered species population takes time and we look forward to working with the service in this endeavor.

It is our understanding that the above mitigation requirements fulfills our obligation under the Endangered Species Act for Taurus and Delta II launches at Site 576E and SLC-2 for any potential effects to endangered species. We have enjoyed the cooperative efforts of the Service in this matter.

Sincerely

LOUIS D. VAN MULLEM, Lt Col, USAF
Deputy Chief, Environmental Management

United States Department of the Interior

FISH AND WILDLIFE SERVICE

ECOLOGICAL SERVICES
Ventura Field Office
2140 Eastman Avenue, Suite 100
Ventura, California 93003

April 12, 1993

Mr. Mackey J. Real, Jr., Chief
30th Space Wing/Environmental Management
Department of the Air Force
Vandenberg Air Force Base, California 93437

Subject: Biological Opinion for Missile Launches From Two Sites at Vandenberg Air Force Base, Santa Barbara County, California (1-8-93-F-8)

Dear Mr. Real:

This biological opinion responds to your request for formal consultation with the Fish and Wildlife Service (Service) pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (Act). Your initial request, which pertained only to the Space Launch Complex-2 West (SLC-2W) site, was dated January 7, 1993, and received by us on January 11, 1993. Your second request, which included operation of the 576E site, was dated February 23, 1993, and received by us on February 24, 1993. At issue are the impacts that operation of SLC-2W and 576E during the nesting season may have on the California least tern (*Sterna antillarum browni*), a federally listed endangered species and the western snowy plover (*Charadrius alexandrinus nivosus*), a federally listed threatened species. This biological opinion will not address the brown pelican (*Pelicanus occidentalis*) or southern sea otter (*Enhydra lutris nereis*). The Service and the U.S. Air Force have agreed, through informal consultation, that operation of SLC-2W and 576E would not affect these species.

This biological opinion was prepared using information: included with the requests for consultation; contained in the environmental assessment for Modification of SLC-2W Medium Expendable Launch Vehicle Services (SLC-2W EA) (National Aeronautics and Space Administration [NASA] 1991) and its subsequent supplemental environmental assessment (SLC-2W SEA) (NASA 1992); contained in the report on noise measurements taken during Delta launches (Keegan 1992); contained in the environmental assessment for the Taurus Standard Small Launch Vehicle Program (Taurus EA) (U.S. Air Force 1992) and its subsequent supplemental environmental assessment (Taurus SEA) (U.S. Air Force 1993); contained in the report on noise measurements taken during a Peacekeeper launch July, 1992 (McInerny 1992); contained in your August 31, 1992, letter to the Carlsbad Field Office of the Service; obtained during informal consultation between our staffs; and contained in our files.

Biological Opinion

It is the opinion of the Service that the proposed projects are not likely to jeopardize the continued existence of the California least tern or the western snowy plover. Critical habitat has not been designated for these species. Therefore, the proposed action would not adversely modify critical habitat.

Description of the Proposed Action

The Air Force proposes to launch vehicles from sites SLC-2W and 576E on Vandenberg Air Force Base (VAFB) during the California least tern and western snowy plover nesting season (between mid-March and mid-September). NASA requires a space launch azimuth of 190 degrees or greater to support polar and other high inclination orbits. The unique location of SLC-2W on VAFB provides a launch azimuth from 190 to 215 degrees. These orbits provide coverage of the entire planet for weather and earth resources surveillance, communications relay, defense, navigational systems, and other scientific purposes (NASA 1991). The Air Forces proposes the Taurus launch in support of the U.S. Department of Defense space program and the Advanced Space Technology Program (U.S. Air Force 1992).

Standard Delta II vehicles are proposed to be launched from SLC-2W which is located north of the Santa Ynez River and east of La Purisima Point approximately 3000 feet inland of the Pacific Ocean. At least one launch is proposed during each nesting season in 1994, 1995, and 1996. However, as many as four launches may occur per nesting season. The SLC-2W is located approximately 2400 feet from a California least tern and western snowy plover nesting site (see enclosed map).

The SLC-2W consists of a launch pad and various support structures including: mobile service and fixed umbilical towers, blockhouse, and facilities for horizontal processing, the solid rocket motor, vehicle assembly, fueling, preflight checkout, and launch. The facility is currently being configured to launch a standard Delta II launch vehicle. These launch vehicles, facilities, and the proposed modifications to the facilities are described in the SLC-2W EA (NASA 1991).

The Air Force proposes to launch one Taurus vehicle from site 576E on VAFB during the California least tern and western snowy plover nesting season. Launch site 576E is located 3.2 miles north of the Santa Ynez River. It is approximately 6000 feet southeast of SLC-2W and an estimated 1200 feet inland of the Pacific Ocean. Launch site 576E is approximately 2600 feet from the California least tern nests and an estimated 2250 feet from the nearest western snowy plover nests (Allan Naydol, pers. comm., 1993).

Launch site 576E consists of an existing launch facility, concrete pad, and a 180-foot deep silo with underground access. The Taurus launch vehicles, 576E launch site facilities, and the proposed minor modifications to the launch facilities are described in the Taurus EA (U.S. Air Force 1992).

The SLC-2W SEA (NASA 1992) and Taurus SEA (U.S. Air Force 1993) contain the following mitigation and conservation measures which have been or will be implemented as part of the proposed action:

1. Acoustic measurements will be performed on the first available launch from SLC-2W and 576E and made available to the Service. Coordination will continue between the Air Force, NASA, and the Service.

2. Exhaust plume deposition will also be monitored on the first available launch from SLC-2W and 576E and the information gathered will be made available to the Service. Coordination will continue between the Air Force, NASA, and the Service.

3. The Air Force will enter into a Memorandum of Agreement with the Service to protect and enhance the California least tern habitat and population at VAFB.

    a. The U.S. Department of Agriculture Animal Damage Control will monitor predation and conduct testing, evaluation, and development of ecologically sensitive, non-lethal predator control measures.

    b. Habitat shelters (roof tiles) for the California least terns will be placed in the colony prior to the start of the 1993 nesting season. Roof tiles provide chicks protection from avian predation.

    c. The wooden pole near the La Purisima Point least tern colony which could be used as a perch by avian predators will be removed.

    d. California least tern decoys will be installed at the La Purisima Point colony and other appropriate areas at VAFB prior to the start of the 1993 nesting season.

    e. The California least tern monitoring program will be increased from past levels to three days a week at all sites.

    f. Aircraft will be restricted from flying within 1900 feet of the California least tern colony.

    g. Emergency fuel jettison points for aircraft will be a minimum of two miles off shore.

Your letter dated August 31, 1992, contains the following additional mitigation and conservation measures which have been or will be implemented as part of the proposed action:

1. Launches will not occur during the California least tern nesting season when the wind is blowing toward the La Purisima Point colony.

2. The Air Force will provide funds to the Service in the amount of $5,000 to fund scientific research on the impacts of noise to avian species.

3. The Air Force will provide funds to the Service in the amount of $1,800 to purchase 125 California least tern decoys for placement at VAFB.

4. The Air Force will provide funds to Animal Damage Control in the amount of $20,000 to provide the following for the La Purisima Point and San Antonio Creek colonies: monitoring and a report regarding the extent of predation; an evaluation of the effectiveness of non-lethal protection measures; and recommendations for predator control techniques.

Representatives from VAFB's Environmental Management staff and the Service have also discussed the need to establish a monitoring program for the western snowy plover on VAFB (James Johnston, pers. comm., 1993).

Effects of the Proposed Action on the Listed Species

Species Account

California least tern.

The California least tern was federally listed as endangered in 1970. Details of the life history, biology, and reasons for decline of the California least tern are contained in the 1980 Recovery Plan (U.S. Fish and Wildlife Service 1980) and are mentioned briefly here.

The California least tern is a bird of the family Laridae. It is one of 12 recognized subspecies of the least tern, three of which inhabit the United States. The breeding range of this subspecies is described as extending along the Pacific Coast from San Francisco Bay, California, to Bahia de San Quintin, Baja California, Mexico.

The California least tern measures approximately nine inches long and weighs roughly 1.6 ounces. Males and females look alike with a black cap, gray wings with black tips, orange legs, and a black-tipped yellow bill. Immature birds have darker plumage and a dark bill with distinctive white heads and dark eye stripes. It is a migratory species which arrives in California by late April to breed and departs to unknown southerly locations by late August. It nests on coastal, sandy, open areas, usually around bays, estuaries, and creek and river mouths. Nests are simply scrapes or depressions in the sand that the birds often adorn with small fragments of shell or pebbles. During the average 21 day incubation period the nest is tended continually. Both adults of a mated pair take turns tending the nest. This is followed by a period of approximately three weeks in which the adults tend the flightless but quite mobile chicks. After fledging, the young terns do not become fully proficient at capturing fish until after they migrate from the breeding grounds. Adults and fledglings usually leave the breeding colony within about 10 days of fledging.

This species was once common along the central and southern California coast. The precipitous decline of the California least tern is attributed to prolonged and widespread destruction and degradation of nesting and foraging habitats as well as increasing human disturbance to breeding colonies. Conflicting uses of southern and central California beaches during the

California least tern nesting season have led to isolated colony sites that are extremely vulnerable to predation from native, feral and exotic species, overwash by high tides, and vandalism and harassment by beach users. Since its classification as a Federal and State endangered species, considerable effort has been expended on annual population surveys, protection and enhancement of existing nesting colonies, and the establishment of new nesting locations. Control of predators constitutes one of the most crucial management responsibilities at California least tern nesting sites.

The nesting colonies in Santa Barbara and San Luis Obispo counties are a relatively small portion of the total state-wide population. However, they represent the only currently active breeding areas between Ventura County and San Francisco Bay. Monitoring efforts on VAFB have consisted of two visits per week to the La Purisima Point colony. One visit per week was made to the site north of La Purisima Point and to the Santa Ynez River mouth depending upon the presence of California least terns at those sites. The colony at La Purisima Point has ranged from zero to approximately 30 pairs that produced from zero to approximately 25 fledglings per year since 1978. In 1992, this colony consisted of 12 pairs that produced only one successful fledgling. It is believed that the major detrimental factor was the high rate of natural predation from coyotes (Perry 1992).

Western snowy plover.

The Pacific coast population of the western snowy plover was federally listed as threatened March 5, 1993, under the Act. Details of the life history, biology, and reasons for decline of the Pacific coast population of the western snowy plover are contained in Volume 58, Number 42 of the Federal Register (1993) and are summarized below.

The snowy plover is a bird of the family Charadriidae, in the order Charadriiformes, the shorebirds. This species is a small, pale-colored shorebird with dark patches on either side of the upper breast. Birds of the Charadriidae family are characterized by being compactly-built shorebirds that are thicker-necked than typical sandpipers. Their short pigeon-like bills, large eyes, and locomotory trait of short starts and stops further typify the family. Snowy plovers forage on invertebrates in the wet sand and among surf-cast kelp within the intertidal zone; in dry, sandy areas above the high tide; on salt pans; spoils sites; and along the edges of salt marshes and salt ponds. Little quantitative information is available on food habits.

The western snowy plover is one of the two recognized subspecies in North America. This subspecies breeds on the Pacific coast from southern Washington to southern Baja California, Mexico, and in interior areas of Oregon, California, Nevada, Utah, New Mexico, Colorado, Kansas, Oklahoma and north-central Texas as well as coastal areas of extreme southern Texas, and possibly extreme northeastern Mexico. The Pacific coast population of the western snowy plover is defined as those individuals that nest adjacent to or near tidal waters, and includes all nesting colonies on the mainland coast, peninsulas, offshore islands, adjacent bays, and estuaries. They are believed to be genetically isolated from western snowy plovers breeding in the interior.

Twenty-eight breeding sites or areas currently occur on the Pacific coast of the United States. Two sites occur in southern Washington. Six sites occur in Oregon. Twenty plover breeding areas currently occur in coastal California. Eight areas support 78 percent of the California coastal breeding population: San Francisco Bay, Monterey Bay, Morro Bay, the Callendar-Mussel Rock Dunes area, the Point Sal to Point Conception are, the Oxnard lowland, Santa Rosa Island, and San Nicolas Island.

The Pacific coast population of the western snowy plover nests primarily on coastal beaches. Nesting habitat is unstable and ephemeral as a result of unconsolidated soil characteristics influenced by high winds, storms, wave action, and colonization by plants. Other less common nesting habitats include saltpan areas of wetlands, coastal dredge spoil disposal sites, salt evaporation ponds, and salt pond levees. Nest sites typically occur in flat, open areas with sandy or saline substrates; vegetation and driftwood are usually sparse or absent. The majority of snowy plovers are site-faithful, returning to the same breeding site in subsequent breeding seasons. Birds often nest in exactly the same locations as the previous year. Double brooding and polygamy (i.e., the female successfully hatches more than one brood in a nesting season with different mates) have been observed in coastal California. After loss of a clutch or brood or successful hatching of a nest, plovers may renest in the same colony site or move, sometimes up to several hundred miles, to other colony sites to nest.

Western snowy plovers breed in loose colonies with the number of adults at coastal breeding sites ranging from 2 to 318. The breeding season of the coastal population of the western snowy plover extends from mid-March through mid-September. Nest initiation and egg laying occurs from mid-March through mid-July. The usual clutch size is three eggs. Incubation averages 27 days with both sexes incubating the eggs. Plover chicks are precocial, leaving the nest within hours after hatching to search for food. Fledging (reaching flying age) requires an average of 31 days. Broods rarely remain in the nesting territory until fledging.

The coastal population of the western snowy plover consists of both resident and migratory birds. Some birds winter in the same areas used for breeding. Other birds migrate either north or south to wintering areas. The majority of the birds winter south of Bodega Bay, California. Many interior birds west of the Rocky Mountains winter on the Pacific coast. Birds winter in habitats similar to those used during the nesting season. Poor reproductive success resulting from human disturbance, predation, and inclement weather, combined with permanent or long-term loss of nesting habitat to encroachment of introduced European beachgrass (*Ammophila arenaria*) and urban development has led to a decline in active nesting colonies, and an overall decline in the breeding and wintering population of the western snowy plover along the Pacific coast of the United States.

Western snowy plovers have been counted on VAFB since 1980 and monthly counts of adults have been recorded from 1987 to November, 1992. Few data are available regarding the locations or numbers of the western snowy plover nests on VAFB. However, they are known to occur among the California least tern

nests at La Purisima Point and to extend further south on suitable habitat adjacent to La Purisima Point (Allan Naydol, pers. comm., 1993). This area will be collectively referred to as the La Purisima Point and south nesting area for the purpose of this biological opinion.

Analysis of Impacts

The launches proposed during the nesting season could cause the direct and indirect take of California least terns and western snowy plovers at the La Purisima Point nesting area as a result of the effects of launch noise and exhaust clouds. In general, launch noise could cause ear damage or a startle response. A startle response could potentially result in increased predation or the birds harming themselves. Acid deposition occurring as a result of the generation of a ground cloud could potentially burn birds, eggs, or chicks if the cloud reaches any nesting birds. The launch facility modifications, however, are sufficiently distant from the nesting area and are not likely to affect either of these two species.

Noise.

Space vehicle launches produce noise and vibrations that could potentially damage terrestrial and freshwater biota in the immediate vicinity of the launch site. Noise and vibration caused by a launch vehicle can affect broad areas but are usually of short duration because the vehicle gains altitude and accelerates quickly. Sounds generated from rocket launches originate from: 1) combustion noise radiating from the rocket motor chamber; 2) high velocity jet noise generated by the interaction of the rocket exhaust jet with the atmosphere; 3) combustion noise associated with the post burning of the fuel-rich combustion products exhausted into the atmosphere; and 4) sonic booms associated with the high velocities of the launch vehicles. The first three sources comprise the majority of the noise level in the immediate vicinity of the launch.

The SLC-2W SEA (NASA 1992) states that the sound level from Delta II space vehicle launches at SLC-2W is expected to be between 100 and 126 decibels (db) in the nesting area which is an estimated 2400 feet away. Sound levels above 100 db would last approximately five seconds. The Taurus EA (U.S. Air Force 1992) states that the overall sound pressure level (OASPL) contour for the Taurus launch at 576E is estimated to be 125 db at a distance of approximately 2600 feet from the source which is the approximate distance to the California least tern nesting area. The western snowy plover is potentially nesting approximately 2250 feet from launch site 576E. Table 2 from the Peacekeeper noise report (McInerny 1992) states that the OASPL is estimated to be 131 db at 2000 feet from the source. Because Taurus vehicles use a similar first stage engine as the Peacekeeper, nesting western snowy plovers may be exposed to an estimated 131 db OASPL.

Inadequate information is available with respect to the short- and long-term effects of noise on wildlife to fully assess the impacts that the subject launches may have on California least terns and western snowy plovers. However, a 1986 Delta launch at a SLC-2 site may have caused California least terns to abandon the La Purisima Point nesting site (U.S. Air Force 1989). As

stated in the SLC-2W SEA (NASA 1992) and Taurus SEA (U.S. Air Force 1993), noise may affect animals in several of the following ways:

1. Cause hearing damage or impairment (a temporary hearing threshold shift);

2. Trigger a startle response which can:

   a. alter predator/prey interactions by alerting predators to prey locations or by leaving eggs or young temporarily vulnerable to predators;

   b. cause damage to the animal, its eggs, or its young;

3. Mask biologically significant sounds such as predators;

4. Cause changes in distribution and abundance (provoke temporary or permanent emigration or separate colonies);

5. Affect growth and resistance to disease;

6. Reduce energetic efficiency;

7. Cause mortality; or

8. Induce reproductive failures.

A report on the effects of Minuteman launches on California least terns at the La Purisima Point colony noted a temporary startle effect on the terns from an unweighted sound exposure level of 104 db (Atwood at al. 1981). Overall, no long term or adverse effects on the birds were detected. Similarly, representatives from the Service, VAFB Environmental Management staff, and The Nature Conservancy reported no adverse effect to California least terns during a June 9, 1990, F-16 Thunderbird overflight at La Purisima Point that was recorded at 102 db (Michael McElligott, pers. comm., 1992).

Information gathered from the Taurus launch scheduled to take place during the nesting season of these two species will be used to ascertain impacts that may occur to the nesting birds at the La Purisima Point and south nesting areas. The implementation of predator control measures should significantly reduce the potential predation on California least terns and western snowy plovers associated with a startle response from noises generated from launches occurring at the SLC-2W and 576E launch sites.

Launch Emissions.

Aluminum oxide, hydrochloric acid, and nitrogen oxides are recognized in the SLC-2W EA (NASA 1991) and Taurus EA (U.S. Air Force 1992) as potentially hazardous emissions of a launch. NASA Technical Memorandum 83103 (1985) states that hydrochloric acid from Space Shuttle launches causes acute vegetation damage. Effects on wildlife may also be significant. In general, acid breaks down or denatures protein. The effects of the launch emission

could range from eye irritation to death in adults and could damage eggs depending on the level of acidity of the cloud and whether it reaches any nesting birds.

Delta II launch clouds extend from the launch point at a radius of 600-900 feet and persist for only a few minutes. The Taurus launch cloud radius was not predicted; however, it is likely to be larger than the Delta II radius because the Taurus is a larger vehicle. The Air Force has agreed to launch only when the wind is still or blowing away from the La Purisima Point nesting area. This should significantly reduce the potential for impacts to California least terns and western snowy plovers from launch cloud emissions.

The Service believes the impacts described above are not likely to jeopardize the continued existence of the California least tern and the western snowy plover. We present this conclusion for the following reasons:

1. The project description includes mitigation measures to minimize the take of individual California least terns and western snowy plovers.

2. The Air Force is undertaking conservation measures to enhance management of California least terns and western snowy plovers on VAFB. For example, the Air Force prohibits human intrusion on two important nesting areas on VAFB lands during sensitive breeding periods. The La Purisima Point and south nesting area is closed to public access from April 15 to August 31 every year for the purpose of protecting the California least terns. Approximately 3000 acres from north of La Purisima Point north to Shuman Creek and inland to the railroad tracks are also closed to human access. These closures provide protection from human intrusions on two important areas that support California least terns and western snowy plovers during the nesting season (Allan Naydol, pers. comm., 1993). These measures and the other conservation actions being implemented by the U.S. Air Force (pages 3 and 4 of this biological opinion) should decrease disturbance caused by predators or humans, and should result in more stable colonies. Stable colonies should be less likely to abandon the nest site than colonies that are frequently disturbed by predators and human activities.

Cumulative Effects

Cumulative effects are those impacts of future non-Federal (State, local government, or private) activities on endangered or threatened species or critical habitat that are reasonably certain to occur during the course of the Federal activity subject to consultation. Future Federal actions are subject to the consultation requirements established in section 7 of the Act, and therefore, are not considered cumulative in the project.

The Service is aware of other projects currently approved or under review by the state, county, or local authorities where biological surveys have documented the occurrence of the California least tern and western snowy plover. These projects include coastal access and development issues. We do not anticipate that the action under evaluation in this opinion, considered

together with those non-federal actions of which we are aware, would significantly impair the ability of these species to survive and recover.

Incidental Take

Section 9 of the Act prohibits the take of listed species without special exemption. Taking is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering (50 CFR 17.3). Under the terms of sections 7(b)(4) and 7(o)(2) of the Act, taking that is incidental to and not intended as part of the agency action is permitted taking under the Act provided that such taking is in compliance with this incidental take statement. These terms and conditions are nondiscretionary, and must be undertaken by the agency or made a binding condition of any grant or permit, as appropriate.

The Service anticipates the following take:

1. A total of five (5) California least terns and/or western snowy plovers or their eggs in the form of direct mortality. Examples of direct mortality might include death from predation or acid deposition as a direct result of launch noises or emissions.

2. A total of one (1) temporary flushing of California least tern and/or western snowy plover colonies from their nests without signs of nest abandonment or death per year.

If, during the course of the action, the amount or extent of the incidental take limit is reached, the Air Force shall immediately notify the Service in writing. If the incidental take limit is exceeded, the Air Force must immediately cease the activity resulting in the take, and reinitiate consultation with the Service immediately to avoid further violation of section 9 of the Act. Operations must be stopped in the interim period between the initiation and completion of the new consultation if it is determined that the impact of the additional taking will cause an irreversible and adverse impact on the species, as required by 50 CFR 402.14(i). The Air Force should provide an explanation of the causes of the taking.

Reasonable and Prudent Measures

The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize incidental take of California least terns and western snowy plovers from operation of SLC-2W and 576E launch sites during the nesting season:

1. Measures shall be implemented to reduce predation at the nearby La Purisima Point and south nesting area of California least terns and western snowy plovers that may result from launch noises.

be affected by this action (50 CFR 402.16). Any questions or comments should be directed to Ms. Naomi Mitchell of my staff at (805) 644-1766.

Sincerely,

Acting for Craig Faanes
Field Supervisor

Enclosure

Literature Cited

Atwood, J.L., F.T. Awbrey, B.S. Stewart, and A.E. Bowles. 1981. Effects of Minuteman launch on California least tern nesting activity, Vandenberg Air Force Base, California. A report to the U.S. Air Force.

Federal Register. 1993. Endangered and Threatened Wildlife and Plants; determination of threatened status for the Pacific Coast population of the western snowy plover. pp 12864-12874.

Keegan, N.R. 1992. Report on noise measurements during Delta launch. Aerospace Corporation Report for National Aeronautics and Space Administration.

McInerny, S.A. 1992. Peacekeeper launch sound levels at 1000, 2000, and 4000 feet from the pad. A report to U.S.A.F. Space and Missiles Systems Center.

National Aeronautics and Space Administration. 1991. Environmental Assessment, modifications and operations of Space Launch Complex-2W for the Delta II launch vehicle at Vandenberg Air Force Base, California. McDonnell Douglas Space Systems Company, Huntington Beach, California.

National Aeronautics and Space Administration. 1992. Supplemental Environmental Assessment, modifications and operations of Space Launch Complex-2W for the Delta II launch vehicle at Vandenberg Air Force Base, California. McDonnell Douglas Space Systems Company, Huntington Beach, California.

Perry, M.S. 1992. Report on the California least tern 1992 breeding season along the central California coast. A report to The Nature Conservancy.

Schmalzer, P.A., Hinkle, C.R., and Breininger, D. 1985. Effects of Space Shuttle launches STS-1 through STS-9 on terrestrial vegetation of John F. Kennedy Space Center, Florida. National Aeronautics and Space Administration Technical Memorandum 83103.

U.S. Air Force. 1989. Draft Environmental Assessment for American Rocket Company commercial expendable launch vehicle.

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 vehicle program at Vandenberg Air Force Base, California. The Aerospace Corp., El Segundo, California.

U.S. Fish and Wildlife Service. 1980. California least tern Recovery Plan. Fish and Wildlife Service, Region 1, Portland, Oregon, in cooperation with the Recovery Team.

Personal Communications

Johnston, James L. 1993. Chief, Environmental Planning, Environmental Management. Vandenberg Air Force Base.

McElligott, Michael. 1992. Wildlife Biologist. Vandenberg Air Force Base.

Naydol, Allan V. 1993. Chief, Natural Resources, Civil Engineering. Vandenberg Air Force Base.