Federal Aviation Administration

Final Programmatic Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications

September 2009

HQ-09938

Final Programmatic Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications

RESPONSIBLE AGENCY: Federal Aviation Administration (FAA)

COOPERATING AGENCIES: National Aeronautics and Space Administration and United States Air Force

TITLE: *Final Programmatic Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications* (Final PEIS)

ABSTRACT: This Final PEIS addresses the potential environmental impacts of the Proposed Action (the Preferred Alternative), under which the FAA would issue experimental permits for the launch and reentry of reusable suborbital rockets from both FAA-licensed and non-licensed launch sites using this PEIS as the basis for determining the potential environmental consequences of issuing experimental permits. This Final PEIS also addresses the potential environmental impacts of the No Action Alternative, under which the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets using its present method of analyzing environmental consequences case by case, without tiering from a programmatic document such as this PEIS.

CONTACT INFORMATION: Questions regarding the Final EIS can be addressed to Mr. Daniel Czelusniak, FAA Environmental Specialist, FAA Experimental Permits PEIS, c/o ICF International, 9300 Lee Highway, Fairfax, VA 22031; submitted by email to PEIS-Experimental-Permits@icfi.com; or faxed to (703) 934-3951.

After careful and thorough consideration of the facts contained herein and following consideration of the views of Federal agencies having jurisdiction by law or special expertise regarding the environmental impacts described, the undersigned finds that the proposed Federal action is consistent with existing national environmental policies and objectives as set forth in Section 101(a) of the National Environmental Policy Act of 1969. This Final PEIS becomes a Federal document when evaluated, signed, and dated by the responsible FAA official.

Responsible FAA Official:

_______________________________ Date: 8/31/09

Dr. George C. Nield
Associate Administrator for Commercial Space Transportation

Federal Aviation Administration

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EXECUTIVE SUMMARY

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CONTENTS

ACRONYMS AND ABBREVIATIONS

AST	Office of Commercial Space Transportation
CCAFS	Cape Canaveral Air Force Station
CFR	Code of Federal Regulations
Cl	chlorine
CO	carbon monoxide
CO_2	carbon dioxide
CSLAA	Commercial Space Launch Amendments Act of 2004
dBA	A-weighted decibels
DNL	day/night average sound level
EA	environmental assessment
EIS	environmental impact statement
FAA	Federal Aviation Administration
H+	hydrogen ions
H_2O	water
HCl	hydrogen chloride
KLC	Kodiak Launch Complex
KSC	John F. Kennedy Space Center
LC	Launch Complex
MARS	Mid-Atlantic Regional Spaceport
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO_X	nitrogen oxides
PEIS	Programmatic Environmental Impact Statement
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of less than 10 microns
SO_X	sulfur oxides
U.S.	United States
VOC	volatile organic compound

EXECUTIVE SUMMARY

ES.1 Introduction

The U.S. Federal Aviation Administration (FAA) Office of Commercial Space Transportation (AST) regulates the commercial space transportation industry to ensure public safety for licensed U.S. launch activities and to support the continued growth and expansion of the U.S. space transportation industry. In fulfilling its mission and in accordance with the Commercial Space Launch Amendments Act of 2004 (CSLAA), the FAA issues (1) licenses for commercial launches of expendable and reusable launch vehicles and reentry activities, (2) licenses for the operation of commercial launch and reentry sites, and (3) experimental permits for the launch and reentry of developmental reusable suborbital rockets. The CSLAA directs the FAA to promote the development of the emerging commercial space flight industry; makes the FAA responsible for regulating private human space flight under 49 United States Code Subtitle IX, Chapter 701, Commercial Space Launch Activities (formerly the Commercial Space Launch Act); and establishes the Experimental Permit Program for launching developmental reusable suborbital rockets on suborbital trajectories. Under 49 U.S.C 70105a, an applicant must propose to operate a reusable suborbital rocket for one of the following purposes:

- Research and development to test new design concepts, new equipment, or new operating techniques;
- A showing of compliance with requirements for obtaining a license; or
- Crew training before obtaining a license for a launch or reentry using the design of the rocket for which the permit would be issued.

The FAA prepared this Programmatic Environmental Impact Statement (PEIS) with cooperation from the National Aeronautics and Space Administration and the U.S. Air Force to examine the environmental impacts of an alternative approach for complying with the National Environmental Policy Act (NEPA) when reviewing applications for reusable suborbital rockets operating under experimental permits. The intent of this PEIS is to facilitate the preparation of environmental documents for the issuance of experimental permits to individual launch operators. By providing information and analyses common to all reusable suborbital rockets, the FAA may choose to tier future environmental documents, either an environmental assessment (EA) or an environmental impact statement (EIS), as appropriate, from this PEIS to focus on environmental impacts specific to an applicant's proposed operations under an experimental permit. Tiering from this PEIS would eliminate repetitive discussions of recurring issues and focus on the actual issues that are ready for decision.

In addition, by providing information and analyses common to all reusable suborbital rockets and analyzing the environmental impacts of the use of such rockets at specified facilities, this PEIS could also provide the streamlining benefit of avoiding a duplicate NEPA analysis because some experimental permit applications would not require further NEPA analysis (an EA or EIS) for a decision about whether to grant an applicant an experimental permit. Rather, this PEIS would serve as the NEPA document for that decision, but only after the FAA/AST documented that the impacts of the pending permit decision have been analyzed or addressed in this PEIS.

This PEIS will not authorize the launch or reentry of reusable suborbital rockets from launch sites. Individual launch operators would be required to coordinate with site operators to gain access to a site. In addition, the launch operators would be required to apply to the FAA for an experimental permit, which would require an individual safety and environmental review.

ES.2 Purpose and Need for the Action

The ***purpose*** of the FAA Proposed Action is to facilitate the issuance of experimental permits for the launch and/or reentry of reusable suborbital rockets by streamlining the environmental review portion of the application. Environmental documents tiering from this PEIS would eliminate repetitive discussions of recurring issues and when necessary focus those environmental documents on any unaddressed impacts or issues ready for decision. In addition, the Proposed Action would further the mission of the FAA to promote the growth of the U.S. space transportation industry while protecting public health and safety, the safety of property, and U.S. national security and foreign policy interests.

The ***need*** for the FAA Proposed Action results from the statutory direction from Congress to facilitate commercial rocket developers' research and development associated with testing new design concepts, new equipment, or new operating techniques; compliance with requirements; and training of flight crews. Facilitating the issuance of experimental permits implements the direction and intent Congress provided to the FAA in the CSLAA. In addition, the need for the Proposed Action is to aid the permitting process to meet the 120-day deadline Congress imposed under the CSLAA.

ES.3 Proposed Action

Under the Proposed Action, which is the FAA's preferred alternative, the FAA would issue experimental permits for the launch and reentry of reusable suborbital rockets from both FAA-licensed and non-licensed launch sites using this PEIS as the basis for determining the environmental consequences of issuing the permits. The information and analyses provided in this PEIS would be used to facilitate the preparation of environmental documents for the issuance of experimental permits to individual rocket operators. Because this PEIS presents information and analyses common to all reusable suborbital rockets, the FAA could choose to tier future environmental documents from the PEIS to focus on environmental impacts specific to an applicant's proposed operations under an experimental permit. Tiering from this PEIS would eliminate repetitive discussions of recurring issues and focus on the issues that are ready for decision. So long as the activities analyzed in a tiered document are within the scope of this PEIS, the subsequent environmental impact analysis for the issuance of experimental permits need only summarize the issues discussed in this PEIS, incorporate discussions from this PEIS by reference, and concentrate on the impacts specific to each launch permit.

An experimental permit would authorize the operation of a reusable suborbital rocket and the activities directly associated with its operation, including pre-flight activities; takeoff, flight (including reentry), and landing activities; and post flight activities. Most suborbital launches would operate under a single permit, which would stipulate the appropriate safety requirements. A permit would be valid for one year and would authorize an unlimited number of launches and reentries of a reusable suborbital rocket design from a specified site(s). However, for the purpose of this PEIS, based on the FAA's review of past activities and consultations with various organizations in the commercial space industry, the FAA projected that a maximum of 1,000 launch and reentry events could occur annually at any one location between 2009 and 2014.

The FAA could issue experimental permits for the launch and reentry of a variety of reusable suborbital rockets, including those already designed or currently under development. The general suborbital rocket designs include vehicles resembling conventional aircraft, cylindrical vehicles resembling conventional rockets, and vehicles designed to hover (vertical takeoff and landing). General dimensions and mass by design include:

- Vehicles resembling conventional aircraft – 30 to 140 feet in length with unfueled weight of up to 9,921 pounds;
- Vehicles resembling conventional rockets – 6 to 33 feet in length with unfueled weight of up to 5,500 pounds;
- Vehicles that hover – up to 20 feet in length or diameter with unfueled weight of up to 4,400 pounds.

To assess the potential impacts of a single launch and reentry, the FAA considered a variety of liquid, solid, and hybrid propellants that could be used to operate a reusable suborbital rocket under an experimental permit. The FAA conservatively assumed that the total propellant capacity of a reusable suborbital rocket would not exceed 11,000 pounds. The FAA also estimated the proportion of experimental permits that would be issued to support three general flight profiles: (1) horizontal takeoff (rocket or jet powered), flight, and horizontal landing (glide or jet powered), (2) vertical takeoff (rocket powered), flight, and vertical landing (rocket powered or parachute), and (3) rocket-powered hovering flights (vertical takeoff and landing). Exhibit ES-1 identifies the estimated proportion of the annual 1,000 launch and reentry events for each profile.

Exhibit ES-1. Estimated Annual Proportion of Flight Profiles

Flight Profile	Proportion
Horizontal	40%
Vertical	30%
Hover	30%

Under an experimental permit, launch and reentry activities could occur from any location that has the appropriate infrastructure and safety requirements in place to support a reusable suborbital rocket launch and reentry. Although most operators would be expected to utilize existing site infrastructure, some operators could use temporary launch structures such as mobile launch platforms, roll-out launch platforms, and other temporary support equipment including a mobile launch control trailer. Temporary structures and equipment would be brought to the launch site in advance of launch day and would be removed after launch activity has been conducted. For this programmatic review, the FAA analyzed the potential impacts of issuing an experimental permit for the operation of reusable suborbital rockets from anywhere in the United States and abroad, and the potential site-specific impacts of permitted launches from seven FAA-licensed commercial launch sites and one Federal range. Exhibit ES-2 lists the launch sites and the types of reusable suborbital rocket flight profiles that were considered for the particular sites.

Exhibit ES-2. Launch Sites and Associated Launch and Reentry Activities (page 1 of 2)

Site	Location	Flight Profiles*
California Spaceport	Vandenberg Air Force Base, California	Vertical Launch and Reentry
John F. Kennedy Space Center (KSC), Shuttle Landing Facility	Cape Canaveral, Florida	Horizontal Launch and Reentry
Kodiak Launch Complex (KLC)	Kodiak Island, Alaska	Vertical Launch and Reentry
Mid-Atlantic Regional Spaceport (MARS)	Wallops Island, Virginia	Vertical Launch and Reentry
Mojave Air and Space Port	Mojave, California	Horizontal Launch and Reentry
Oklahoma Spaceport	Washita County, Oklahoma	Vertical and Horizontal Launch and Reentry

Exhibit ES-2. Launch Sites and Associated Launch and Reentry Activities (page 2 of 2)

Site	Location	Flight Profiles*
Space Florida, Launch Complex 46	Cape Canaveral, Florida	Vertical Launch and Reentry
Spaceport America	Sierra County, New Mexico	Vertical and Horizontal Launch and Reentry

* Hover flight activities could occur at all sites.

ES.4 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets using its present system of analyzing environmental consequences on a case-by-case basis without tiering from a programmatic document. The information and analyses provided in this PEIS would not be used to facilitate the preparation of environmental documents for the issuance of experimental permits to individual rocket operators. Under the current permitting process, then, the information contained in this PEIS would not be used to eliminate repetitive discussions of recurring issues, and would not focus subsequent environmental analysis on the actual issues that are ready for decision. This would result in increased paperwork, duplication, and time needed to develop future site-specific and project-specific analyses when compared to the Proposed Action.

ES.5 Summary of Environmental Consequences

The FAA evaluated the potential environmental consequences of the Proposed Action and No Action Alternative in accordance with all applicable legal requirements, including 40 CFR 1502.16 and FAA Policies and Procedures (FAA Order 1050.1E, dated June 8, 2004) for complying with NEPA, which specify significance thresholds by resource. The evaluation considered direct and secondary (indirect) impacts, cumulative impacts, and potential impacts associated with accidents or suborbital rocket failures. The scope of this PEIS does not include construction activities and assumes the use of existing launch support infrastructure.

This PEIS analyzes the potential impacts of permitted launches from anywhere in the U.S. or abroad on the resource areas listed below. For the eight specified launch sites, this PEIS includes the same list of resource categories:

- Air quality;
- Biological resources (fish, wildlife, and plants);
- Historical, architectural, archaeological, and cultural resources;
- Floodplains;
- Hazardous materials, pollution prevention, and solid waste;
- Health and safety;
- Land use (including U.S. Department of Transportation Section 4(f) Resources, Farmlands, Wild and Scenic Rivers, and Coastal Resources);
- Light emissions and visual resources;
- Natural resources and energy supply;
- Noise and compatible land use;
- Socioeconomic impacts, environmental justice, and children's environmental health and safety;

- Water quality; and
- Wetlands.

Exhibit ES-3, Potential General Environmental Impacts under the Proposed Action, and Exhibit ES-4, Potential Site-Specific Environmental Impacts under the Proposed Action, list potential impacts by resource (impact category). Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of impacts associated with the No Action Alternative would fall within the envelope of impacts described for the Proposed Action. However, if the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate the potential impacts, and would not use the information and analyses provided in this PEIS. This would result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

Under both the Proposed Action and the No Action Alternative, the resulting NEPA impact analysis could be part of a decision to deny or not issue a requested experimental permit. In the case of a permit denial, the area to be affected by the projected impacts from the proposed activities would not experience these projected impacts or changes. With one exception, a permit denial therefore would not, in most cases, result in negative impacts to the environment of the affected area. The possible exception would be related to socioeconomic impacts. Denying an experimental permit would eliminate any local employment and services that may be needed to implement the requested activities. However, based on the small size of the staff working at a launch or reentry site and the short duration of these events, the anticipated negative socioeconomic impacts of a denial would be insignificant and should not result in any notable change in the health of the local economy. At the national level, the positive socioeconomic impacts of the Experimental Permit Program, such as those related to the desired increase in research and funding for the commercial space industry and increased employment opportunities for skilled and professional workers, would not be negatively affected because any possible denials would likely be widely geographically dispersed and intermittent. In the case of the Proposed Action, should the socioeconomic impacts from a specific, pending denial differ substantially from those discussed in this paragraph, these impacts would be specifically addressed in a NEPA document and not tiered from the programmatic analysis.

Exhibit ES-3. Potential General Environmental Impacts under the Proposed Action (page 1 of 2)

Impact Category	Impact
Air quality[a]	Of the chemicals generated by emissions from reusable suborbital rockets, the emissions of concern are HCl, Cl, PM, NO_X, SO_X, CO, CO_2, H_2O (in the stratosphere), H^+ (in the ionosphere), and VOCs. Emissions from reusable suborbital rockets on or near the ground would be of very short duration and would rapidly disperse. Ambient pollutant concentrations at locations accessible to the public would be low and not expected to result in violations of any NAAQS or state standards. Emissions of ozone-depleting substances and greenhouse gases would be negligible compared to atmospheric emissions worldwide.
Biological resources (fish, wildlife, and plants)	The launch and landing of reusable suborbital rockets in or near vegetated areas could result in adverse impacts to the local vegetative community. Deposition of rocket engine emissions, exposure to exhaust heat, the removal of a vegetative community or decrease in its fitness, and the noise associated with reusable suborbital launch could adversely impact wildlife. Vegetation and wildlife in the vicinity of a launch site would experience direct, but minor and temporary adverse impacts. The Proposed Action could result in location- and species-specific adverse impacts to protected species and essential fish habitat.
Historical, architectural, archaeological, and cultural resources	Operating reusable suborbital rockets likely would not be expected to have a significant impact on cultural resources. Such activities would not result in ground-disturbing activities that would directly affect the integrity of below-ground (archaeological) resources eligible or listed on the *National Register of Historic Places*. However, operating reusable suborbital rockets in an area where such activities or other aircraft have not previously or routinely been operated could affect the character or setting of historic properties.
Floodplains	No new permanent infrastructure would be constructed, and all temporary structures would be removed after a launch or reentry event. Therefore, there would be no impacts on floodplains.
Hazardous materials, pollution prevention, and solid waste	The primary hazardous materials used under the Proposed Action would be propellants. Because activities associated with the Proposed Action would comply with all applicable Federal, state, and local regulations related to hazardous materials and hazardous waste, no significant impacts would be expected.
Health and safety	For all applicants, the FAA would perform a safety review, including a hazard analysis, to ensure the operation of reusable suborbital rockets would not result in significant impacts on public health and safety. Propellants would be stored in accordance with Federal and state regulations, and site-specific standard operating procedures, and would be handled by trained personnel. Propellant loading activities would not be expected to affect the health and safety of site personnel or the surrounding public.
Land use (including U.S. Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)	The potential for land-use conflicts would be remote. All key flight-safety events would occur over unpopulated or sparsely populated areas. Because no new permanent facilities or infrastructure would be developed, no prime farmland would be lost, and there would be no physical taking of lands protected under Section 4(f). There would likely be no impact on wild and scenic rivers or coastal resources.
Light emissions and visual resources	Launches and reentries of reusable suborbital rockets would conform to the visual resource management policies and statutes of Federal, state, and local agencies and tribes. There would likely not be a significant impact on aesthetics and visual resources.
Natural resources and energy supply	Reusable suborbital rocket launch and reentry events would not result in notable changes to energy demands or consumption of other natural resources. The use of rocket propellants and jet fuel under the Proposed Action would not notably alter propellant or fuel supply or demand. Minor impacts on natural resources and energy supplies would be expected.

Exhibit ES-3. Potential General Environmental Impacts under the Proposed Action (page 2 of 2)

Impact Category	Impact
Noise and compatible land use[b]	The 65 decibel DNL noise contour would be approximately 450 feet from the launch pad for vertical flights and approximately 1,300 feet for hovering vehicle launches. Noise-sensitive receptors beyond these areas would not experience significant noise impacts. The upper-bound noise levels for horizontal launches would be similar to existing jet aircraft activity at launch facilities. The increase in the number of horizontal launches would not result in significant increase in noise at launch sites with existing activity. Because the reusable suborbital rocket operating area would be over unpopulated or sparsely populated areas, sonic booms would have minimal noise impacts. Landing noise would be the same or less than noise generated by takeoff.
Socioeconomic resources, environmental justice, and children's environmental health and safety	Based on the small size of the staff working at the launch or reentry site and short duration of the event, demands on the local infrastructure would not result in a notable change over the current conditions. Potential national socioeconomic impacts would include a small increase in research and funding for the commercial space industry and increased employment opportunities for skilled and professional workers. No large and adverse human health or environmental effects would disproportionately affect minority or low-income populations, because no such effects are associated with the Proposed Action. The Proposed Action would not disproportionately affect children, because the operating area for suborbital rocket activity would be over unpopulated or sparsely populated areas.
Water quality	Deposition material associated with rocket engine emissions could result in local adverse impacts to freshwater and marine systems. However, monitoring of local streams around active launches pads has not shown long-term effects on basic water chemistry. Site-specific spill prevention plans and requirements would minimize groundwater impacts.
Wetlands	The deposition of rocket engine emissions could result in local adverse impacts to wetland vegetation and wildlife, but would not be significant. Under the Proposed Action, no wetlands would be filled or drained. In addition, any temporary launch structures would be expected to be located beyond wetland areas and would be removed after a launch or reentry event.
Accidents	Impacts from launch accidents near the launch pad would produce local air emissions, propellant spills, and potential safety impacts to people on site. Propellant emissions released would be essentially the same as during a normal flight, but concentrated near the accident site. Vegetation and local water bodies could be affected by heat and falling debris.
Cumulative impacts	The Proposed Action would make a relatively small incremental contribution to increasing global CO_2 concentrations, which would likely have a cumulative impact on climate change. In addition, small incremental contributions to the atmosphere of criteria pollutants, air toxics, precursors of acid rain, and regional haze, could also have impacts on air quality. As a result of the duration of a launch event and the overall frequency at a particular site, there would be no cumulatively significant impacts on the existing noise environment. Because the FAA does not know the actual flight paths of reusable suborbital rockets evaluated under the Proposed Action, it could not perform a cumulative impacts analysis of sonic booms at this time.

[a] HCl = hydrogen chloride; Cl = chlorine; PM = particulate matter; nitrogen oxides (NO_X = nitrogen oxides; SO_X = sulfur oxides; CO = carbon monoxide; CO_2 = carbon dioxide; H_2O = water; H^+ = hydrogen ions; VOCs = volatile organic compounds; NAAQS = National Ambient Air Quality Standards.

[b] DNL = day/night average sound level.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 1 of 17)

Site/Impact Category	Proposed Action
California Spaceport, California	
Air quality[a]	Annual emissions from ground level to 3,000 feet, based on the assumption of 600 yearly launch and reentry events, were estimated to be about 186 tons CO; 77 tons CO_2; and 203 tons H_2O. There would be no emissions of hazardous air pollutants under the Proposed Action. Any emissions would be of short duration and would rapidly dissipate. Emissions of PM_{10}, VOCs, and NO_X, for which the region is designated nonattainment by California standards, would be less than 0.005 ton each and would not have a measurable effect on air quality. Therefore, the launch of reusable suborbital rockets at California Spaceport would not significantly affect air quality.
Biological resources (fish, wildlife, and plants)	The launch of reusable suborbital rockets would create minimal vegetation disturbance near the launch site. No significant impacts to terrestrial wildlife species would be expected as a result of the launch or flight noise. Impacts on aquatic plants and animals would be minor and would not adversely affect populations or behavior. Activities under an experimental permit could affect the protected Gaviota tarplant, surf thistle, California brown pelican, California red-legged frog, Southern sea otter, western snowy plover, California least tern, El Segundo blue butterfly, tidewater goby, unarmored threespine stickleback, and various whale species. Although launches under the Proposed Action could cause short-term effects on these species, the launches would be unlikely to adversely affect the long-term wellbeing, reproduction rates, or survival of any of these species.
Historical, architectural, archaeological, and cultural resources	There would be no new ground disturbances under the Proposed Action. The launch and reentry of suborbital rockets would not represent a new type of activity in the area that would affect the character or setting of the cultural resources. Therefore, there would be no impact on cultural resources. The Proposed Action would not affect the setting or character of traditional cultural properties near the site.
Floodplains	South Vandenberg Air Force Base is not in a floodplain. Therefore, there would be no adverse impacts to floodplains as a result of the Proposed Action.
Hazardous materials, pollution prevention, and solid waste	The increase in the amount of hazardous material, hazardous waste, and solid waste generated at the California Spaceport would not exceed storage, handling, or management capacities. No adverse impacts from the management of hazardous materials and waste would be expected.
Health and safety	In coordination with Vandenberg Air Force Base, the FAA would review and verify the hazard analysis to evaluate potential hazards and reduce the associated risks to an acceptable level. Access to launch and support areas would be limited to essential Base and launch personnel. All applicable Federal, State of California, and local health and safety requirements would be followed. Safety programs under the Proposed Action would be the same as safety programs for current launch operations. Therefore, no impacts would be expected.
Land use (including U.S. Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)	Under the Proposed Action, there would be no new activities or coastal development. The potential need to close recreational areas, such as Jalama Beach and Ocean Beach county parks, during launch activity are unknown at this time and would be based on the defined operating area and proposed rocket type and size.
Light emissions and visual resources	Launch vehicles would leave visible contrails, but they would be similar in visual impact to contrails from existing operations. Because this area is already used for aircraft takeoffs and landings, the visual sensitivity is low. Visual impacts from launch operations, including impacts on Jalama Beach, would be infrequent, temporary, and minor.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 2 of 17)

Site/Impact Category	Proposed Action
California Spaceport, California (continued)	
Natural resources and energy supply	Activities that would be permitted under the Proposed Action would not result in the development of new facilities at the California Spaceport or result in notable changes in local energy demands or consumption of other natural resources. Because of the relatively small scale of activity at the California Spaceport under the Experimental Permit Program, the use of rocket propellants would not notably alter their supply or demand, and would result in only minor impacts to natural resources and energy supplies.
Noise and compatible land use	Noise levels generated by each launch or reentry under an experimental permit would vary, depending on the rocket configuration, flight path, and weather conditions. While the issuance of experimental permits would result in an increase in the potential number and frequency of launches at Vandenberg Air Force Base, the experimental vehicles would be expected to be smaller and produce lower noise levels than the class of vehicles currently operating at the Base. Any sonic booms generated by reusable suborbital rockets would reach Earth's surface at a distance downrange of Vandenberg Air Force Base over the ocean. Sonic booms would not affect coastal land areas.
Socioeconomic resources, environmental justice, and children's environmental health and Safety	The Proposed Action would result in minor short-term impacts to local socioeconomics. Such impacts would result from the launch and reentry support staff working at the launch or reentry site for the duration of the event. Because of the relatively small number of support staff and short duration of each event, demands on the local infrastructure (*e.g.*, power, water, disposal, transportation system) would not result in a noticeable change in existing conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. No large and adverse human health or environmental effects associated with the Proposed Action were identified at the California Spaceport. Therefore, no minority or low-income populations would be disproportionately affected. The FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. As a result, the California Spaceport would not be likely to adversely affect children's environmental health and safety.
Water quality[a]	Minor adverse impacts to freshwater systems as a result of the deposition of materials associated with rocket engine emissions into surface waters could occur under the Proposed Action. However, monitoring of the water chemistry in local streams around active launch pads from which rockets have been launched has shown that emissions from rocket engines have not had a long-term effect on basic water chemistry. There would be no impacts to water quality from Cl and HCl. Furthermore, the Proposed Action would be expected to have a minor short-term affect on local surface water quality, but would not be expected to affect the designated use as defined under Section 303 of the Clean Water Act. The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater. However, impacts would be expected to be minimized through adherence to all site-specific spill prevention and control requirements at the site.
Wetlands	No wetlands are in the operating area of Space Launch Complex 8 at the California Spaceport. Therefore, there would be no adverse impacts to wetlands as a result of the Proposed Action.
Cumulative impacts	Emissions under the Proposed Action would not significantly affect air quality in the troposphere, but would contribute to cumulative air quality impacts in the area of California Spaceport. Launches under experimental permits may result in an increase in launch noise and sonic boom events and rocket emissions that could impact biological resources in the area. However, no long-term significant cumulative effects to biological resources, including threatened and endangered species or critical habitats, would be expected.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 3 of 17)

Site/Impact Category	Proposed Action
Kennedy Space Center (KSC), Florida	
Air quality[a]	KSC is located in an area considered to be in attainment for all criteria pollutants. Annual emissions from ground level to 3,000 feet based on the assumption of 700 yearly launch and reentry events were estimated to be about 188 tons CO, 209 tons CO_2, 197 tons H_2O, 0.10 ton NO_X, less than 0.005 ton PM, 0.058 ton SO_X, and 0.54 ton VOCs. These emissions would be of short duration and would be rapidly dispersed. There would be no lower tropospheric emissions of hazardous air pollutants (Cl and HCl). Therefore, the launch of reusable suborbital rockets at KSC would not significantly affect air quality.
Biological resources (fish, wildlife, and plants)	Vegetation in the vicinity of the launch area could experience short-term distress, resulting in minor impacts. Because the frequency of launch and reentry activities under an experimental permit at KSC could increase launch activities and noise, the FAA has concluded that these activities could affect the Florida scrub-jay, least tern, wood stork, Southeastern beach mouse, Atlantic salt marsh snake, eastern indigo snake, and Atlantic loggerhead, green, and leatherback sea turtle. Facility lighting for night launches could disorient sea turtle hatchlings, but this would be prevented by implementing a light-management plan. Although launches under the Proposed Action could cause short-term effects on these species, the launches would not be likely to adversely affect the long-term well-being, reproduction rates, or survival of any of these species.
Historical, architectural, archaeological, and cultural resources	There would be no new ground disturbances, and the launch and reentry of suborbital rockets would not represent a new activity in the area that would affect the character or setting of a cultural resource. Therefore, there would be no impact to cultural resources.
Floodplains	The majority of KSC lies within the 100-year floodplain. No new permanent infrastructure would be constructed under the Proposed Action, and all temporary structures (*e.g.*, a launch stand or reentry pad) would be removed after a launch or reentry event. Therefore, there would be no adverse impacts to floodplains as a result of the Proposed Action.
Hazardous materials, pollution prevention, and solid waste	The types of hazardous wastes associated with the Proposed Action would be similar to those already used at KSC. Reusable suborbital rockets would not be expected to generate more hazardous materials or solid waste than could be safely handled by existing operations.
Health and safety	In coordination with KSC, the FAA would review and verify the hazard analysis to evaluate potential hazards and reduce the associated risks to an acceptable level. Access to launch and support areas would be limited to essential KSC and launch personnel. KSC standard operating procedures would be followed to protect the public health and safety.
Land use (including U.S. Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)	Activities associated with reusable suborbital rockets would be compatible with existing land uses. The potential need to close nearby Section 4(f) resources, Merritt Island National Wildlife Refuge, or Canaveral National Seashore during periods of launch activity is unknown at this time and would be based on the defined operating area and rocket type and size.
Light emissions and visual resources	Launch vehicles would leave visible contrails, but they would be similar in visual impact to contrails from existing operations. Because this area is already used for aircraft takeoffs and landings, the visual sensitivity is low. Launch operations would not substantially degrade the existing visual character or quality of the site and its surroundings. Visual impacts from launch operations would be infrequent, temporary, and minor.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 4 of 17)

Site/Impact Category	Proposed Action
Kennedy Space Center (KSC), Florida (continued)	
Natural resources and energy supply	Activities that would be permitted under the Proposed Action would not result in the development of new facilities at KSC or result in notable changes in local energy demands or consumption of other natural resources. Because of the relatively small scale of activity at KSC under the Experimental Permit Program, the use of rocket propellants and jet fuel would not notably alter their supply or demand, and would result in only minor impacts to natural resources and energy supplies.
Noise and compatible land use[b]	The Proposed Action would not generate DNL 65 contours into surrounding residential areas. Sonic booms would reach Earth's surface at a distance downrange of KSC, over the ocean, precluding noise impacts on coastal land areas.
Socioeconomic resources, environmental justice, and children's environmental health and safety	The Proposed Action would result in minor short-term impacts to local socioeconomics. Such impacts would result from the launch and reentry support staff working at the launch or reentry site for the duration of the event. Because of the relatively small number of support staff and short duration of each event, demands on the local infrastructure (*e.g.*, power, water, disposal, transportation system) would not result in a noticeable change in existing conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. No large and adverse human health or environmental effects associated with the Proposed Action were identified at the KSC. Therefore, no minority or low-income populations would be disproportionately affected. The FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. As a result, KSC would not be likely to adversely affect children's environmental health and safety.
Water quality	Minor adverse impacts to freshwater systems as a result of the deposition of materials associated with rocket engine emissions into surface waters could occur under the Proposed Action. However, monitoring of the water chemistry in local streams around active launch pads from which rockets have been launched has shown that emissions from rocket engines have not had a long-term effect on basic water chemistry. There would be no impacts to water quality from Cl and HCl. Furthermore, the Proposed Action would be expected to have a minor short-term affect on local surface water quality, but would not be expected to affect the designated use as defined under Section 303 of the Clean Water Act. The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater. However, impacts would be expected to be minimized through adherence to all site-specific spill prevention and control requirements at the site.
Wetlands	The Proposed Action could result in local adverse impacts to wetland vegetation and wildlife from deposition of rocket engine emissions, but such impacts would not be significant. The Proposed Action would not result in filling or draining of wetlands, because no new permanent infrastructure would be constructed at KSC and all temporary structures (*e.g.*, a launch stand or reentry pad) would be expected to be located beyond wetland areas and would be removed after a launch or reentry event.
Cumulative impacts	Emissions under the Proposed Action would not significantly affect air quality in the troposphere, but would contribute to cumulative air quality impacts in the area of KSC. Launches under experimental permits may result in an increase in launch noise and sonic boom events and rocket emissions that could impact biological resources in the area. However, no long-term significant cumulative effects to biological resources, including threatened and endangered species or critical habitats, would be expected.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 5 of 17)

Site/Impact Category	Proposed Action
Kodiak Launch Complex (KLC), Alaska	
Air quality[a]	KLC is located in an area considered to be in attainment for all criteria pollutants. Annual emissions from ground level to 3,000 feet based on the assumption of 600 yearly launch and reentry events were estimated to be about 186 tons CO, 77 tons CO_2, and 203 tons H_2O. These emissions would be of short duration and would be rapidly dispersed. There would be no emissions of hazardous air pollutants (Cl and HCl). Therefore, the launch of reusable suborbital rockets at KLC would not significantly affect air quality.
Biological resources (fish, wildlife, and plants)	Launches would have short-term minor impacts on terrestrial plants and animals from exhaust heat and emissions deposition. No significant impacts to aquatic species would be expected. Activities under an experimental permit could affect the protected Steller sea lion, northern sea otter, Steller's eider, short-tail albatross, and various whale species. Although launches under the Proposed Action could cause short-term effects on these species, the launches would not be likely to adversely affect the long-term well-being, reproduction rates, or survival of any of these species. Monitoring records have not shown any long-term effects on these species.
Historical, architectural, archaeological, and cultural resources	The Proposed Action would not affect historic resources, because there are no identified historic resources in or around KLC. There would be no construction associated with the Proposed Action. Therefore, there would be no impact to archaeological resources.
Floodplains	KLC is not in a floodplain. Therefore, there would be no adverse impacts to floodplains as a result of the Proposed Action.
Hazardous materials, pollution prevention, and solid waste	Increases in the generation of hazardous material, hazardous waste, and solid waste would not exceed KLC's production limit of 2,200 pounds of hazardous waste per month. There would be no adverse impacts expected from the use, generation, or management of hazardous material, hazardous waste, and solid waste.
Health and safety	In coordination with the KLC Range Safety Officer, the FAA would review and verify the hazard analysis to evaluate potential hazards and reduce the associated risks to an acceptable level. Access to launch and support areas would be limited to essential KLC and launch personnel. There would be no significant impacts on health and safety.
Land use (including U.S. Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)	The Proposed Action is consistent with existing launch activities and land uses at KLC and would not add any new coastal development to Kodiak Island. The actions would be consistent with the Alaskan Coastal Zone Management Program and Kodiak Borough Coastal Management Program. The need for temporary closures of the Fossil Beach and East Twin Lake recreational areas during periods of launch activity are unknown at this time and would be based on the defined operating area and rocket type and size.
Light emissions and visual resources	Launch vehicles would leave visible contrails, but they would be similar in visual impact to contrails from existing operations. Due to the isolation of KLC and the consequent lack of permanent viewers, launch operations would result in minimal impacts to visual resources. Visual impacts from launch operations, including impacts to Narrow Cape, would be infrequent, temporary, and minor.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 6 of 17)

Site/Impact Category	Proposed Action
Kodiak Launch Complex (KLC), Alaska (continued)	
Natural resources and energy supply	Activities that would be permitted under the Proposed Action would not result in the development of new facilities at KLC or result in notable changes in local energy demands or consumption of other natural resources. Because of the relatively small scale of activity at KLC under the Experimental Permit Program, the use of rocket propellants would not notably alter their supply or demand, and would result in only minor impacts to natural resources and energy supplies.
Noise and compatible land use[b]	Reusable suborbital vehicles would generate less noise than existing launch activities at KLC. The nearest residential area is well beyond the DNL 65 contour line associated with the Proposed Action. Sonic booms would reach Earth's surface at a distance downrange of KLC, over the ocean, precluding noise impacts on coastal land areas. Therefore, there would be no significant impacts.
Socioeconomic resources, environmental justice, and children's environmental health and safety	The Proposed Action would result in minor short-term impacts to local socioeconomics. Such impacts would result from the launch and reentry support staff working at the launch or reentry site for the duration of the event. Because of the relatively small number of support staff and short duration of each event, demands on the local infrastructure (*e.g.*, power, water, disposal, transportation system) would not result in a noticeable change in existing conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. No large and adverse human health or environmental effects associated with the Proposed Action were identified at the KLC. Therefore, no minority or low-income populations would be disproportionately affected. The FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. As a result, KLC would not be likely to adversely affect children's environmental health and safety.
Water quality[a]	Minor adverse impacts to freshwater systems as a result of the deposition of materials associated with rocket engine emissions into surface waters could occur under the Proposed Action. However, monitoring of the water chemistry in local streams around active launch pads from which rockets have been launched has shown that emissions from rocket engines have not had a measurable impact on basic water chemistry. There would be no impacts to water quality from Cl and HCl. Furthermore, the Proposed Action could have a minor short-term affect on local surface water quality, but would not be expected to affect the designated use as defined under Section 303 of the Clean Water Act. The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater. However, impacts would be expected to be minimized through adherence to all site-specific spill prevention and control requirements at the site.
Wetlands	The Proposed Action could result in local adverse impacts to wetland vegetation and wildlife from deposition of rocket engine emissions, but such impacts would not be significant. The Proposed Action would not result in filling or draining of wetlands, because no new permanent infrastructure would be constructed at KLC and all temporary structures (*e.g.*, a launch stand or reentry pad) would be expected to be located beyond wetland areas and would be removed after a launch or reentry event.
Cumulative impacts	Emissions under the Proposed Action would not significantly affect air quality in the troposphere, but would contribute to cumulative air quality impacts in the area of KLC. Launches under experimental permits may result in an increase in launch noise and sonic boom events and rocket emissions that could impact biological resources in the area. However, no long-term significant cumulative effects to biological resources, including threatened and endangered species or critical habitats, would be expected.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 7 of 17)

Site/Impact Category	Proposed Action
Mid-Atlantic Regional Spaceport (MARS), Wallops Flight Facility, Virginia	
Air quality[a]	MARS is located in an area considered to be in attainment for all criteria pollutants. Annual emissions from ground level to 3,000 feet based on the assumption of 600 yearly launch and reentry events were estimated to be about 186 tons CO, 77 tons CO_2, and 203 tons H_2O. These emissions would be of short duration and would be rapidly dispersed. There would be no emissions of hazardous air pollutants (Cl and HCl). Therefore, the launch of reusable suborbital rockets at MARS would not significantly affect air quality.
Biological resources (fish, wildlife, and plants)	Vegetation near the launches could experience some distress from emissions, resulting in minor short-term impacts, but no long-term adverse effects would be expected. No significant impacts on marine species would be expected. The Proposed Action could affect protected species, including the piping plover, Wilson's plover, peregrine falcon, upland sandpiper, gulled-billed tern, bald eagle, and various sea turtles, and species protected under the Marine Mammal Protection Act. Although launches under the Proposed Action could cause short-term effects on these species, the launches would not be likely to adversely affect the long-term well-being, reproduction rates, or survival of any of these species.
Historical, architectural, archaeological, and cultural resources	There would be no new construction activities under the Proposed Action. Launch activities would not disturb the character or setting of nearby historic sites or archaeological sites. There would be no impact on the area's cultural resources.
Floodplains	Reusable suborbital rocket activities at MARS under the Proposed Action would not affect floodplains. No new permanent infrastructure would be constructed at MARS under the Proposed Action, and all temporary structures (*e.g.*, a launch stand or reentry pad) would be removed after a launch or reentry event.
Hazardous materials, pollution prevention, and solid waste	Wallops Flight Facility has an Integrated Contingency Plan which implements hazardous material spill prevention and cleanup measures. Increases in the generation of hazardous material, hazardous waste, and solid waste would not exceed Wallops Flight Facility's waste-handling capacity under the Facility's management programs. There would be no adverse impacts expected from the use, generation, or management of hazardous material, hazardous waste, and solid waste.
Health and safety	There are no anticipated significant impacts on health and safety.
Land use (including U.S. Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)	There would be no significant noise impacts to Section 4(f) resources or nearby Chincoteague National Wildlife Refuge. Because the launches would not add any new activities or coastal development, the actions would be consistent with the Virginia Coastal Resources Management Plan. In the past, rocket launches at MARS have precluded staff at Chincoteague National Wildlife Refuge (CNWR) from accessing Assawoman Island for the purposes of monitoring beach nesting birds, including piping plovers. Should the FAA receive any future permit applications at MARS, the FAA would coordinate with NASA in order to determine (1) the current status of any consultations with the U.S. Fish and Wildlife Service and CNWR staff concerning both impacts to nesting birds as well as the monitoring program, and (2) the need for any further mitigation measures as a result of any proposed new experimental launches. Based on the measures the FAA would implement regarding consultation with CNWR staff, there would be no significant impacts on existing or future land uses.
Light emissions and visual resources	Launch vehicles would leave visible contrails, but they would be similar in visual impact to contrails from existing operations. Because this area is already used for aircraft takeoffs and landings, the visual sensitivity is low. Launch operations would not substantially degrade the existing visual character or quality of the site and its surroundings. Visual impacts from launch operations would be infrequent, temporary, and minor.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 8 of 17)

Site/Impact Category	Proposed Action
Mid-Atlantic Regional Spaceport (MARS), Wallops Flight Facility, Virginia (continued)	
Natural resources and energy supply	Activities that would be permitted under the Proposed Action would not result in the development of new facilities at MARS or result in notable changes in local energy demands or consumption of other natural resources. Because of the relatively small scale of activity at MARS under the Experimental Permit Program, the use of rocket propellants would not notably alter their supply or demand, and would result in only minor impacts to natural resources and energy supplies.
Noise and compatible land use[b]	The marshland and water surrounding the island would act as a buffer zone for noise generated during rocket launches. Because towns and private farms are well beyond the DNL 65 contour line associated with the launches, there would be no significant noise impacts. Sonic booms associated with launches would occur downrange of the launch site, over the ocean, and would not affect coastal land areas or islands.
Socioeconomic resources, environmental justice, and children's environmental health and safety	The Proposed Action would result in minor short-term impacts to local socioeconomics. Such impacts would result from the launch and reentry support staff working at the launch or reentry site for the duration of the event. Because of the relatively small number of support staff and short duration of each event, demands on the local infrastructure (*e.g.*, power, water, disposal, transportation system) would not result in a noticeable change in existing conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. No large and adverse human health or environmental effects associated with the Proposed Action were identified at MARS. Therefore, no minority or low-income populations would be disproportionately affected. The FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. As a result, MARS would not be likely to adversely affect children's environmental health and safety.
Water quality[a]	Minor adverse impacts to freshwater systems as a result of the deposition of materials associated with rocket engine emissions into surface waters are possible under the Proposed Action. However, monitoring of the water chemistry in local streams around active launch pads from which rockets have been launched has shown that emissions from rocket engines have not had a long-term effect on basic water chemistry. There would be no impacts to water quality from Cl and HCl. Furthermore, the Proposed Action would be expected to have a minor short-term affect on local surface water quality, but would not be expected to affect the designated use as defined under Section 303 of the Clean Water Act. The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater. Strict compliance with the Integrated Contingency Plan should minimize the risk of accidental releases of hazardous materials that could impact groundwater and would minimize impacts to groundwater should an accidental release occur.
Wetlands	The Proposed Action could result in local adverse impacts to wetland vegetation and wildlife from deposition of rocket engine emissions, but such impacts would not be significant. The Proposed Action would not result in filling or draining of wetlands, because no new permanent infrastructure would be constructed at MARS and all temporary structures (*e.g.*, a launch stand or reentry pad) would be expected to be located beyond wetland areas and would be removed after a launch or reentry event.
Cumulative impacts	Emissions under the Proposed Action would not significantly affect air quality in the troposphere, but would contribute to cumulative air quality impacts in the area of MARS. Launches under experimental permits may result in an increase in launch noise and sonic boom events and rocket emissions that could impact biological resources in the area. However, no long-term significant cumulative effects to biological resources, including threatened and endangered species or critical habitats, would be expected.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 9 of 17)

Site/Impact Category	Proposed Action
Mojave Air and Space Port, California	
Air quality[a]	Mojave Air and Space Port is located in Eastern Kern County which is a non-attainment area for the Federal and state 8-hour ozone standard and the state 1-hour ozone standard. Annual emissions from ground level to 3,000 feet based on the assumption of 700 yearly launch and reentry events were estimated to be about 188 tons CO, 209 tons CO_2, 197 tons H_2O, 0.10 ton NO_X, less than 0.005 ton PM, 0.058 ton SO_X, and 0.54 ton VOCs. Both the total annual NO_X and VOC emissions would be substantially below the *de minimis* levels (100 tons of NO_X or VOCs) for this area and are less than the 10-percent threshold for regional significance. The Proposed Action would not require a General Conformity determination for launch events.
Biological resources (fish, wildlife, and plants)	Localized foliar scorching and spotting from rocket launches could cause temporary harm to nearby vegetation, but would not be intense enough to cause long-term damage to vegetation. Impacts to terrestrial species from noise disturbance would be temporary and minor. No aquatic plants or animals are present, so there would be no impacts to these species. The federally listed threatened desert tortoise and the state listed threatened Mohave ground squirrel have been known to occur at the Mojave Air and Space Port. There is no designated critical habitat for desert tortoises at Mojave Air and Space Port and, based on the species preferred habitat, it is unlikely that a desert tortoise would be found within the launch area. The launch of rockets under an experimental permit would not be expected to affect the Mohave ground squirrel.
Historical, architectural, archaeological, and Cultural Resources	There are no *National Register of Historic Places* listed or eligible sites, tribal lands, or traditional cultural properties at the Mojave Air and Space Port. Launch activities would not result in new ground disturbances. Therefore, there would be no impacts to cultural resources.
Floodplains	The Mojave Air and Space Port is not in a floodplain. Therefore, there would be no adverse impacts to floodplains as a result of the Proposed Action.
Hazardous materials, pollution prevention, and solid waste	Procedures are in place to accommodate additional propellants and other launch-related hazardous materials, including paint, oils, lubricants, and solvents. All propellants and other hazardous materials would be stored and used in compliance with the regulations applicable to their storage and use, and already in place at Mojave Air and Space Port. No adverse impacts would be anticipated from these additional hazardous materials.
Health and safety	Launch hazard areas, impact debris corridors and road closures, in addition to disseminating Notices to Airmen, would serve to protect public health and safety. In coordination with Mojave Air and Space Port, the FAA would review and verify the hazard analysis to evaluate potential hazards and reduce the associated risks to an acceptable level. Access to launch and support areas would be limited to essential launch personnel. There would be no significant impacts on health and safety.
Land use (including U.S. Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)	There are no Section 4(f) resources, farmlands, or wild and scenic rivers at the Mojave Air and Space Port. No areas outside of the launch site would have to be cleared or roads closed. There would be no impacts to land use, Section 4(f) resources, farmlands, wild and scenic rivers, or coastal resources.
Light emissions and visual resources	Launch vehicles would leave visible contrails, but they would be similar in visual impact to contrails from existing operations. Because this area is already used for aircraft takeoffs and landings, the visual sensitivity is low. Launch operations would not substantially degrade the existing visual character or quality of the site and its surroundings. Visual impacts from launch operations would be infrequent, temporary, and minor.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 10 of 17)

Site/Impact Category	Proposed Action
Mojave Air and Space Port, California (continued)	
Natural resources and energy supply	Activities that would be permitted under the Proposed Action would not result in the development of new facilities at the Mojave Air and Space Port or result in notable changes in local energy demands or consumption of other natural resources. Because of the relatively small scale of activity at the Mojave Air and Space Port under the Experimental Permit Program, the use of rocket propellants and jet fuel would not notably alter their supply or demand, and would result in only minor impacts to natural resources and energy supplies.
Noise and compatible land use[b]	The Proposed Action would add a maximum of 400 jet-assisted launches per year at the site to the baseline of over 1,200 jet operations. The DNL associated with this change would increase by less than 1.5 dBA. Therefore, noise impacts associated with horizontal launches would not be significant. Hovering vehicles would produce DNL 65 contours within the Mojave Air and Space Port environment and therefore would produce no significant noise impacts. The Proposed Action would not result in a substantial permanent or temporary increase in ambient noise levels in the vicinity. Significant impacts from sonic booms are not expected because it would require up to 750 sonic booms per year to reach a significance threshold.
Socioeconomic resources, environmental justice, and children's environmental health and safety	The Proposed Action would result in minor short-term impacts to local socioeconomics. Such impacts would result from the launch and reentry support staff working at the launch or reentry site for the duration of the event. Because of the relatively small number of support staff and short duration of each event, demands on the local infrastructure (*e.g.*, power, water, disposal, transportation system) would not result in a noticeable change in existing conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. No large and adverse human health or environmental effects associated with the Proposed Action were identified at the Mojave Air and Spaceport. Therefore, no minority or low-income populations would be disproportionately affected. The FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. As a result, the Mojave Air and Space Port would not be likely to adversely affect children's environmental health and safety.
Water quality	There are no standing bodies of surface water at the Mojave Airport, but there are surface drainage channels to the east and southwest of the runways. The Proposed Action does not involve construction and would not be expected to create discharges to these channels. Therefore, no impacts to surface water quality would be expected. The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater. However, impacts would be expected to be minimized through adherence to all site-specific spill prevention and control requirements at the site.
Wetlands	There are no jurisdictional wetlands at the Mojave Air and Space Port and any temporary launch structures would be located beyond the series of drainage channels that are located to the east and southwest of the runway operating area. Thus, there would be no adverse impacts to wetlands as a result of the Proposed Action.
Cumulative impacts	Emissions under the Proposed Action would not significantly affect air quality in the troposphere, but would contribute to cumulative air quality impacts in the area of Mojave Air and Space Port. The total increases in emissions would be less than *de minimis* levels and would be less than the 10-percent threshold for regional significance. Launches under experimental permits may result in an increase in launch noise and sonic boom events and rocket emissions that could impact biological resources in the area. However, no long-term significant cumulative effects to biological resources, including threatened and endangered species or critical habitats, would be expected.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 11 of 17)

Site/Impact Category	Proposed Action
Oklahoma Spaceport, Oklahoma	
Air quality[a]	Oklahoma Spaceport is located in an area considered to be in attainment for all criteria pollutants. Annual emissions from ground level to 3,000 feet based on the assumption of 1,000 yearly launch and reentry events were estimated to be about 215 tons CO, 276 tons CO_2, 239 tons H_2O, 0.10 ton NO_X, less than 0.005 ton PM, 0.058 ton SO_x, and 0.54 ton VOCs. These emissions would be of short duration and would be rapidly dispersed. There would be no lower tropospheric emissions of hazardous air pollutants (Cl and HCl). The launches would not significantly affect air quality and would have a negligible impact on visibility.
Biological resources (fish, wildlife, and plants)	The greatest effects to terrestrial wildlife would occur from visual and noise disturbances during overflight activities, but these effects would be temporary and no long-term impacts would be expected. There are no federally protected, listed, or other special status plant species, wildlife species, or designated critical habitats at the Oklahoma Spaceport.
Historical, architectural, archaeological, and cultural resources	There are no prehistoric or historic sites within the site boundary. Launch activities would not require new ground disturbances and would not represent a new type of activity. Therefore, there would be no impacts to cultural resources.
Floodplains	Reusable suborbital rocket activities under the Proposed Action at the Oklahoma Spaceport would not affect floodplains. No new permanent infrastructure would be constructed under the Proposed Action, and all temporary structures (*e.g.*, a launch stand or reentry pad) would be removed after a launch or reentry event.
Hazardous materials, pollution prevention, and solid waste	The proposed launches would increase the hazardous material, hazardous waste, and solid waste generated at the Clinton-Sherman Industrial Airpark. Standard operating procedures would be in place to minimize the hazard associated with transporting and storing jet fuel and propellants. No adverse impacts from the use, generation, or management of hazardous material, hazardous waste, and solid waste would be expected.
Health and safety	The Proposed Action would not impede or adversely affect existing contamination or clean-up activities at the Airpark. There would be no significant impacts on health and safety.
Land use (including U.S. Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)	The Proposed Action would not preclude or alter land uses in and around Clinton-Sherman Industrial Air Park, and would not affect Washita National Wildlife Refuge. There are no coastlands or wild and scenic rivers near the Airpark. The Proposed Action would not preclude or alter any land uses in and around the Airpark.
Light emissions and visual resources	The visual presence of launches would not be new to the area. Most existing aircraft operations at the Oklahoma Spaceport involve jet-powered aircraft. Launch vehicles would leave visible contrails, but they would be similar in visual impact to contrails from existing operations. Because this area is already used for aircraft takeoffs and landings, the visual sensitivity is low. Launch operations would not substantially degrade the existing visual character or quality of the site and its surroundings. Visual impacts from launch operations would be infrequent, temporary, and minor.
Natural resources and energy supply	Activities that would be permitted under the Proposed Action would not result in the development of new facilities at the Oklahoma Spaceport or result in notable changes in local energy demands or consumption of other natural resources. Because of the relatively small scale of activity at the Oklahoma Spaceport under the Experimental Permit Program, the use of rocket propellants and jet fuel would not notably alter their supply or demand, and would result in only minor impacts to natural resources and energy supplies.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 12 of 17)

Site/Impact Category	Proposed Action
Oklahoma Spaceport, Oklahoma (continued)	
Noise and compatible land use[a]	Noise from the launches should not result in a change in noise exposure in excess of the applicable threshold of significance within the DNL 65 contour in noise-sensitive areas. Additional noise sources would be similar to noise generated by large military aircraft currently in use. The most likely areas for sonic booms are sparsely populated, and therefore there would be no significant noise impacts associated with sonic booms.
Socioeconomic resources, environmental justice, and children's environmental health and safety	The Proposed Action would result in minor short-term impacts to local socioeconomics. Such impacts would result from the launch and reentry support staff working at the launch or reentry site for the duration of the event. Because of the relatively small number of support staff and short duration of each event, demands on the local infrastructure (*e.g.,* power, water, disposal, transportation system) would not result in a noticeable change in existing conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. No large and adverse human health or environmental effects associated with the Proposed Action were identified at the Oklahoma Spaceport. Therefore, no minority or low-income populations would be disproportionately affected. The FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. As a result, the Oklahoma Spaceport would not be likely to adversely affect children's environmental health and safety.
Water quality[a]	Minor adverse impacts to freshwater systems as a result of the deposition of materials associated with rocket engine emissions into surface waters are possible under the Proposed Action. However, monitoring of the water chemistry in local streams around active launch pads from which rockets have been launched has shown that emissions from rocket engines have not had a long-term effect on basic water chemistry. There would be no impacts to water quality from Cl and HCl. Furthermore, the Proposed Action would be expected to have a minor short-term affect on local surface water quality, but would not be expected to affect the designated use as defined under Section 303 of the Clean Water Act. The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater. However, impacts would be expected to be minimized through adherence to all site-specific spill prevention and control requirements at each site.
Wetlands	The Proposed Action could result in local adverse impacts to wetland vegetation and wildlife from deposition of rocket engine emissions, but such impacts would not be significant. The Proposed Action would not result in filling or draining of wetlands, because no new permanent infrastructure would be constructed at the Oklahoma Spaceport and all temporary structures (*e.g.,* a launch stand or reentry pad) would be expected to be located beyond wetland areas and would be removed after a launch or reentry event.
Cumulative impacts	Emissions under the Proposed Action would not significantly affect air quality in the troposphere, but would contribute to cumulative air quality impacts in the area of Oklahoma Spaceport. There are no known federally protected species or designated critical habitats at the Oklahoma Spaceport. Therefore, there would likely be no cumulative impacts to protected species.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 13 of 17)

Site/Impact Category	Proposed Action
Space Florida, Launch Complex 46	
Air quality[a]	Launch Complex 46 is located in an area considered to be in attainment for all criteria pollutants. Annual emissions from ground level to 3,000 feet based on the assumption of 600 yearly launch and reentry events were estimated to be about 186 tons CO, 77 tons CO_2, and 203 tons H_2O. These emissions would be of short duration and would be rapidly dispersed. There would be no emissions of hazardous air pollutants (Cl and HCl). Therefore, the launch of reusable suborbital rockets at LC-46 would not significantly affect air quality.
Biological resources (fish, wildlife, and plants)	Launches could cause temporary distress to nearby vegetation from launch emissions, resulting in minor short-term impacts, but no long-term adverse effects would be expected. Visual and noise disturbances during overflight activities would be temporary and would not significantly affect local wildlife. The FAA has concluded that these additional launch activities could affect the Florida scrub-jay, least tern, piping plover, wood stork, and peregrine falcon. The launches could also disturb the indigo snake, various sea turtle species, the Southeastern beach mouse, and the West Indian Manatee, although no significant impacts are expected. Although launches under the Proposed Action could cause short-term effects on these species, the launches would not be likely to adversely affect the long-term well-being, reproduction rates, or survival of any of these species.
Historical, architectural, archaeological, and cultural resources[c]	The Proposed Action would not affect the *National Register of Historic Places* listed or eligible sites or cultural resources at CCAFS, or alter their character or setting. The activities associated with the Proposed Action would not result in any new ground disturbances and would not represent a new type of activity in the area. Therefore, there would be no impacts to cultural resources.
Floodplains	Reusable suborbital rocket activities at CCAFS under the Proposed Action would not affect floodplains. No new permanent infrastructure would be constructed under the Proposed Action, and all temporary structures (*e.g.*, a launch stand or reentry pad) would be removed after a launch or reentry event.
Hazardous materials, pollution prevention, and solid waste	The proposed launches would increase the hazardous material, hazardous waste, and solid waste generated at CCAFS. Standard operating procedures would be in place to minimize the hazard associated with transporting and handling hazardous materials. Increased volume of hazardous materials could affect the ability of CCAFS to meet pollution prevention goals, and launch activities would be coordinated with CCAFS pollution prevention plans and goals to reduce impacts.
Health and safety	There would be no significant impacts on health and safety.
Land use (including U.S. Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)	Proposed activities would be compatible with existing land uses. The potential need to close nearby Section 4(f) resources (*i.e.*, Merritt Island National Wildlife Refuge and Canaveral National Seashore), during launch activity is unknown at this time and would be based on the defined operating area and rocket type and size. There would be no impacts to farmlands, or wild and scenic rivers. The Proposed Action would not have significant impacts on coastal resources.
Light emissions and visual resources	Launch vehicles would leave visible contrails, but they would be similar in visual impact to contrails from existing operations. Because this area is already used for launch activities, the visual sensitivity is low. Launch operations would not substantially degrade the existing visual character or quality of the site and its surroundings. Visual impacts from launch operations would be infrequent, temporary, and minor.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 14 of 17)

Site/Impact Category	Proposed Action
Space Florida, Launch Complex 46 (continued)	
Natural resources and energy supply	Activities under the Proposed Action would not result in the development of new facilities at CCAFS or result in notable changes in local energy demands or consumption of other natural resources. Because of the relatively small scale of activity at CCAFS under the Experimental Permit Program, the use of rocket propellants would not notably alter their supply or demand, and would result in only minor impacts to natural resources and energy supplies.
Noise and compatible land use	Under the Proposed Action, the number of launches at CCAFS would increase, but the additional launches would be smaller and have lower noise levels than current launches. Populated areas are well beyond the Proposed Action DNL 65 noise contour. Flight paths would not be over populated areas; any sonic booms generated would reach Earth's surface downrange of Launch Complex 46, over the ocean. Therefore, no significant noise impacts would be expected.
Socioeconomic resources, environmental justice, and children's environmental health and safety	The Proposed Action would result in minor short-term impacts to local socioeconomics from launch and reentry support staff working at the launch or reentry site for the duration of the event. Because of the relatively small number of support staff and short duration of each event, demands on the local infrastructure (*e.g.*, power, water, disposal, transportation system) would not cause a noticeable change in existing conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. No large and adverse human health or environmental effects associated with the Proposed Action were identified at CCAFS. Therefore, no minority or low-income populations would be disproportionately affected. The FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. Therefore, the Proposed Action would not be likely to adversely affect children's environmental health and safety.
Water quality[b]	Under the Proposed Action, minor adverse impacts to freshwater systems as a result of the deposition of materials associated with rocket engine emissions into surface waters would be possible. However, monitoring of the water chemistry in local streams around active launch pads from which rockets have been launched has shown that emissions from rocket engines have not had a long-term effect on basic water chemistry. There would be no impacts to water quality from Cl and HCl. Furthermore, the Proposed Action would be expected to have a minor short-term affect on local surface water quality, but would not be expected to affect the designated use as defined under Section 303 of the Clean Water Act. The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater. However, impacts would be expected to be minimized through adherence to all site-specific spill prevention and control requirements at each site.
Wetlands	The Proposed Action could result in local adverse impacts to wetland vegetation and wildlife from deposition of rocket engine emissions, but such impacts would not be significant. The Proposed Action would not result in filling or draining of wetlands, because no new permanent infrastructure would be constructed at Launch Complex 46 and all temporary structures (*e.g.*, a launch stand or reentry pad) would be expected to be located beyond wetland areas and would be removed after a launch or reentry event.
Cumulative impacts	Emissions under the Proposed Action would not significantly affect air quality in the troposphere, but would contribute to cumulative air quality impacts in the area of Launch Complex 46. Launches under experimental permits could result in an increase in launch noise and sonic boom events and rocket emissions that could impact biological resources in the area. However, no long-term significant cumulative effects to biological resources, including threatened and endangered species or critical habitats, would be expected.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 15 of 17)

Site/Impact Category	Proposed Action
Spaceport America, New Mexico	
Air quality[a]	Spaceport America is located in an area considered to be in attainment for all criteria pollutants. Annual emissions from ground level to 3,000 feet based on the assumption of based on the assumption of 882 yearly launch and reentry events, would be about 0.05 ton Cl, 13 tons CO, 3,091 tons CO_2, 4.0 tons HCl, 19 tons NO_x, 8.7 tons PM, 1.4 tons SO_x, and 2.1 tons VOCs. There would be no hazardous air pollutants emitted to the lower troposphere from the launch of reusable suborbital rockets. The launches would not significantly affect air quality and would have a negligible impact on visibility.
Biological resources (fish, wildlife, and plants)	The greatest effects to terrestrial wildlife would occur from visual and noise disturbances during overflight activities, but these effects would be temporary and no long-term impacts would be expected. The only federally or state listed species documented as observed in the Spaceport America Project area are bald and golden eagles and Bell's vireo. It is possible that individuals of these species would be temporarily disturbed by launch noise or sonic booms. These disturbances would be brief, and the resultant brief alteration in behavior should not materially affect the local and regional populations of the species, or its ability to survive and reproduce.
Historical, architectural, archaeological, and cultural resources	Impacts to historic properties, including changes to setting, visual and auditory effects, would occur as a result of the proximity of Spaceport America to a National Historic Trail, El Camino Real, and the Aleman Draw Historic District (Aleman Draw). Launching of vehicles at Spaceport America would result in moderate visual and noise effects to the settings of the National Historic Trail and Aleman Draw, but these direct impacts would be short in duration and periodic. Impacts also would be expected as a result of increased activity at the site during the X Prize Cup; however, these impacts would be limited to the 1 week of the year in which the event would be conducted; therefore, impacts would be temporary. In addition, a Programmatic Agreement between the New Mexico Spaceport Authority and Section 106 consulting parties outlines the processes to develop plans to minimize or mitigate adverse affects.
Floodplains	Reusable suborbital rocket activities at Spaceport America under the Proposed Action would not affect floodplains. No new permanent infrastructure would be constructed under the Proposed Action, and all temporary structures (*e.g.*, a launch stand or reentry pad) would be removed after a launch or reentry event.
Hazardous materials, pollution prevention, and solid waste	Onsite impacts stemming from the management of hazardous materials and hazardous and solid wastes would not be expected because they would be handled, stored, and used in compliance with all applicable regulations. Offsite impacts from disposal of spaceport-generated waste would be negligible to minimal due to the small quantities of waste in comparison to waste disposal capacity available in the region. No adverse impacts from the use, generation, or management of hazardous material, hazardous waste, and solid waste would be expected.
Health and safety	There are no anticipated significant impacts on health and safety.
Land use (including U.S. Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)	There would be no direct use or constructive use of Section 4(f) resources as a result of launch activities at Spaceport America, and no protected farmlands are present. Therefore, there would be no impacts to Section 4(f) resources or protected farmlands resulting from operation of the launch facility. Direct impacts to land use from launch operations would be limited to lands converted from rangeland to vertical and horizontal launch and support facilities, and areas already designated on the White Sands Missile Range for landing. Because the actual land area disturbed for launch operations would be less than 6 percent of the total of more than 16,000 acres of land within the Spaceport America site, direct impacts to land use from launch operations would be minimal. Therefore, there would be no impacts to land use, Section 4(f) resources, farmlands, wild and scenic rivers, or coastal resources.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 16 of 17)

Site/Impact Category	Proposed Action
Spaceport America, New Mexico (continued)	
Light emissions and visual resources	Horizontal launch vehicles departing the airfield could fly over visually sensitive areas, and rocket exhaust plumes and contrails could be visible. However, contrails that result from high-altitude military and commercial aircraft operations are routinely and commonly visible throughout Spaceport America, and rocket plumes from activities at the White Sands Missile Range are visible whenever there is a launch. Therefore, launch operations would not represent a large percentage change to these occurrences, and no significant visual impacts would result from launch operations. Visual impacts on the El Camino Real National Historic Trail and Yost Escarpment would be infrequent, temporary, and minor.
Natural resources and energy supply	Various fuels would be required at Spaceport America to launch and land vehicles and to operate vehicles and infrastructure to support launches and recoveries. Most of the rocket fuel supply would be trucked to the site from national or regional suppliers. Gasoline and diesel needs would be relatively small. There would be no impact to energy supplies as a result of the Proposed Action. The demand for electrical energy in the region would increase if the Proposed Action were implemented. However, the limited electrical distribution capacity to the site makes it unlikely that other system users would be affected by electricity use at Spaceport America.
Noise and compatible land use[b]	Vertical launches would have the highest noise levels (90 dBA), but would occur for short periods of time, periodically, and only during daylight hours. Persons within 3 miles of the launch site would experience loud, but not damaging sound levels. Horizontal launches along with airport operations would generate noise that is more frequent than vertical launches, but noise peaks would be less (up to approximately 75 dBA for both horizontal launches and airport operations). The greatest noise levels would be associated with the X Prize Cup event, when noise levels are estimated at about 50 dBA at 300 feet from Sierra County Road A013, a level the U.S. Environmental Protection Agency associates with that of a small town (between 46.1 and 47.2 dBA). Therefore, no significant noise impacts would be expected.
Socioeconomic resources, environmental justice, and children's environmental health and safety	The Proposed Action would result in minor short-term impacts to local socioeconomics. Such impacts would result from the launch and reentry support staff working at the launch or reentry site for the duration of the event. Because of the relatively small number of support staff and short duration of each event, demands on the local infrastructure (*e.g.*, power, water, disposal, transportation system) would not result in a noticeable change in existing conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. No large and adverse human health or environmental effects associated with the Proposed Action were identified at Spaceport America. Therefore, no minority or low-income populations would be disproportionately affected. The FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. As a result, Spaceport America would not be likely to adversely affect children's environmental health and safety.

Exhibit ES-4. Potential Site-Specific Environmental Impacts under the Proposed Action (page 17 of 17)

Site/Impact Category	Proposed Action
Spaceport America, New Mexico (continued)	
Water quality	Surface water is limited to storm water runoff. No impacts to these ephemeral surface waters would be expected. The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater. However, impacts would be expected to be minimized through adherence to all site-specific spill prevention and control requirements at each site.
Wetlands	There are no jurisdictional wetlands at Spaceport America. Thus, there would be no adverse impacts to wetlands as a result of the Proposed Action.
Cumulative impacts	Emissions under the Proposed Action would not significantly affect air quality in the troposphere, but would contribute to cumulative air quality impacts in the area of Spaceport America. Launches under experimental permits may result in an increase in launch noise and sonic boom events and rocket emissions that could impact biological resources in the area. However, no long-term significant cumulative effects to biological resources, including threatened and endangered species or critical habitats, would be expected.

[a] HCl = hydrogen chloride; Cl = chlorine; PM = particulate matter; nitrogen oxides (NO_X = nitrogen oxides; SO_X = sulfur oxides; CO = carbon monoxide; CO_2 = carbon dioxide; H_2O = water; H^+ = hydrogen ions; VOCs = volatile organic compounds; NAAQS = National Ambient Air Quality Standards.
[b] DNL = day/night average sound level; dbA = A-weighted decibels.
[c] CCAFS = Cap Canaveral Air Force Station.

Federal Aviation Administration

Final Programmatic Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications

September 2009

HQ-09938

CONTENTS

CONTENTS (continued)

Section **Page**

CONTENTS (continued)

Section **Page**

CONTENTS (continued)

Section **Page**

CONTENTS (continued)

Section **Page**

CONTENTS (continued)

CONTENTS (continued)

Section **Page**

CONTENTS (continued)

Section **Page**

Exhibit

CONTENTS (continued)

Exhibit **Page**

CONTENTS (continued)

Exhibit **Page**

APPENDICES

ACRONYMS AND ABBREVIATIONS

AEE	Office of Energy and the Environment
AFR	Air Force Regulation
AH_3	ammonium
Al_2O_3	aluminum oxide
Ar	Argon
ASEL	A-weighted sound level
AST	Office of Commercial Space Transportation
ºC	degrees Celsius
CAAQS	California Ambient Air Quality Standards
CCAFS	Cape Canaveral Air Force Station
CDNL	C-weighted DNL
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	Chlorofluorocarbon
CFR	Code of Federal Regulations
CH_4	methane
Cl	chlorine
Cl^-	chlorine ions
CO	carbon monoxide
CO_2	carbon dioxide
CSLAA	Commercial Space Launch Amendments Act of 2004
CTPB	carboxy terminated polybutadiene
dB	decibels
dBA	A-weighted decibels
DNL	day/night average sound level
DoD	Department of Defense, U.S.
DOT	Department of Transportation, U.S.
EA	environmental assessment
EIS	environmental impact statement
EPA	Environmental Protection Agency, U.S.
ºF	degrees Fahrenheit
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FR	Federal Register
GEO	geosynchronous transfer orbits
GMD	ground-based midcourse defense
H	atomic hydrogen
H+	hydrogen ions
H_2	molecular hydrogen
H_2O	water
H_2O_2	hydrogen peroxide
HCl	hydrogen chloride
He	helium
HNO_3	nitric acids
HTP	high-test peroxide
HTPB	hydroxyl terminated polybutadiene
IPA	isopropyl alcohol
IPF	Integrated Processing Facility
IRFNA	inhibited red-fuming nitric acid

ºK	degrees Kelvin
KLC	Kodiak Launch Complex
KSC	John F. Kennedy Space Center
LC	Launch Complex
LEO	low Earth orbits
LH_2	liquid hydrogen
LO_2	liquid oxygen
LOX	liquid oxygen
LP	launch pad
LSAIP	Launch Site Accident Investigation Plan
LTO	landing-takeoff cycle
MARS	Mid-Atlantic Regional Spaceport
MMH	monomethyl hydrazine
N	atomic nitrogen
N_2	molecular nitrogen
N_2O	nitrous oxide
N_2O_4	nitrogen tetroxide
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NH_3	ammonia
NLR	noise level reduction
NO	nitric oxide
NO_2	nitrogen dioxide
NO_X	nitrogen oxides
NOAA	National Oceanic Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
O	atomic oxygen
O_2	molecular oxygen
O_3	ozone
OH^-	hydroxyl radicals
OSHA	Occupational Safety and Health Administration
OTR	ozone transport region
Pb	lead
PCB	polychlorinated biphenyls
PEIS	Programmatic Environmental Impact Statement
ppm	parts per million
PM	particulate matter
$PM_{2.5}$	particulate matter with an aerodynamic diameter of less than 2.5 microns
PM_{10}	particulate matter with an aerodynamic diameter of less than 10 microns
PSD	prevention of significant deterioration
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
RSTS	Range Safety and Telemetry System
RV	reentry vehicle
SCL	Space Launch Complex
SO_2	sulfur dioxide
SPCC	spill prevention, control, and countermeasures
SR	State Road
SSI	Space Systems International

SWMU	solid waste management units
UDMH	unsymmetrical dimethyl hydrazine
U.S.	United States
U.S.C.	United States Code
UV	ultraviolet
UVB	ultraviolet radiation band “B”
VCSFA	Virginia Commercial Space Flight Authority
VMRC	Virginia Marine Resources Commission
VOC	volatile organic compound

1. PURPOSE AND NEED FOR AGENCY ACTION

1.1 Introduction

The United States (U.S.) Federal Aviation Administration (FAA) Office of Commercial Space Transportation (AST) regulates the commercial space transportation industry to ensure public safety for licensed U.S. launch activities and to support the continued growth and expansion of the U.S. space transportation industry. In fulfilling its mission and in accordance with the Commercial Space Launch Amendments Act of 2004 (CSLAA) (Public Law 108-492), the FAA issues (1) licenses for commercial launches of expendable and reusable launch vehicles and reentry activities, (2) licenses for the operation of commercial launch and reentry sites, and (3) experimental permits for the launch and reentry of developmental reusable suborbital rockets. The CSLAA directs the FAA to promote the development of the emerging commercial space flight industry; makes the FAA responsible for regulating private human space flight under 49 United States Code (U.S.C.) Subtitle IX, Chapter 701, Commercial Space Launch Activities (formerly the Commercial Space Launch Act); and establishes the Experimental Permit Program for launching developmental reusable suborbital rockets on suborbital trajectories.[1] The FAA issued a proposed rule in the *Federal Register* (*FR*), 71 *FR* 16251, on March 31, 2006, to update and clarify requirements of the Experimental Permit Program. The FAA published the final rule in the *Federal Register*, 72 *FR* 17001, on April 6, 2007.[2]

As Congress directed, to be eligible for an experimental permit, an applicant must propose to operate a reusable suborbital rocket for one of the following purposes:

- Research and development to test new design concepts, new equipment, or new operating techniques;
- A showing of compliance with requirements for obtaining a license; or
- Crew training before obtaining a license for a launch or reentry using the design of the rocket for which the permit would be issued.

The FAA prepared this Programmatic Environmental Impact Statement (PEIS) with cooperation from the National Aeronautics and Space Administration (NASA) and the U.S. Air Force to examine the environmental impacts of an alternative approach for complying with the National Environmental Policy Act of 1969, as amended (NEPA; 42 U.S.C. 4321, *et seq*.) when reviewing applications for reusable suborbital rockets operating under experimental permits. The intent of this PEIS is to facilitate the preparation of environmental documents for the issuance of experimental permits to individual launch operators. By providing information and analyses common to all reusable suborbital rockets, the FAA may choose to tier future environmental documents, either an environmental assessment (EA) or an environmental impact statement (EIS), as appropriate, from this PEIS to focus on environmental impacts specific to an applicant's proposed operations under an experimental permit. Tiering from this PEIS would eliminate repetitive discussions of recurring issues and focus on the actual issues that are ready for decision. So long as the activities of the tiered document are within the scope of this PEIS, a subsequent environmental analysis would only need to summarize the issues discussed in this PEIS, incorporate discussions from this PEIS by reference, and concentrate on the issues specific to the subsequent action. Focusing on issues that are ready for decision, and excluding from consideration issues already decided,

[1] The CSLAA defines suborbital rocket as a vehicle, rocket-propelled in whole or in part, intended for flight on a suborbital trajectory, whose thrust is greater than its lift for the majority of the rocket-powered portion of ascent. A suborbital trajectory is defined in the CSLAA as the intentional flight path of a launch vehicle, reentry vehicle, or any portion thereof, whose vacuum instantaneous impact point does not leave the surface of Earth.
[2] An electronic copy can be obtained using the Internet by visiting the FAA Regulations and Policies web page at http://www.faa.gov/regulations_policies/; or accessing the Government Printing Office web page at http://www.gpoaccess.gov/fr/index.html.

would reduce paperwork, duplication, and time needed to develop future site-specific and project-specific analyses.

Additionally, by providing information and analyses common to all reusable suborbital rockets and analyzing the environmental impacts of the use of such rockets at specified facilities, this PEIS may also provide the streamlining benefit of avoiding a duplicate NEPA analysis in that for some experimental permit applications no further NEPA document, EA or EIS, may be needed for a decision on whether or not to grant an experimental permit to an applicant. Rather, this PEIS would serve as the NEPA document for that decision, but only after the FAA/AST documented that the impacts of the pending permit decision have been fully analyzed or addressed in this PEIS.

This PEIS will not authorize the launch or reentry of reusable suborbital rockets from a particular launch site. Individual launch operators would be required to coordinate with site operators to gain access to a site. In addition, the launch operators would need to apply to the FAA for an experimental permit, which would require an individual safety and environmental review.

1.2 Background

Prior to enactment of the CSLAA, a reusable launch vehicle license was the only mechanism available to the FAA to authorize the launch or reentry of a reusable suborbital vehicle. The CSLAA provides definitions and requirements for an experimental permit program and directs the FAA to make a determination on issuing an experimental permit within 120 days of receiving a substantially completed application; the FAA has 180 days to make a license determination. The CSLAA also outlines the following specifications for issuing an experimental permit:

- The permit must authorize an unlimited number of launches and reentries for a particular suborbital rocket design (49 U.S.C. 70105a[e][1]).
- The permit must specify the modifications that may be made to the suborbital rocket without changing the design to an extent that would invalidate the permit (49 U.S.C. 70105a[e][2]).
- The permit is not transferable (49 U.S.C. 70105a[f]).
- The permit does not provide indemnification (49 U.S.C. 70113).
- An experimental permit may not be issued for, and a permit that has already been issued shall cease to be valid for, a particular design for a reusable suborbital rocket after a license has been issued for the launch or reentry of a rocket of that design (49 U.S.C. 70105a[g]).
- No person may operate a reusable suborbital rocket under a permit for carrying any property or human being for compensation or hire (49 U.S.C. 70105a[h]).

Under 49 U.S.C. Subtitle IX, Chapter 701, and delegation of authority from the Secretary of Transportation, the FAA is authorized to regulate the operations and safety of the emerging commercial human space flight industry (49 U.S.C. 70101 [a][13]). In addition, the FAA is authorized to oversee and coordinate the conduct of commercial launch and reentry operations, issue permits and commercial licenses and transfer commercial licenses authorizing those operations, and protect the public health and safety, safety of property, and U.S. national security and foreign policy interests (49 U.S.C. 70101 [b][3]).

As the designated authority for regulating the U.S. commercial space transportation industry and authorizing launches, reentries, and the operation of launch and reentry sites, the FAA is the lead agency preparing this PEIS. NASA and the U.S. Air Force are cooperating agencies in the development of this PEIS.

The FAA prepared this PEIS in accordance with NEPA, Council on Environmental Quality (CEQ) NEPA implementing regulations (40 Code of Federal Regulations [CFR] Parts 1500 to 1508), and FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures*.

1.3 FAA Experimental Permit Program

Under the final rule issued on April 6, 2007, an experimental permit applicant is required to prepare and submit the following information to the FAA:

- ***Program Description*** – physical description of the suborbital rocket and its systems, the purpose of its flight, any payload, the propellant and any hazardous materials, and foreign ownership information;
- ***Flight Test Plan*** – flight test program, the estimated number of flights, key flight safety events, maximum altitude, and the geographic boundary of the suborbital rocket operating area where its flights would be performed;
- ***Operational Safety Documentation*** – hazard analysis; verification of operating area and key flight-safety event limitations; identification of landing and impact areas; agreements with site operators, the U.S. Coast Guard for over-water flights, and the appropriate air traffic control authority; tracking methods; the flight rules; and a mishap response plan;
- ***Environmental Information*** – including vehicle and flight plan description to allow the FAA to analyze the potential impacts in accordance with NEPA and its implementing regulations;
- ***Financial Responsibility*** – liability insurance or demonstration of financial responsibility in amounts to compensate for the maximum probable loss for third parties and government property.

The FAA has issued five permits for launches at four different sites under the Experimental Permit Program, including launches of Blue Origin's PM-1 rocket, Armadillo Aerospace's MOD-1 and QUAD rockets, and TrueZer0's Ignignokt rocket. The FAA prepared NEPA documents to support these activities (FAA, 2006a; FAA, 2006b; FAA, 2007a; FAA, 2007b; FAA, 2008a) and for other proposed operations, such as the Masten Space Systems proposal to launch three types of vehicle from Mojave Airport (FAA, 2006c).

1.4 Purpose and Need for the Action

The ***purpose*** of the FAA Proposed Action is to facilitate the issuance of experimental permits for the launch and/or reentry of reusable suborbital rockets by streamlining the environmental review portion of the application. Environmental documents tiering from this PEIS would eliminate repetitive discussions of recurring issues and when necessary focus those environmental documents on any unaddressed impacts or issues ready for decision. For some permit applications, no further NEPA documents may be needed. In addition, the purpose of the Proposed Action is to further the mission of the FAA to promote the growth of the U.S. space transportation industry while protecting public health and safety, the safety of property, and U.S. national security and foreign policy interests.

The ***need*** for the FAA Proposed Action results from the statutory direction from Congress to facilitate commercial rocket developers' research and development associated with testing new design concepts, new equipment, or new operating techniques; compliance with requirements; and training of flight crews. Facilitating the issuance of experimental permits implements the direction and intent Congress provided to the FAA in the CSLAA. In addition, the need for the Proposed Action is to aid the permitting process to meet the 120-day deadline Congress imposed under the CSLAA.

1.5 Scope of the Programmatic Environmental Impact Statement

The scope of this PEIS includes activities associated with the issuance of an experimental permit, including pre-flight activities; takeoff, flight (including reentry), and landing activities; and post-flight activities. Pre-flight activities include those performed to prepare a reusable suborbital rocket for launch, beginning with its arrival at the point of launch. Takeoff, flight, and landing activities include those performed from engine ignition to landing. Post-flight activities include vehicle and equipment recovery (*e.g.*, parachute recovery) and vehicle safing (*i.e.*, ensuring that the vehicle is stable and presents no public hazards during recovery).

The scope of this PEIS does not include construction activities and assumes the use of existing launch support infrastructure, such as launch pads, radar or communication systems, propellant loading systems, or control buildings. Consequently, any proposed construction activities (*e.g.*, repair or modification of existing infrastructure or development of new infrastructure) would be addressed in separate site-specific environmental documentation, as appropriate. In addition, because the FAA does not issue licenses or experimental permits for "amateur rocket activities,"[3] this PEIS does not consider such activities.

1.5.1 Approach to the Analysis

This PEIS analyzes the potential impacts of issuing an experimental permit for the operation of reusable suborbital rockets from anywhere in the U.S. or abroad, as well as from any one of the seven FAA-licensed commercial launch sites and one Federal range listed in Section 2.1.2. In terms of these eight sites, this PEIS addresses and incorporates to the fullest extent possible the site-specific impacts of the projected maximum number of experimental launches that could occur annually at each site between 2009 and 2014.

This PEIS analyzes the potential impacts of permitted launches from anywhere in the U.S. or abroad on the resource areas listed below. For the eight specified launch sites, this PEIS includes the same list of resource categories:

- Air quality;
- Biological resources (fish, wildlife, and plants);
- Historical, architectural, archaeological, and cultural resources;
- Floodplains;
- Hazardous materials, pollution prevention, and solid waste;
- Health and safety;
- Land use (including U.S. Department of Transportation Section 4(f) Resources, Farmlands, Wild and Scenic Rivers, and Coastal Resources);
- Light emissions and visual resources;
- Natural resources and energy supply;
- Noise and compatible land use;
- Socioeconomic impacts, environmental justice, and children's environmental health and safety;

[3] Defined in 14 CFR 1.1 as an unmanned rocket that (1) is propelled by a motor or motors having a combined total impulse of 889,600 Newton-seconds (200,000 pound-seconds) or less and (2) cannot reach an altitude greater than 150 kilometers (93.2 statute miles) above Earth's surface.

- Water quality; and
- Wetlands.

1.5.2 Incomplete or Unavailable Information

To gain the tiering and streamlining benefits attributable to a programmatic EIS, this PEIS analyzes the potential environmental impacts of reusable suborbital rockets operating under experimental permits by including an analysis of the general environmental impacts that could be expected at any site and the site-specific analyses for eight launch sites. The PEIS makes general assumptions about the types of launch vehicles that could be used and the potential launch profile, and includes a projected maximum number of launches from each site. It is reasonable to expect that as the Program matures and rocket operators apply for experimental permits, some of the assumptions in this PEIS may no longer be valid. Consequently, the FAA will reexamine the need to amend this PEIS within a 5-year period if the FAA makes substantial changes to the Program that are relevant to environmental concerns or the FAA becomes aware of significant new circumstances relevant to environmental concerns and related to the Program or its impacts.

Additionally, at this stage of the Program, the FAA does not know the actual number of launches that could occur from particular sites under the Proposed Action. Therefore, certain environmental impact analyses at some of the eight launch sites listed in this PEIS cannot reach a specific determination of potential effect, if any, until subsequent and specific consultations are completed on the permit application for such resources as endangered species and with such expert agencies as the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. Consequently, as the FAA receives permit applications, it would evaluate each application to determine the applicability of this PEIS and the need for additional environmental documentation, NEPA analyses, and interagency consultation, as described in Section 1.5.3.

1.5.3 Future Uses of the PEIS

An operator applying for an experimental permit for the launch and/or reentry of a reusable suborbital rocket should consult with the FAA to determine the type of environmental document that must be prepared in accordance with NEPA and FAA Order 1050.1E. In order to do this, the FAA would complete a NEPA checklist (see Appendix A[4]) to examine each permit application in relation to the analyses in this PEIS. If the applicant's proposed launch activities were addressed in this PEIS as well as their potential environmental impacts, the FAA would document those findings in the NEPA checklist. For example, if the proposed launch site was one that required no further site-specific consultations or analyses for such sensitive resources as endangered species, marine mammals, or Section 4(f) resources, the likely outcome would be that the NEPA analysis in this PEIS would suffice for the permit application and no duplication of effort or paperwork would occur. In such a case, the FAA/AST would conclude its NEPA review by so executing the NEPA Checklist. Consequently, this example application review case would tier from this PEIS for NEPA compliance purposes.

Whenever the FAA cannot, through the completion of the NEPA Checklist, conclude that no further NEPA document is required, the appropriate NEPA document, an EA or an EIS, would be prepared in accordance with FAA Order 1050.1E. However, that NEPA document would focus only on the proposed activity, resource area(s), and impact(s) not addressed in this PEIS. This focused approach would again avoid both a duplication of effort and effectively streamline the NEPA compliance process for the FAA and the applicant.

[4] The FAA could change the content of the checklist over time based on its experience with completing it, but would not eliminate its coverage of any currently listed resource categories.

1.5.3.1 Launch Sites not Evaluated in this Programmatic Environmental Impact Statement

If an applicant proposes to launch from a site not evaluated in this PEIS, the FAA could develop an EA or EIS, as appropriate, that partially tiers from this PEIS and provides an impact analysis for the site-specific resource areas listed in Section 1.5.1. The impacts that would most likely accommodate some degree of tiering would include those that apply generally to all potential launch sites, as identified in Section 4.1.

1.5.3.2 Launch Sites Evaluated in this Programmatic Environmental Impact Statement

For applicants proposing to launch from one of the eight sites evaluated in detail in this PEIS (see Section 2.1.2), the FAA could develop an environmental document that entirely or partially tiers from and incorporates the findings of this PEIS. Similarly, if the applicant proposes to use one of the eight launch sites covered in this PEIS but that site either needs (1) continuing consultation with a federal consulting agency because of the nearby presence of a sensitive resource such as an endangered species or a marine mammal, or (2) a site-specific Section 4(f) determination,[5] the FAA would undertake the consultation or complete the determination. Any "no effect" finding from the completed consultation(s) or a FAA no effect, *de minimis* effect, or no substantial impairment determination for Section 4(f) compliance purposes would be documented in the NEPA Checklist. If no additional analyses are needed, the FAA would execute the NEPA Checklist and conclude the NEPA compliance process for the covered permit application with no resulting need to prepare either an EA or an EIS.

1.5.4 Related NEPA Documentation

This PEIS incorporates and summarizes information from several site-specific NEPA analyses, as appropriate. Exhibit 1-1 lists the eight launch and reentry sites analyzed in this PEIS, along with relevant NEPA support documents incorporated by reference throughout Chapters 3 and 4.

1.6 Public Involvement

Throughout the preparation of the Draft PEIS, including the scoping process, the FAA sought substantive input from a variety of interested parties concerning the environmental issues to be addressed and the alternatives to be considered. The FAA received comments on the Draft EIS and the agency's response to comments are included in Appendix E.

1.6.1 Scoping

On March 27, 2006, the FAA published a Notice of Intent to prepare a PEIS (71 *FR* 15251) in the *Federal Register*. The Notice of Intent is presented in Appendix B. The Notice of Intent invited interested agencies, organizations, Native American tribes, and members of the public to submit comments to assist the FAA in identifying significant environmental issues and in determining the appropriate scope of the PEIS. The FAA extended the scoping period on May 9, 2006 (71 *FR* 27023) and again on September 20, 2006 (71 *FR* 55048). These notices provided interested parties an opportunity to provide comments and request scoping meetings. Information on the PEIS was provided on the FAA/AST website at http://www.faa.gov/about/office_org/headquarters_offices/ast/. In addition, the FAA sought scoping comments from the commercial space industry during the 9th annual Commercial

[5] See Section 3.1.7.2 of this PEIS for an explanation of Section 4(f).

Exhibit 1-1. Launch Sites and NEPA Documentation

Site	Location	NEPA Documentation
California Spaceport	Vandenberg Air Force Base, California	Department of the Air Force. *Final Environmental Assessment for the Orbital/Sub-Orbital Program*. July 2006. Department of the Air Force. *Final Environmental Assessment for the California Spaceport, Vandenberg Air Force Base, California*. February 1995.
John F. Kennedy Space Center	Cape Canaveral, Florida	National Aeronautics and Space Administration. *Final Environmental Impact Statement for the International Space Research Park (ISRP) at the John F. Kennedy Space Center (KSC)*. June 2004. National Aeronautics and Space Administration. *Final Environmental Impact Statement for the ISRP at the KSC*. November 2004. National Aeronautics and Space Administration. *Final Environmental Assessment for the Expanded Use of the Shuttle Landing Facility*. September 2007. National Aeronautics and Space Administration. *Final Constellation Programmatic Environmental Impact Statement*. January 2008.
Kodiak Launch Complex	Kodiak Island, Alaska	Department of the Air Force. *Final Environmental Assessment for the Orbital/Sub-Orbital Program*. July 2006. Department of Transportation. *Final Environmental Assessment of the Kodiak Launch Complex, Kodiak Island, Alaska*. May 1996. Missile Defense Agency. *Ground-Based Midcourse Defense (GMD) Extended Test Range (ETR) Environmental Impact Statement*. July 2003.
Mid-Atlantic Regional Spaceport	Wallops Island, Virginia	Department of the Air Force. *Final Environmental Assessment for the Orbital/Sub-Orbital Program*. July 2006. National Aeronautics and Space Administration. *Site-Wide Environmental Assessment for the Wallops Flight Facility*. January 2005.
Mojave Air and Space Port	Mojave, California	Department of Transportation. *Final Environmental Assessment for the East Kern Airport District Launch Site Operator License for the Mojave Airport*. February 2004. Department of Transportation. *Final Environmental Assessment/Initial Study for the 3,000-Foot Extension of Runway 12/30 at the Mojave Airport.* May 2005. Department of Transportation. *Final Environmental Assessment for Masten Space Systems*. August 2006.
Oklahoma Spaceport	Washita County, Oklahoma	Department of Transportation. *Final Environmental Assessment for the Oklahoma Spaceport*. May 2006. Department of the Air Force. *Final Environmental Assessment for C-17 Program Changes for Altus Air Force Base, Oklahoma*. July 2004.

Exhibit 1-1. Launch Sites and NEPA Documentation (continued)

Site	Location	NEPA Documentation
Space Florida Launch Complex-46	Cape Canaveral, Florida	Department of the Air Force. *Final Environmental Assessment of the Proposed Spaceport Florida Authority Commercial Launch Program at Launch Complex-46 at the Cape Canaveral Air Station, Florida*. October 1994. Department of the Air Force. *Final Environmental Impact Statement for the Evolved Expendable Launch Vehicle Program*. April 1998. Department of the Air Force. *Supplemental Environmental Impact Statement for the Evolved Expendable Launch Vehicle Program*. March 2000. Department of the Air Force. *Final Environmental Assessment for the Orbital/Sub-Orbital Program*. July 2006.
Spaceport America	Sierra County, New Mexico	Department of Transportation. *Final Environmental Impact Statement for the Spaceport America Commercial Launch Site, Sierra County, New Mexico.* November 2008.

Space Transportation Conference in 2006 and during a May 2007 experimental permits workshop for potential experimental permit applicants. In summary, the FAA did not receive any scoping comments regarding environmental concerns or requests for scoping meetings.

1.6.2 Public Comments on the Draft PEIS

In a Notice of Availability (74 *FR* 16439, April 10, 2009) the FAA requested comments on the Draft PEIS and announced a public comment period extending through May 25, 2009. The Notice of Availability is presented in Appendix B. The FAA also mailed copies of either the full PEIS or an Executive Summary with CD-ROM attached to a distribution list of approximately 670 elected officials, Federal agencies, Native American tribes, state agencies, county agencies, local agencies, organizations, and members of the public. Copies of the PEIS were made available for review in 14 public libraries near the eight launch sites evaluated in the PEIS. The PEIS was also made available on FAA's website. The FAA received 16 comment documents (letters, e-mails, and faxes) during the comment period. The FAA has considered all comments on the Draft PEIS in preparing this Final PEIS. Appendix E provides copies of the comment documents with individual comments marked and the FAA responses to those comments.

The FAA made a number of changes to the PEIS based on public and agency comments to improve the analysis or correct factual errors. The FAA's response to each comment indicates whether the FAA made changes or additions to the PEIS.

1.6.3 Decision Schedule

The FAA will make no decision on the Proposed Action until a minimum of 30 days after the publication of this Final PEIS. After that period, the FAA will prepare a Record of Decision (ROD) concerning the Proposed Action. The ROD will notify the public of the alternative the FAA has selected and the reasons for that decision. The FAA will publish the ROD in the *Federal Register* and will post the ROD on the FAA/AST website (http://www.faa.gov/about/office_org/headquarters_offices/ast/).

2. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

The Federal Aviation Administration (FAA) prepared this Programmatic Environmental Impact Statement (PEIS) to examine the environmental impacts of an alternative approach for complying with the National Environmental Policy Act (NEPA) when reviewing experimental permit applications for launching reusable suborbital rockets under experimental permits. This PEIS evaluates two alternatives, the Proposed Action to use this PEIS as a streamlined NEPA compliance tool in its decisionmaking process for approving or denying experimental permits for the launch and reentry of reusable suborbital rockets from both FAA-licensed and non-licensed sites, and the No Action Alternative to continue complying with NEPA by preparing a completely new NEPA document for the approval or denial of each experimental permit application. These alternatives allow the FAA to present the environmental impacts in comparative form, define the issues, and provide a basis for options decisionmakers will consider.

2.1 Proposed Action (Preferred Alternative)

Under the Proposed Action, which is the FAA's preferred alternative, the FAA would issue experimental permits for the launch and reentry of reusable suborbital rockets from both FAA-licensed and non-licensed launch sites using this PEIS as the basis for determining the environmental consequences of issuing the permits. As described in Section 1.5.3, the FAA would use the information and analyses in this PEIS to facilitate the preparation of environmental documents for the issuance of experimental permits to individual rocket operators. Because this PEIS presents information and analyses common to all reusable suborbital rockets, the FAA could choose to tier future environmental documents from the PEIS to focus on environmental impacts specific to an applicant's proposed operations under an experimental permit. Tiering from this PEIS would eliminate repetitive discussions of recurring issues and focus on the issues ready for decision. So long as the activities analyzed in a tiered document are within the scope of this PEIS, the subsequent environmental impact analysis for the issuance of experimental permits need only summarize the issues discussed in this PEIS, incorporate discussions from this PEIS by reference, and concentrate on the impacts specific to each experimental permit.

For most suborbital launches, the FAA would authorize the launch[1] under a single permit, which would stipulate the appropriate safety requirements. A permit would be valid for one year and would authorize an unlimited number of launches and reentries of a specified reusable suborbital rocket design from a specified site(s). A permittee could renew the permit by submitting a written application to the FAA for renewal at least 60 days before the permit expired.

Although the permit authorizes an unlimited number of launches, the FAA must estimate a number of launches to calculate environmental impacts. To quantify a conservative assumption for the number of reusable suborbital rocket launches and reentries that could occur at any one location under the Experimental Permit Program, the FAA reviewed past activities and consulted with various organizations in the commercial space industry. Based on that review, the FAA projected that a maximum of 1,000 launch and reentry events could occur annually at any one location between 2009 and 2014. The FAA used this estimate to develop an upper bound to assess the potential impacts of the Experimental Permit Program, as described in Chapter 4 of this PEIS. This estimate accounts for special events, such as the X Prize Cup, during which multiple reusable suborbital rockets might be launched in a single day. The actual launch numbers would depend on rocket development and the number of operators that propose to use an individual site. The estimates are extremely conservative and the actual number of launches per

[1] For purposes of this PEIS, launch includes the preparation and flight of the rocket. Launch ends for suborbital reusable rockets after reaching apogee if the flight includes a reentry, or otherwise after vehicle landing or impact on Earth, and after activities necessary to return the vehicle to a safe condition on the ground have been completed.

year would likely be lower. The maximum number of events analyzed in Chapter 4 for specific sites could be less than 1,000 if the site cannot support all of the flight profiles identified in this PEIS. Further, many launches could be low-altitude, short-duration hover events or small "hops" from point to point. See Section 2.1.1.4 for more detailed information on flight profiles.

2.1.1 Reusable Suborbital Rockets and Propellants

This section describes the wide array of rocket and propellant types that could be used under the Experimental Permit Program. This section also includes a description of typical pre-flight, flight profile (takeoffs, flights, and landings), and post-flight activities.

2.1.1.1 Reusable Suborbital Rockets

Under the Experimental Permit Program, the FAA would issue experimental permits for the launch and reentry of a variety of reusable suborbital rockets, including those already designed or currently under development. The general suborbital rocket designs include vehicles resembling conventional aircraft, cylindrical vehicles resembling conventional rockets, and vehicles designed to hover (vertical takeoff and landing). Previous FAA studies have identified the following general dimensions and mass by design:

- Vehicles resembling conventional aircraft – 30 to 140 feet in length with unfueled weight of up to 9,921 pounds (see Exhibit 2-1);
- Vehicles resembling conventional rockets – 6 to 33 feet in length with unfueled weight of up to 5,500 pounds (see Exhibit 2-2); and
- Vehicles that hover – up to 20 feet in length or diameter with unfueled weight of up to 4,400 pounds (see Exhibit 2-3).

Exhibit 2-1. Examples of Launch Vehicles Resembling Conventional Aircraft

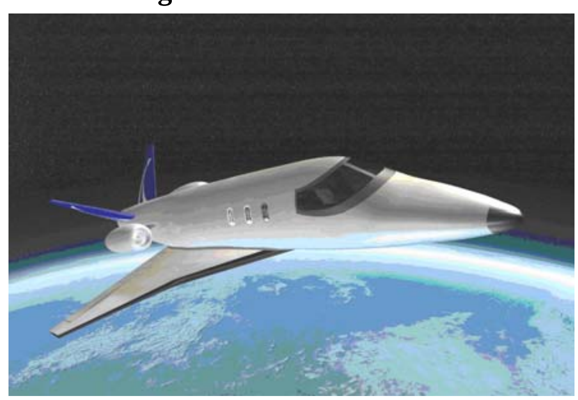


Exhibit 2-2. Examples of Launch Vehicles Resembling Conventional Rockets

Exhibit 2-3. Example of a Hover Vehicle

2.1.1.2 Propellants

A variety of liquid, solid, and hybrid propellants could be used to operate a reusable suborbital rocket under an experimental permit. Propellants are the chemical mixtures burned to produce thrust in rockets, and consist of a fuel and an oxidizer. A fuel is a substance that burns when combined with oxygen, producing gas for propulsion. An oxidizer is an agent that releases oxygen for combination with a fuel. The ratio of oxidizer to fuel is called the mixture ratio. Propellants are generally classified according to their physical state (*i.e.*, liquid, solid, or hybrid).

- ***Liquid*** propellants can be classified into petroleum fuels, cryogenic and hypergolic propellants, and other liquids.
- ***Petroleum*** fuels are those refined from crude oil and are a mixture of complex hydrocarbons (*i.e.*, organic compounds containing only carbon and hydrogen). The hydrocarbon used as rocket fuel is a

type of highly refined kerosene, called RP-1. Petroleum fuels are usually used in combination with liquid oxygen (LO_2 or LOX) as the oxidizer.

- ***Cryogenic*** propellants are liquefied gases stored at low temperatures, most frequently liquid hydrogen (LH_2) as the fuel and LOX as the oxidizer. Liquid methane and liquid propane are other cryogenic propellants.
- ***Hypergolic*** propellants are fuel and oxidizer combinations that ignite spontaneously on contact with each other and require no ignition source. Fuels commonly used in hypergolic systems include hydrazine, monomethyl hydrazine, and unsymmetrical dimethyl hydrazine. Nitrogen tetroxide (N_2O_4) or nitric acids (HNO_3) are typical oxidizers used in hypergolic systems. N_2O_4 is less corrosive than HNO_3. The nitric acid formulation most commonly used is type III-A, called inhibited red-fuming nitric acid (IRFNA); however, white fuming nitric acid can also be used. Storable hypergolic propellants remain liquid at ambient temperatures and do not pose the storage problems of cryogenic propellants. However, hypergolic propellants are highly toxic and must be handled with extreme care.
- ***Other liquids*** include propellants like concentrated hydrogen peroxide (H_2O_2), which can be used as a monopropellant or in combination with kerosene or alcohol-based fuels. Hydrazine can be used as a monopropellant and in hypergolic systems. Methanol, ethanol, and isopropanol can also be used as rocket fuels. E-85 fuel is a blend of ethanol and kerosene.
- ***Solid*** propellants used in solid rocket motors are composites of a polymeric binder like hydroxyl terminated polybutadiene (HTPB) or carboxy terminated polybutadiene (CTPB) with ammonium perchlorate oxidizer and aluminum fuel. Solid propellants are not typically used in reusable rockets; they are more commonly used in boosters for expendable rockets.
- ***Hybrid*** propulsion systems are a combination of liquid and solid propellants. One of the substances is solid, usually the fuel, while the other, usually the oxidizer, is liquid. The liquid is injected into the solid, the fuel reservoir of which also serves as the combustion chamber. An example is nitrous oxide as the liquid oxidizer and HTPB rubber as the solid fuel.

Exhibit 2-4 lists the common propellants and the ratio of fuel and oxidizer. As a conservative analysis, the FAA assumed that the total propellant capacity of a reusable suborbital rocket operating under an experiment permit would not exceed 11,000 pounds. Appendix C contains a detailed list of the fuel and oxidizer combinations and information on the characteristics of the fuel and oxidizer, including handling characteristics.

2.1.1.3 Pre-Flight Activities

Pre-flight activities under an experimental permit would include preparing the suborbital rocket for launch and providing ground operations support. Preparing a reusable suborbital rocket would begin with its arrival at the launch location. Dollies and a forklift and/or a crane would be used to transfer the suborbital rocket from the transporter (typically a truck) to a staging area, test pad, or launch pad for assembly, as appropriate. Trailers or pick-up trucks and a commercial tank truck would be used to transport the propellants from the propellant storage area to the test or launch site.

Propellants (fuel and oxidizer) for the suborbital rockets would require various transportable propellant storage containers, associated plumbing and pumps, and portable secondary containment structures. Other containers, such as 55-gallon fuel drums, bottles of pressurized inert gases such as helium or nitrogen, or liquid nitrogen bottles, might be needed (see Appendix C for a list of containers and handling requirements for the various fuels and oxidizers). Propellants would be stored in accordance with all

Exhibit 2-4. Summary of Propellant Systems[a] for Reusable Suborbital Rockets

Propellant System	Fuel/Oxidizer Combination	Fuel to Oxidizer Ratio
1	Propane/70% H_2O_2	1 to 7.8
2	RP-1 or JP-1/70% H_2O_2	1 to 7.8
3	Ethanol or other alcohol/LOX	1 to 1.3
4	Isopropanol/LOX	1 to 1.3
5	Methanol/50% H_2O_2	1 to 1.3
6	Kerosene/High Test Peroxide (HTP)[b]	1 to 7.8
7	Hydrocarbon X (proprietary)/Inhibited White Fuming Nitric Acid	1 to 1.3
8	RP-1 or Kerosene or Jet A/LOX	1 to 2.3
9	Propane/LOX	1 to 2.8
10	Methane/LOX	1 to 2.8
11	LH_2/LOX	1 to 5.0
12	HTPB rubber/Nitrous Oxide	1 to 6.5
13	Plexiglass/Nitrous Oxide	1 to 6.5
14	Solid – (68% Ammonium Perchlorate + 18% Aluminum + 14% HTPB)	NA[1]
15	Hydrazine monopropellant	NA[2]
16	H_2O_2 monopropellant	NA[2]

[a] The propellant quantities will vary based on the size of the reusable suborbital rocket and the size of the rocket engine.
[b] HTP is 85 to 98 percent H_2O_2.
NA[1] – Not applicable, solid composite propellant
NA[2] – Not applicable, oxidizer and fuel combined in one compound

appropriate and applicable procedures. Specific propellant handling and storage plans for the launch site would be developed in coordination with the FAA and relevant launch-site management and local agencies, as appropriate. Following the propellant transfer, the propellant-loading equipment would be removed from the area. Standard safety precautions, such as clearing the area of unnecessary personnel and ignition (including spark) sources, would be implemented. In the event of a spill or release, propellant-loading operations would be halted until the permit holder properly cleaned up the spill. Any spills would be minimized through compliance with all applicable spill prevention and control requirements.

A ground crew of up to 15 people would perform and supervise all pre-flight, flight, and landing operations and would be familiar with the operating protocol for the specific launch site. Test support equipment would include laptop computers, radio transceivers, and portable or existing mission control facilities. No portable radar systems would be used.

During preparations for launch, the suborbital rocket would be inspected for loose electrical or mechanical connections, and flight control diagnostics and health checks would be completed to ensure proper operation of electrical systems and moving parts. The suborbital rocket would initiate its formal launch sequence (*i.e.*, ignition of its propulsion system) after all preparation and pre-flight operations were completed.

2.1.1.4 Flight Profile (Takeoffs, Flights, and Landings)

To assess the potential impacts of a single launch and reentry, the FAA has estimated the proportion of experimental permits that would be issued to support three general flight profiles, including (1) horizontal takeoff (rocket or jet powered), flight, and horizontal landing (glide or jet powered); (2) vertical takeoff (rocket powered), flight, and vertical landing (rocket powered or parachute); (3) rocket powered hovering flights (vertical takeoff and landing). Exhibit 2-5 lists the estimated proportion of the annual 1,000 launch and reentry events for each profile.

Exhibit 2-5. Estimated Annual Proportion of Flight Profiles

Flight Profile	Proportion
Horizontal	40%
Vertical	30%
Hover	30%

For the horizontal flight profiles, the impact analysis in Chapter 4 includes both rocket engine and jet engine takeoffs and powered and unpowered landings. For vertical flight profiles, the analysis includes both rocket-powered and unpowered landings. Appendix D provides further breakdowns and descriptions of the horizontal and vertical flight profiles and the amount of fuel and oxidizer used to assess air quality impacts.

The flight path of a reusable suborbital rocket under an experimental permit would be defined in the applicant's flight test plan, which would include the flight test program, the estimated number of flights, key flight safety events, maximum altitude, and the geographic boundary of the operating area where flights would be performed. Reusable suborbital rocket launch flight profiles include takeoff, flight, and landing.

Reusable suborbital rockets resembling conventional aircraft would take off horizontally; vehicles resembling conventional rockets and hover-rockets would take off vertically. Horizontal take offs would be under rocket power or the power of a conventional jet engine. Some of these vehicles would be carried to a specific release altitude by a carrier or support aircraft powered by conventional jet engines. All vertical takeoffs would be rocket-powered. Exhibit 2-6 summarizes the reusable suborbital rocket configurations, the FAA projected maximum number of launch and reentry events, and their flight profiles. Horizontal and vertical rockets with high-altitude flight profiles would exceed an altitude of 3,000 feet (above ground surface) within 15 seconds of igniting rocket engines at ground surface. Horizontal rockets carried by a carrier aircraft would be released to ignite engines above 3,000 feet. The FAA conservatively assumed that all hovering vertical flight would occur within 3,000 feet of ground surface. The Federal Government uses the level of 3,000 feet and below to assess contributions of emissions to ambient air quality (see Section 4.1.1).

Under certain conditions, the flight of a reusable suborbital rocket would include reentry. The FAA evaluated reentry activities in *Final Programmatic Environmental Impact Statement for Horizontal Launches and Reentry of Reentry Vehicles* and found that they would not result in a significant impact on the human environment (FAA, 2005). Therefore, this PEIS incorporates reentry activities by reference and does not analyze them further. The full documentation and analysis are available on the Internet at: http://www.faa.gov/about/office_org/headquarters_offices/ast/licenses_permits/launch_reentry/reusable/environmental/. The landing profile of a reusable suborbital rocket would include one of the following:

- Gliding and landing on a runway;
- Conventional jet engine landing on a runway;
- Controlled descent via a parachute;

Exhibit 2-6. Overview of Suborbital Launch Vehicle Configurations and Flight Profiles

Configuration	Description and Propellant Load (kilograms)[a]	Maximum Annual Number of Launches at Each Site[b]	Flight Profile
Horizontal Takeoff	Horizontal 1 - Jet engine takeoff and landing (3,674)	150	Jet engine for lift off; jet engine shut down at or above 20,000 feet; rocket engine ignited at or above 20,000 feet; jet engine started during decent; reentry powered by jet engines
	Horizontal 2 - Rocket engine takeoff and unpowered landing (4,763)	180	Rocket engine ignited for lift off; no jet engine; rocket engine stops; unpowered reentry
	Horizontal 3 - Assist aircraft with jet engine takeoff and landing (1,523)	70[c]	Jet engine for lift off; assist aircraft releases reusable suborbital rocket at or above 20,000 feet and returns to the launch site; rocket engine ignited at or above 20,000 feet; rocket engine stops; unpowered reentry
Vertical Takeoff	Vertical 1 - Rocket engine – full thrust (5,000)	300	Rocket engine ignites and reusable suborbital rocket accelerates to termination of rocket thrust, ascends to apogee, and returns unpowered or powered to surface
	Vertical 2 - Rocket engine with thrust and vector control systems (hover) (1,000)	300	Rocket engine ignites and reusable suborbital rocket attains altitude less than 3,000 feet and performs spatial maneuvers and lands under rocket power

[a] Propellant load is based on previous licensed or permitted launch activities or is assumed to be 5,000 kilograms.
[b] The maximum number of annual launches may be less than indicated due to site launch capabilities. The maximum number of launches for each site is shown in Exhibits 2-9 though 2-16.
[c] Except at Spaceport America, where the maximum number of annual Horizontal 3 launches could reach 750.

- Controlled descent via a parachute followed by rocket-engine controlled descent for touch-down; and
- Continuous rocket engine operation for vertical landing from hovering vertical flight.

Operational safety documentation would define the landing location of a reusable suborbital rocket and would include a hazard analysis; verification of operating area and key flight-safety event limitations; identification of landing and impact areas; agreements with site operators, the U.S. Coast Guard for over-water flights, and the appropriate air traffic control authority; tracking methods; the flight rules; and a mishap response plan. Impacts associated with downrange landing sites and jettisoned components would be addressed in separate site-specific NEPA documentation, as appropriate.

2.1.1.5 Post-Flight Activities

Post-flight activities include vehicle and equipment recovery (*e.g.,* parachute recovery) and vehicle safing. Equipment and rocket recovery would occur within the predefined landing area in accordance with local requirements and access requirements. Upon reusable suborbital rocket landing, safing activities would begin upon completion of all launch and landing activities and the shut down of the engine. LOX oxidizer systems would be purged either by flash boiling or venting. For non-LOX oxidizers (*e.g.*, IRFNA, N_2O_4, or white fuming nitric acid), the oxidizer would be drained into a suitable container for disposal or reuse, as appropriate. Next, the fuel lines would be drained into a suitable container. Finally, any remaining pressurants (*i.e.*, helium or nitrogen) would be vented prior to declaring the vehicle safe and moving the reusable suborbital rocket to its transport vehicle and staging area.

2.1.2 Launch and Landing Locations

Under the Proposed Action, the activities associated with an experimental permit could occur from any location that has the appropriate infrastructure and safety requirements in place to support a reusable suborbital rocket launch and reentry. Exhibit 2-7 illustrates the potential launch sites (active and proposed) throughout the United States that could operate a reusable suborbital rocket under an experimental permit. While most FAA-licensed launch activities occur at Federal spaceports, future launch and landing activities could originate from spaceports operated by private entities or state and local governments. Although most operators would be expected to utilize existing site infrastructure, some operators could use temporary launch structures such as mobile launch platforms, roll-out launch platforms, and other temporary support equipment including a mobile launch control trailer. Temporary structures and equipment would be brought to the launch site in advance of launch day and would be removed after launch activity has been conducted.

This programmatic review evaluates in detail the following FAA-licensed launch sites: California Spaceport, Kodiak Launch Complex (KLC), Mid-Atlantic Regional Spaceport (MARS), Mojave Air and Space Port, Oklahoma Spaceport,[2] and Space Florida Launch Complex (LC)-46 at Cape Canaveral Air Force Station.[3] In the Notice of Intent to prepare this PEIS (71 *Federal Register* 15251, March 27, 2006), the FAA identified six commercial sites under evaluation and requested interested parties to submit comments and recommendations for additional sites to be considered. The FAA subsequently added Spaceport America to the scope of this PEIS. NASA requested that the Shuttle Landing Facility at the John F. Kennedy Space Center (KSC) be included in this PEIS. Thus, Spaceport America and KSC are among the sites evaluated in detail in this PEIS. As described in Section 1.5.3.1, other Federal spaceports that decide to support activities under an experimental permit could develop an environmental document that tiers from this PEIS and provides an impact analysis.

This PEIS does not evaluate proposed commercial launch sites or other non-licensed launch sites (see Exhibit 2-7) in detail because each site would require a complete safety and environmental review to receive a Launch Site Operator License. Upon the successful completion of the license application process and the issuance of a Launch Site Operator License, the FAA could supplement this PEIS to include the additional licensed site and its findings.

Exhibit 2-8 lists the launch sites and the associated reusable suborbital rocket flight profiles evaluated in detail in this PEIS. This PEIS does not authorize any experimental permit activities from the launch sites listed in Exhibit 2-8. All operators would be required to apply for an individual experimental permit and comply with the terms and conditions of the license from the site at which they would operate.

2.1.2.1 California Spaceport

The California Spaceport occupies approximately 109 acres of land collocated at Vandenberg Air Force Base in Santa Barbara County, California. The California Spaceport provides commercial launch and payload processing services and is operated and managed by Spaceport Systems International, a limited partnership of ITT Federal Services Corporation. Launch infrastructure at Vandenberg Air Force Base consists of launch pads, runways, payload processing facilities, telemetry, and tracking equipment. All launches under an experimental permit would be expected to occur from Space Launch Complex 8, which consists of the following infrastructure: pad deck, support equipment building, launch equipment vault, launch duct, launch stand, access tower, communications equipment, Integrated Processing Facility

[2] Sea Launch Platform and Blue Origin Spaceport are exclusive-use sites and are not available for use by other launch operators.
[3] Space Florida's Launch Site Operator License for Launch Complex-46 at Cape Canaveral Air Force Station expired since the FAA initiated this PEIS. Space Florida is in the process of applying for a new license.

launch control room, and the Western Range interfaces needed to support a launch. Exhibit 2-9 lists the projected maximum number of launch and reentry events for each flight profile analyzed in this PEIS. See Exhibit 2-6 for an overview of vehicle configurations and flight profiles.

Exhibit 2-7. U.S. Spaceports and Launch Sites

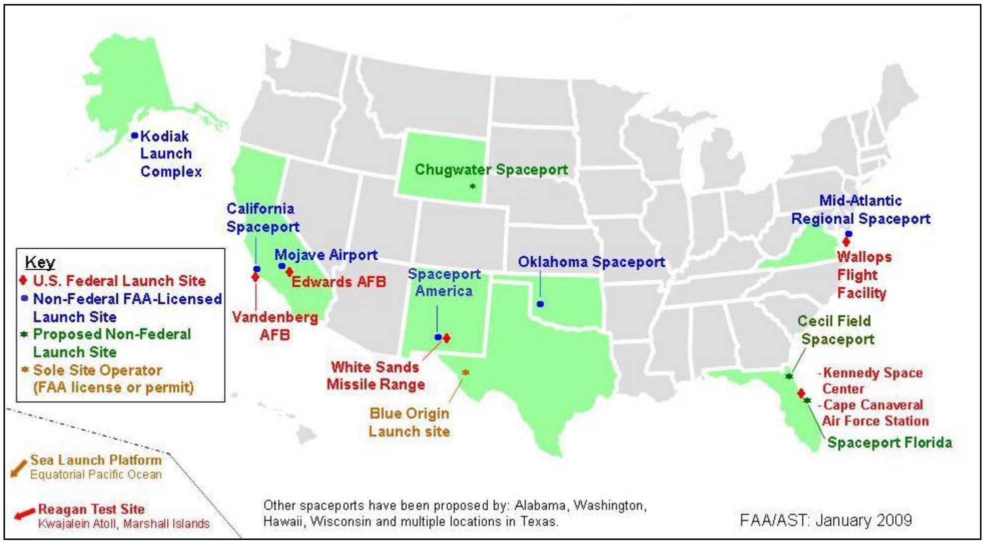


Exhibit 2-8. Launch Sites and Associated Flight Profiles

Site	Location	Flight Profiles*
California Spaceport	Vandenberg Air Force Base, California	Vertical Launch and Reentry
John F. Kennedy Space Center	Cape Canaveral, Florida	Horizontal Launch and Reentry
Kodiak Launch Complex	Kodiak Island, Alaska	Vertical Launch and Reentry
Mid-Atlantic Regional Spaceport	Wallops Island, Virginia	Vertical Launch and Reentry
Mojave Air and Space Port	Mojave, California	Horizontal Launch and Reentry
Oklahoma Spaceport	Washita County, Oklahoma	Vertical and Horizontal Launch and Reentry
Space Florida Launch Complex-46	Cape Canaveral, Florida	Vertical Launch and Reentry
Spaceport America	Sierra County, New Mexico	Vertical and Horizontal Launch and Reentry

* Hover flight activities could occur at all sites.

Exhibit 2-9. Maximum Suborbital Launch and Reentry Events at the California Spaceport

Horizontal Takeoff			Vertical Takeoff	
Horizontal 1	Horizontal 2	Horizontal 3	Vertical 1	Vertical 2
0	0	0	300	300

2.1.2.2 John F. Kennedy Space Center

NASA's KSC occupies 139,490 acres of land and open-water resources in Brevard and Volusia Counties, Florida. KSC is on the north end of Merritt Island, which forms a barrier island complex adjacent to Cape Canaveral Air Force Station (CCAFS). The primary mission of KSC is to process and launch the Space

Shuttle and future generations of crewed space vehicles and to process payloads for various expendable launch vehicles launched from CCAFS. Major launch infrastructure includes launch pads, the Vehicle Assembly Building, and the Shuttle Landing Facility. All launches and reentries under an experimental permit would be expected to occur from the Shuttle Landing Facility, which consists of a runway 15,000 feet long and 300 feet wide. The Facility includes a parking apron, tow-way, the Orbiter Processing Facility, the Landing Aids Control Building, and four microwave scanning-beam landing-system ground stations equipped with navigation and landing aids. A tactical air navigation system, precision approach path indicators, and a recovery-convoy staging area are located along the runway. Exhibit 2-10 lists the projected maximum number of launch and reentry events for each flight profile analyzed in this PEIS. See Exhibit 2-6 for an overview of vehicle configurations and flight profiles.

Exhibit 2-10. Maximum Suborbital Launch and Reentry Events at the John F. Kenney Space Center

Horizontal Takeoff			Vertical Takeoff	
Horizontal 1	**Horizontal 2**	**Horizontal 3**	**Vertical 1**	**Vertical 2**
150	180	70	0	300

2.1.2.3 Kodiak Launch Complex

KLC occupies 3,717 acres at Narrow Cape on Kodiak Island, Alaska. The Alaska Aerospace Corporation, which was established by the Alaska State Legislature, owns and operates KLC. KLC provides processing, integration, and checkout services for orbital and sub-orbital rocket launches. Launch infrastructure consists of a launch control center, payload processing facility, integration and processing facility, orbital and suborbital launch pads, and maintenance and storage facilities. Launches under an experimental permit would be expected to occur from one of the two launch pads (LPs) available at KLC – LP-1 or LP-2. The Launch Service Structure services LP-1 and the Spacecraft and Assemblies Transfer Facility services LP-2. The Launch Service Structure and Spacecraft and Assemblies Transfer Facility allow for the transfer of payloads to the launch site without exposure to the outside environment and allow for all-weather launch operations. Exhibit 2-11 lists the projected maximum number of launch and reentry events for each flight profile analyzed in this PEIS. See Exhibit 2-6 for an overview of vehicle configurations and flight profiles.

Exhibit 2-11. Maximum Suborbital Launch and Reentry Events at the Kodiak Launch Complex

Horizontal Takeoff			Vertical Takeoff	
Horizontal 1	**Horizontal 2**	**Horizontal 3**	**Vertical 1**	**Vertical 2**
0	0	0	300	300

2.1.2.4 Mid-Atlantic Regional Spaceport

MARS is located within NASA Goddard Space Flight Center's Wallops Flight Facility in Accomack County, Virginia. Through a bi-state agreement, Virginia and Maryland jointly operate MARS. The Wallops Flight Facility encompasses more than 6,500 acres over three different land parcels: the Main Base, the Mainland, and the Wallops Island Launch Site, where MARS is located. MARS provides launch support services and facilities to a variety of Federal, commercial, and academic users. Launch infrastructure consists of suborbital and orbital launch pads, a payload processing and integration facility, vehicle storage and assembly buildings, mobile liquid fueling capability, on-site and downrange telemetry and tracking, and payload recovery capability. Launches under an experimental permit would be expected to occur from one of the two LPs available at MARS, LPs 0-A or 0-B. LP 0-A can support launch vehicles with gross liftoff weights of up to 200,000 pounds. LP 0-A has an 82-foot service tower.

Currently, LP 0-A is proposed to undergo upgrades and renovations which include a pad access ramp, launch pad, and deluge system in the same location as the existing pad (NASA, 2009). LP 0-B is capable of supporting launch vehicles with gross liftoff weights of up to 501,000 pounds. Exhibit 2-12 lists the projected maximum number of launch and reentry events for each flight profile analyzed in this PEIS. See Exhibit 2-6 for an overview of vehicle configurations and flight profiles.

Exhibit 2-12. Maximum Suborbital Launch and Reentry Events at the Mid-Atlantic Regional Spaceport

Horizontal Takeoff			Vertical Takeoff	
Horizontal 1	**Horizontal 2**	**Horizontal 3**	**Vertical 1**	**Vertical 2**
0	0	0	300	300

2.1.2.5 Mojave Air and Space Port

The Mojave Air and Space Port comprises an area of approximately 3,000 acres in Kern County, California. East Kern Airport District manages the site, which is east of the unincorporated town of Mojave. In addition to being a general-use public airport, Mojave Air and Space Port supports flight testing, space industry development, and aircraft maintenance activities. Launch infrastructure consists of an air traffic control tower, three runways (Runway 12-30, Runway 8-26, and Runway 4-22), a motor test stand, engineering facilities, and a high bay building. More than 300 acres are zoned specifically for rocket motor testing and development. Horizontal launches under an experimental permit would be expected to occur from one of the existing runways. Runway 12-30 is 12,500 feet long and is the primary runway for large air carrier jets, high performance civilian and military jet aircraft, and horizontal launch spacecraft. Runway 8-26 is 7,050 feet long and is primarily used by general aviation jet and propeller aircraft. Runway 4-22 is 3,943 feet long and is used by smaller general aviation propeller aircraft and helicopters. Vertical launches would occur from an existing or temporary concrete pad in the designated vertical launch area within the launch site boundary. Exhibit 2-13 lists the projected maximum number of launch and reentry events for each flight profile analyzed in this PEIS. See Exhibit 2-6 for an overview of vehicle configurations and flight profiles.

Exhibit 2-13. Maximum Suborbital Launch and Reentry Events at the Mojave Air and Space Port

Horizontal Takeoff			Vertical Takeoff	
Horizontal 1	**Horizontal 2**	**Horizontal 3**	**Vertical 1**	**Vertical 2**
150	180	70	0	300

2.1.2.6 Oklahoma Spaceport

The Oklahoma Spaceport is in the Clinton-Sherman Industrial Airpark in Washita County, Oklahoma. The Airpark occupies 2,700 acres adjacent to the town of Burns Flat. The Oklahoma Space Industry Development Authority operates the Oklahoma Spaceport, which is in a 107,520-acre area designated by the Oklahoma State Legislature as Spaceport Territory. The Clinton-Sherman Industrial Airpark is a public-use airport that both military and civilian aircraft use primarily as a training facility. Launch infrastructure consists of a 13,500-foot runway, a 5,200-foot runway, a 50,000-square foot manufacturing facility, large maintenance, repair, and storage hangars, and a control tower. Horizontal launches under an experimental permit would be expected to occur from one of the existing runways. Vertical launches would occur from an existing or temporary concrete pad in a designated vertical launch area within the launch site boundary. Exhibit 2-14 lists the projected maximum number of launch and reentry events for each flight profile analyzed in this PEIS. See Exhibit 2-6 for an overview of vehicle configurations and flight profiles.

Exhibit 2-14. Maximum Suborbital Launch and Reentry Events at the Oklahoma Spaceport

Horizontal Takeoff			Vertical Takeoff	
Horizontal 1	**Horizontal 2**	**Horizontal 3**	**Vertical 1**	**Vertical 2**
150	180	70	300	300

2.1.2.7 Space Florida

Space Florida manages and operates an FAA-licensed commercial launch site co-located with CCAFS in Brevard County, Florida. Space Florida holds[4] a Launch Site Operator License for LC-46 and provides commercial launch services. LC-46 is situated on the Canaveral Peninsula and is bordered on the east by the Atlantic Ocean, on the west by the Banana River, on the north by KSC, and on the south by Port Canaveral. Exhibit 2-15 lists the projected maximum number of launch and reentry events for each flight profile analyzed in this PEIS. See Exhibit 2-6 for an overview of vehicle configurations and flight profiles.

Exhibit 2-15. Maximum Suborbital Launch and Reentry Events at Space Florida

Horizontal Takeoff			Vertical Takeoff	
Horizontal 1	**Horizontal 2**	**Horizontal 3**	**Vertical 1**	**Vertical 2**
0	0	0	300	300

2.1.2.8 Spaceport America

Spaceport America is in Sierra County in south-central New Mexico, about 45 miles north of Las Cruces and 30 miles southeast of the town of Truth or Consequences. The Spaceport America boundary encompasses approximately 26 square miles. The New Mexico Spaceport Authority recently obtained a Launch Site Operator License from the FAA. Once constructed, launch infrastructure at Spaceport America will consist of a 10,000-foot runway for horizontal launches, an array of buildings and facilities constructed in a "campus" setting at the northern end of the runway, and a vertical launch development area surrounding an existing amateur launch pad. For the purpose of this PEIS, the FAA has assumed that all launches analyzed in the *Final Environmental Impact Statement for the Spaceport America Commercial Launch Site, Sierra County, New Mexico* (FAA, 2008a) would occur under experimental permits. In reality, this total includes launches that would occur under an FAA license and therefore overstates the likely number of experimental permit launches. Exhibit 2-16 lists the projected maximum number of launch and reentry events for each flight profile analyzed in this PEIS. See Exhibit 2-6 for an overview of vehicle configurations and flight profiles.

Exhibit 2-16. Maximum Suborbital Launch and Reentry Events at Spaceport America

Horizontal Takeoff			Vertical Takeoff	
Horizontal 1	**Horizontal 2**	**Horizontal 3**	**Vertical 1**	**Vertical 2**
5	2	750	105	20

[4] Space Florida's Launch Site Operator License for LC-46 at Cape Canaveral Air Force Station expired since the FAA initiated this PEIS. Space Florida is in the process of applying for a new license.

2.2 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets using its present system of analyzing environmental consequences on a case-by-case basis without tiering from a programmatic document. The information and analyses provided in this PEIS would not be used to facilitate the preparation of environmental documents for the issuance of experimental permits to individual rocket operators. Under the current permitting process, then, the information contained in this PEIS would not be used to eliminate repetitive discussions of recurring issues, and would not focus subsequent environmental analysis on the actual issues that are ready for decision. This would result in increased paperwork, duplication, and time needed to develop future site-specific and project-specific analyses when compared to the Proposed Action.

2.3 Summary Comparison of Potential Environmental Impacts

2.3.1 Summary Comparison of Potential Environmental Impacts When Issuing an Experimental Permit

The Executive Summary includes a summary comparison of potential environmental impacts under the Proposed Action. Exhibit ES-3, Potential General Environmental Impacts under the Proposed Action, and Exhibit ES-4, Potential Site-Specific Environmental Impacts under the Proposed Action, list potential impacts by resource (impact category). Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of impacts associated with the No Action Alternative would fall within the envelope of impacts described for the Proposed Action. However, if the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate the potential impacts and not use the information and analyses provided in this PEIS. This would result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

2.3.2 Comparison of Potential Environmental Impacts When Not Issuing an Experimental Permit

Under both the Proposed Action and the No Action Alternative, the resulting NEPA impact analysis could be part of a decision to deny or not issue a requested experimental permit. In the case of a permit denial, the area to be affected by the projected impacts from the proposed activities would not experience these projected impacts or changes. With one exception, a permit denial therefore would not, in most cases, result in negative impacts to the environment of the affected area. The possible exception would be related to socioeconomic impacts. Denying an experimental permit would eliminate any local employment and services that may be needed to implement the requested activities. However, based on the small size of the staff working at a launch or reentry site and the short duration of these events, the anticipated negative socioeconomic impacts of a denial would be insignificant and should not result in any notable change in the health of the local economy. At the national level, the positive socioeconomic impacts of the Experimental Permit Program, such as those related to the desired increase in research and funding for the commercial space industry and increased employment opportunities for skilled and professional workers, would not be negatively affected because any possible denials would likely be widely geographically dispersed and intermittent. In the case of the Proposed Action, should the socioeconomic impacts from a specific, pending denial differ substantially from those discussed in this paragraph, these impacts would be specifically addressed in a NEPA document and not tiered from the programmatic analysis.

3. AFFECTED ENVIRONMENT

This chapter describes general (*i.e.,* program-wide) and site-specific environmental conditions at the eight launch and landing locations described in Section 2.1.2 of this Programmatic Environmental Impact Statement (PEIS). This description provides the context for understanding the potential environmental consequences described in Chapter 4. The description of the existing environment provides a starting point for determining potential changes in environmental conditions and establishes the baseline for comparison of potential impacts under the Proposed Action and the No Action Alternative.

This chapter defines and describes the following potentially affected resource areas and includes general (Section 3.1) and site-specific descriptions (Sections 3.2 through 3.9):

- Air Quality;
- Biological Resources (fish, wildlife, and plants);
- Historical, architectural, archaeological, and cultural resources;
- Floodplains;
- Hazardous materials, pollution prevention, and solid waste;
- Health and safety;
- Land use (including U.S. Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources);
- Light emissions and visual resources;
- Natural resources and energy supply;
- Noise and compatible land use;
- Socioeconomic impacts, environmental justice, and children's environmental health and safety;
- Water quality; and
- Wetlands.

Section 3.1 also summarizes relevant regulations applicable to each environmental resource, as appropriate.

The launch sites described in detail in this chapter are the California Spaceport (Section 3.2), Kennedy Space Center (KSC) (Section 3.3), Kodiak Launch Complex (KLC) (Section 3.4), Mid-Atlantic Regional Spaceport (MARS) (Section 3.5), Mojave Air and Space Port (Section 3.6), Oklahoma Spaceport (Section 3.7), Space Florida (Section 3.8), and Spaceport America (Section 3.9). Data from existing relevant environmental documentation are summarized[1] where possible.

[1] Agencies shall incorporate material into an environmental impact statement by reference when the effect will be to cut down on bulk without impeding agency and public review of the action. The incorporated material shall be cited in the statement and its content briefly described. No material may be incorporated by reference unless it is reasonably available for inspection by potentially interested persons within the time allowed for comment. Material based on proprietary data which is itself not available for review and comment shall not be incorporated by reference (40 CFR 1502.21).

Section 2.1.1 describes the activities that could occur at each launch site. These activities would be expected to be within the scope of activities normally undertaken at each facility. Any activities determined to be outside the scope of activities that would normally be undertaken at a facility (and, therefore, not addressed in this PEIS), would be subject to separate NEPA review and documentation, as appropriate.

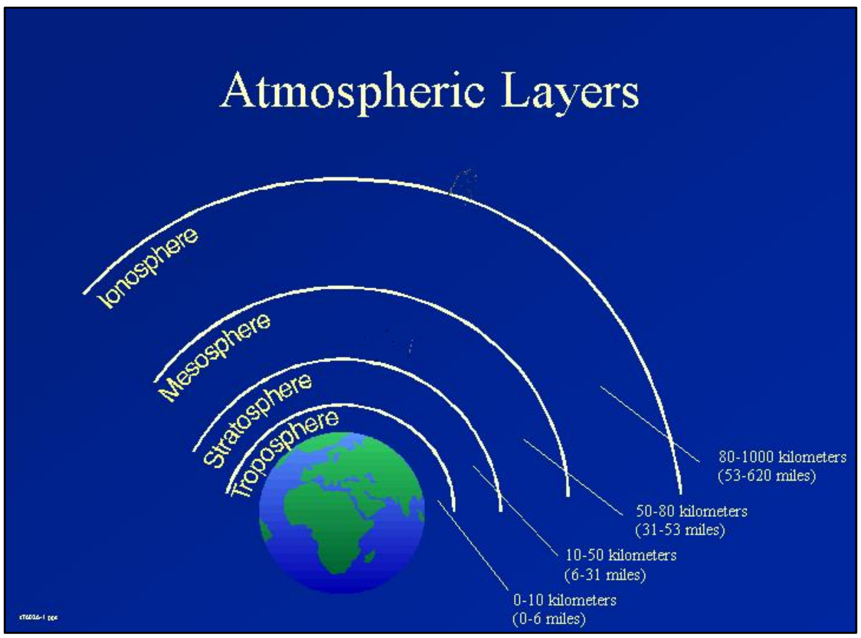
3.1 Resource Area Definitions and Descriptions

3.1.1 Air Quality

3.1.1.1 Definition and Description

Earth's atmosphere consists of four main layers – troposphere, stratosphere, mesosphere, and ionosphere – separated by narrow transition zones. Each layer is characterized by altitude, temperature, structure, density, composition, and degree of ionization (*i.e.*, the positive or negative electric charge associated with each layer). For purposes of this PEIS, lower atmosphere refers to the troposphere, which extends from sea level to an altitude of approximately 6.2 miles. Upper atmosphere refers to the stratosphere, which extends from an altitude of 6.2 miles to approximately 31 miles. Exhibit 3-1 depicts the altitude ranges associated with the atmospheric layers.

Exhibit 3-1. Altitude Range for Atmospheric Layers



Source: FAA, 2005. Not to scale; vertical dimension of atmosphere is exaggerated for clarity.

More than 99 percent of the total atmospheric mass is concentrated within 25 miles of Earth's surface. The upper boundary at which gases disperse into space lies at an altitude of approximately 620 miles above sea level (FAA, 2005). The higher layers of the atmosphere, which are comprised of the mesosphere and ionosphere, differ significantly in composition from the lower layers and also contain a significant proportion of ionized (electrically charged) gas atoms and molecules (FAA, 2005). The following paragraphs describe the approximate altitude, temperature, air density, and air composition of each atmospheric layer.

Troposphere

The troposphere is the region of the atmosphere where weather occurs and includes the air that living organisms breathe. Ambient air quality in the lower atmosphere is usually measured in terms of the concentration of various air pollutants in the atmosphere. The impact of exposure to ambient contaminants is a function of the pollutant involved, the duration of the exposure, and the concentrations reached during the exposure. The significance of a pollutant concentration is determined by comparing the concentration with appropriate Federal and state ambient air quality standards. These standards represent the pollutant concentration thresholds at which public health and welfare are protected and include a reasonable margin of safety (see Section 3.1.1.2).

Ground-level or tropospheric ozone (O_3), which can cause harmful effects to humans and the environment, is among the pollutants regulated by ambient air quality standards. Ozone is made up of three oxygen molecules and is highly reactive. Ground-level ozone is not emitted directly, but is formed in the presence of sunlight by tropospheric chemical reactions among precursor pollutants that are emitted, primarily volatile organic compounds (VOCs) and nitrogen oxides (NO_X). Ground-level ozone is different from the stratospheric ozone layer (discussed below) which protects Earth from harmful ultraviolet (UV) radiation.

Stratosphere

The stratosphere is the second major layer of the atmosphere and occupies the region from 6.2 to 31 miles above Earth's surface. The stratosphere also contains the area known as the ozone layer, which is between 12 and 19 miles above Earth's surface. Ozone plays the major role in regulating the thermal regime of the stratosphere. The temperature increases with ozone concentration, because solar energy is converted to molecular kinetic (heat) energy when ozone molecules absorb UV radiation, resulting in heating of the stratosphere (FAA, 2005). Air temperature in the stratosphere remains relatively constant up to an altitude of 16 miles, where it then gradually increases to a temperature of -53 degrees Celsius (°C) at the lower boundary of the stratopause (the upper boundary of the stratosphere) (FAA, 2005).

The stratosphere contains 90 percent of Earth's atmospheric ozone and acts as a UV radiation shield for the plants and animals on the surface of Earth. Stratospheric ozone is generated by the action of sunlight causing an oxygen molecule (O_2) to combine with an atom of oxygen. Stratospheric ozone is continually created and destroyed by naturally occurring photochemical processes and its concentration fluctuates geographically (generally increasing from equatorial latitudes to the Polar Regions), seasonally (about 25 percent in temperate regions), and annually (1 to 2 percent globally) (FAA, 2005).

Ozone Depletion

Ozone in the atmosphere shields Earth from harmful levels of UV radiation by absorbing some of the UV rays emitted by the sun. Excess levels of UV radiation can result in adverse human health effects ranging from sunburn to skin cancer and immune deficiencies. Most of the UV-shielding ozone layer over Earth's surface is contained within the stratosphere. This protective ozone is different from ground level or tropospheric ozone, which can result in harmful effects to humans and the environment via direct exposure. Stratospheric ozone can be destroyed through chemical and photochemical reactions. As a result, the presence of pollutants that are key components of these reactions (especially chlorine) can result in ozone depletion. Particulate matter might also affect stratospheric ozone; however, the exact impact of particulate matter on ozone depletion is unclear.

Ozone concentrations in the stratosphere have been on a long-term, global downward trend due to ozone-depleting substances such as chlorofluorocarbons (CFCs) and halons, which were formerly used as refrigerants, solvents, and fire-extinguishing agents (FAA, 2005). When these substances reach the stratosphere, UV radiation breaks up the molecules, releasing chlorine and bromine atoms that destroy ozone. One chlorine atom can destroy more than 100,000 ozone molecules. Decreasing ozone levels reduce the effectiveness of the UV shield and allow more Ultraviolet Radiation Band "B" (UVB) radiation to reach Earth's surface. Because UVB radiation is known to be particularly damaging to cellular nucleic acids, this raises the risk of human health problems and biological damage (FAA, 2005). Aluminum oxide (Al_2O_3) particulates and soot aerosols emitted from solid and liquid propellant rocket engines and related to volcanism and wildfires can also provide reaction surfaces for the destruction of ozone. Nitrogen dioxide (NO_2) also functions as a catalyst for the destruction of ozone in the stratosphere.

The release of ozone-depleting substances has resulted in an annual "ozone hole" over Antarctica since the 1980s. In the worst years, the ozone concentration can be decreased by 60 percent, allowing twice the amount of normal UVB radiation to reach Earth's surface (FAA, 2005). Ozone depletion has become a global issue and has been observed over North America, South America, Europe, Asia, Africa, and Australia (FAA, 2005). In response to the decreasing ozone levels, the United States placed a ban on CFC use in aerosol sprays in the 1970s. In 1994, the United States and other developed countries halted production of halons, and in 1996, under the Montreal Protocol, ended the production of CFCs. In addition, under the Clean Air Act, as amended (42 U.S.C. 7401 *et seq.*), the United States regulates carbon monoxide (CO), NO_X, VOCs, and sulfur dioxide (SO_2) because of their roles in influencing the formation and destruction of both tropospheric and stratospheric ozone in addition to other ground-level air quality issues (see Section 3.1.1.2). Because of measures taken under the Montreal Protocol, emissions of ozone-depleting substances are decreasing. Based on measurements of total inorganic chlorine in the atmosphere, which stopped increasing in 1997 and 1998, stratospheric chlorine levels have peaked and are no longer increasing. The natural ozone production process is expected to restore the naturally occurring levels of stratospheric ozone in about 50 years (FAA, 2005).

Climate Change

Climate change refers to long-term fluctuations in temperature, precipitation, wind, and other elements of Earth's climate system. Atmospheric gases affect Earth's surface temperature by absorbing solar radiation that is reflected by Earth's surface back into space. The concentration of these gases, known as greenhouse gases, is increasing as a result of human activities. The primary greenhouse gases are carbon dioxide (CO_2), CFCs, methane (CH_4), and nitrous oxide (N_2O). CO_2 is the most significant greenhouse gas resulting from human activity and represented approximately 84 percent of total greenhouse gas emissions in 2001 (FAA, 2005).

The greatest source of anthropogenic CO_2 and greenhouse gas emissions overall is fossil fuel combustion from stationary sources (*e.g.*, power plants, industry, and manufacturing processes) and mobile sources (*e.g.*, automobiles, trucks, aircraft, construction equipment, and small engines, such as lawn mowers). Electric-power generation from both utilities and non-utilities accounted for the greatest source of anthropogenic greenhouse gas emissions in the United States in 2001, closely followed by transportation sources and industrial processes. Annually, the total consumption of fossil fuels in the United States and the emissions from the combustion of those fuels generally fluctuate in response to changes in general economic conditions, energy prices, weather (temperature extremes during winters and summers), and the availability/acceptance of non-fossil fuel alternatives (FAA, 2005).

Mesosphere

The mesosphere is between 31 and 50 miles above Earth's surface. The mesosphere is the coldest layer of the atmosphere, with the temperature decreasing as altitude increases. The coldest temperatures at the mesopause (the upper boundary of the mesosphere) can reach -100°C (FAA, 2005). Ozone and water (H_2O) are found in negligible concentrations in this layer. The air composition in this layer is made up of lighter gases that are stratified according to their molecular weight due to gravitational separation (FAA, 2005). In the mesosphere, objects entering Earth's atmosphere at high speeds begin to heat up due to friction with air molecules (FAA, 2005). Because air thickness is negligible, objects tend to maintain high speeds and molecular friction typically causes meteors or space debris to burn up before they impact the surface of Earth.

Ionosphere

The ionosphere (also known as the thermosphere) is above the mesosphere and begins between approximately 53 and 65 miles above the surface of Earth and is considered to extend upward to 1,200 miles, although it has no well-defined upper boundary (FAA, 2005). The ionosphere accounts for only a fraction of the atmosphere's mass, because gas molecules are extremely sparse in this layer. This portion of the atmosphere is known as the ionosphere because radiation causes its scattered gas molecules to become electrically charged (ions). This layer of the atmosphere also is known as the thermosphere because solar activity, which releases very short-wavelength solar energy, can raise the temperature of the gas molecules to more than 2,000°C (FAA, 2005). While temperatures would seem extreme on a measured scale, heat sensation in the thermosphere is actually relative to the collision of sparse gas molecules with a foreign body. Therefore, a satellite orbiting Earth in the thermosphere would achieve a temperature based on the amount of solar radiation it absorbs and not the temperature of the surrounding air (FAA, 2005).

The ionosphere is of practical importance because it is what enables long-distance radio communications on Earth, because the radio waves reflect off the ionosphere. Shorter wavelength radio waves can penetrate the ionosphere and are used in satellite communications. The upper regions of the ionosphere are also of practical importance because, although the atmospheric density is very low compared to that in the lower atmosphere, it still acts to slow artificial satellites through friction and limit the length of time a satellite can stay in low-altitude orbits around Earth (FAA, 2005).

The ionosphere is noted for its concentration of ions and free electrons. Gases such as helium (He), argon (Ar), atomic oxygen (O), O_2, CO_2, atomic nitrogen (N), nitric oxide (NO), and molecular nitrogen (N_2) absorb solar radiation passing through the ionosphere and are split into ions and free electrons. The level of ionization depends on sunspot activity, season, geographic location, and the gas being ionized. In general, the ionization levels increase in the sunlit atmosphere and decrease in the shadowed atmosphere. The ionosphere is a dynamic system and is influenced by parameters such as acoustic motions of the atmosphere, electromagnetic emissions, and variations in geomagnetic field (FAA, 2005).

Beyond the ionosphere, the exosphere starts and continues until it merges with interplanetary gases, or space. The exosphere is considered to be beyond Earth's atmosphere. In this region, atomic hydrogen (H) and He are the prime components and are only present at extremely low densities (FAA, 2005).

3.1.1.2 Regulatory Setting

Ambient Air Quality Standards

The primary Federal legislation that addresses air quality is the Clean Air Act. Under the authority of the Clean Air Act and its amendments, the U.S. Environmental Protection Agency (EPA) established a set of National Ambient Air Quality Standards (NAAQS) for certain criteria pollutants – CO, NO_2, ozone, particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}) and 2.5 microns or less ($PM_{2.5}$), SO_2, and lead (Pb). There are primary and secondary NAAQS for these pollutants. The EPA established the primary standards to protect the public health with an adequate margin of safety and the secondary standards to protect the public welfare from any known or anticipated adverse effects of a pollutant (*e.g.*, damage to crops and materials).

Under the Clean Air Act, states are allowed to adopt ambient air quality standards if they are at least as stringent as the NAAQS. The California Ambient Air Quality Standards (CAAQS) established under the California Clean Air Act of 1988 are generally different from and more stringent than the NAAQS. Other state standards are the same as or similar to the NAAQS. Federal agencies are required to meet the state ambient air quality standards in the same way that they are required to meet the NAAQS.

In addition to the EPA-developed NAAQS for the seven criteria pollutants, the CAAQS set standards for sulfates, hydrogen sulfide, vinyl chloride, and visibility-reducing particles. Both primary and secondary standards were determined based on years of scientific research on the health effects of various concentrations of pollutants on biological organisms, and other potential impacts on the environment. The Alaska Ambient Air Quality Standards set additional standards for reduced sulfur compounds and ammonia. New Mexico Ambient Air Quality Standards set additional standards for total suspended particulates. Exhibit 3-2 lists the Federal standards and the state standards for Alaska, California, Florida, New Mexico, Oklahoma, and Virginia.

To further define local and regional air quality, the EPA divided the country into areas that achieve the NAAQS, called attainment areas, and those that do not achieve the NAAQS, called nonattainment areas. The nonattainment and attainment designations are based on air quality monitoring data. Areas for which available data are not sufficient to make an attainment status designation are listed as unclassifiable. Unclassifiable areas are treated as attainment areas for regulatory purposes. Areas that were previously designated nonattainment and subsequently redesignated to attainment due to meeting the NAAQS are classified as maintenance areas. The official list of nonattainment, attainment, maintenance, and unclassified areas and a description of their boundaries is available in the Code of Federal Regulations (CFR) 40 CFR 81 and pertinent Federal Register notices. The EPA maintains an unofficial list on the Internet at http://www.epa.gov/oar/oaqps/greenbk/.

For areas designated as nonattainment, the Clean Air Act Amendments of 1990 established levels and timetables for each region to achieve attainment of the NAAQS. States must prepare a State Implementation Plan that documents how the region will reach its attainment levels by the required date. The Plan includes inventories of emissions within the area and establishes emissions budgets (target levels) designed to bring the area into compliance with the NAAQS. In maintenance areas, the Plan documents how the state intends to maintain compliance with NAAQS. The State Implementation Plan accounts for all the emissions within the federally approved air quality management area that affect ground-level air quality. Emissions 3,000 feet above ground level or higher have been found not to affect ground-level air quality and are not included in the EPA-approved State Implementation Plan for the federally approved air quality management area. To comply with the Plan, a proposed project must not result in any violations of the NAAQS or state standards and must meet the conditions of the conformity regulations.

Conformity with State Implementation Plans

Under Section 176(c) of the Clean Air Act, Federal agencies, such as the FAA, are prohibited from engaging in, supporting in any way, providing financial assistance for, licensing or permitting, or approving any activity that does not conform to an approved State Implementation Plan.

Exhibit 3-2. Federal and State Ambient Air Quality Standards (page 1 of 2)

Pollutant	Standard Type	Averaging Period	National[a]	Alaska[a]	California[a]	Florida[a]	New Mexico[a]	Oklahoma[a]	Virginia[a]
Ozone	Primary and Secondary	1 hour[b]	0.12[b] ppm	Same as NAAQS	0.09 ppm	Same as NAAQS	—	—	—
	Primary	8 hours	0.075 ppm	—	0.070 ppm	—	—	Same as NAAQS	Same as NAAQS
Particulate matter (PM_{10})	Primary and Secondary	24 hours	150 μg/m^3	Same as NAAQS	50 μg/m^3	Same as NAAQS	—	Same as NAAQS	Same as NAAQS
	Primary and Secondary	Annual	—	50 μg/m^3	20 μg/m^3	50 μg/m^3	—	50 μg/m^3	50 μg/m^3
Fine particulate matter ($PM_{2.5}$)	Primary	24 hours	35 μg/m^3	—	—	—	—	65 μg/m^3	65 μg/m^3
	Primary	Annual	15.0 μg/m^3	—	12 μg/m^3	—	—	15 μg/m^3	15 μg/m^3
Total Suspended Particulates	Primary	24 hours	—	—	—	—	150 μg/m^3	—	—
	Primary	7 days	—	—	—	—	110 μg/m^3	—	—
	Primary	30 days	—	—	—	—	90 μg/m^3	—	—
	Primary	Annual geometric mean	—	—	—	—	60 μg/m^3	—	—
Nitrogen dioxide	Primary and Secondary	1 hour	—	—	0.25 ppm	—	—	—	—
	Primary and Secondary	24 hours	—	—	—	—	0.10 ppm	—	—
	Primary and Secondary	Annual	0.053 ppm	Same as NAAQS	—	Same as NAAQS	0.05 ppm	Same as NAAQS	Same as NAAQS
Sulfur dioxide	—	1 hour	—	—	0.25 ppm	—	—	—	—
	Secondary	3 hours	0.50 ppm	Same as NAAQS	—	Same as NAAQS	—	Same as NAAQS	Same as NAAQS
	Primary	24 hours	0.14 ppm	Same as NAAQS	0.04 ppm	260 μg/m^3	0.10 ppm	Same as NAAQS	Same as NAAQS
	Primary	Annual	0.03 ppm	Same as NAAQS	—	60 μg/m^3	0.02 ppm	Same as NAAQS	Same as NAAQS

Exhibit 3-2. Federal and State Ambient Air Quality Standards (page 2 of 2)

Pollutant	Standard Type	Averaging Period	National[a]	Alaska[a]	California[a]	Florida[a]	New Mexico[a]	Oklahoma[a]	Virginia[a]
Carbon monoxide	Primary and Secondary	1 hour	35 ppm	40 ppm	20 ppm	Same as NAAQS	13.1 ppm	Same as NAAQS	Same as NAAQS
	Primary and Secondary	8 hours	9 ppm	Same as NAAQS	9 ppm	Same as NAAQS	8.7 ppm	Same as NAAQS	Same as NAAQS
Lead	Primary and Secondary	Rolling 3-Month Average[e]	0.15[e] μg/m^3	—	—	—	—	—	—
	Primary and Secondary	Calendar quarter	1.5 μg/m^3	Same as NAAQS	—	Same as NAAQS	—	Same as NAAQS	Same as NAAQS
	—	30 days	—	—	1.5 μg/m^3	—	—	—	—
Sulfates	—	24 hours	—	—	25 μg/m^3	—	—	—	—
Hydrogen sulfide	—	1 hour	—	—	0.03 ppm	—	0.010 ppm	—	—
Vinyl chloride	—	24 hours	—	—	0.01 ppm	—	—	—	—
Visibility-reducing particles[c]	—	8 hours	—	—	0.23 per kilometer[c]	—	—	—	—
Reduced sulfur compounds[d]	—	30 minutes	—	50 μg/m^3	—	—	0.003 ppm	—	—
Ammonia (NH_3)	—	8 hours	—	2.1 mg/m^3	—	—	—	—	—

[a] Concentrations are expressed first in the units in which they were promulgated. Equivalent units given in parentheses are based on a reference temperature of 25°C and a reference pressure of 760 torr. ppm = parts per million, μg/m^3 = micrograms per cubic meter, mg/m^3 = milligrams per cubic meter, — = no standard has been established.

[b] The national 1-hour O_3 standard was revoked on June 15, 2005, for all areas except the 8-hour ozone nonattainment Early Action Compact areas (those areas for which the EPA deferred the 8-hour designation in return for commitments to early emission reductions) 40 CFR 50.9(b).

[c] This is the extinction coefficient due to particles when relative humidity is less than 70 percent. The value of the standard generally corresponds to visibility of 10 miles or more.

[d] Expressed as SO_2.

[e] Final EPA rule signed October 15, 2008. States may adopt this standard in the future.

Sources: National – 40 CFR 50; Alaska – 18 AAC 50.010; California – 17 CCR 70200; Florida – 62 FAC 204.240; New Mexico – 20 NMAC 2.3; Oklahoma – 252 OAC 100 Appendices E and F; Virginia – 9 VAC 5-30

The EPA has issued rules for determining conformity of Federal actions in nonattainment and maintenance areas. The General Conformity Rule[2] applies to "non-transportation" projects, *i.e.*, projects not funded by the Federal Highway Administration, Federal Transit Administration, or U.S.C. Title 23. Under this applicability definition, non-transportation projects include commercial space operations for which the FAA is the sponsoring Federal agency. The EPA General Conformity Rule defines a "conforming" project as one that conforms to the State Implementation Plan's overall objective of eliminating or reducing the severity and number of air quality violations in a state, and achieving expeditious attainment of the NAAQS; does not cause or contribute to new NAAQS violations in the area; does not increase the frequency or severity of existing NAAQS violations in the area; and does not delay the state's timely attainment with the NAAQS or impede required progress toward attainment.

The General Conformity Rule established emissions thresholds, or *de minimis* levels, for use in evaluating the conformity of a project. For purposes of attaining the ozone standard, emissions of the ozone precursor pollutants VOCs and NO_X are assessed. Exhibit 3-3 lists the *de minimis* threshold levels

Exhibit 3-3. General Conformity Emissions Thresholds

Area Designation		Pollutants	Threshold in tons per year
Ozone	Extreme Nonattainment	NO_X or VOCs	10
	Severe Nonattainment	NO_X or VOCs	25
	Serious Nonattainment	NO_X or VOCs	50
	Other Nonattainment, within Ozone Transport Region (OTR)	NO_X	100
	Other Nonattainment, within OTR	VOCs	50
	Other Nonattainment, outside OTR	NO_X or VOCs	100
	Maintenance	NO_X	100
	Maintenance, within OTR	VOCs	50
	Maintenance, outside OTR	VOCs	100
PM_{10}	Serious Nonattainment	PM_{10}	70
	Moderate Nonattainment	PM_{10}	100
	Maintenance	PM_{10}	100
$PM_{2.5}$	Nonattainment or Maintenance	$PM_{2.5}$ direct emissions, or SO_2, or NO_X (unless determined not to be a significant precursor), or VOCs or NH_3 (if determined to be significant precursors)	100
CO	Nonattainment or Maintenance	CO	100
SO_2	Nonattainment or Maintenance	SO_2	100
NO_2	Nonattainment or Maintenance	NO_2	100
Pb	Nonattainment or Maintenance	Pb	25

Source: 40 CFR 93.153(b).

[2] General Conformity Rule. 40 CFR 51 Subpart W. Promulgated in the *Federal Register* (*FR*) at 58 *FR* 63214. November 30, 1993.

applicable to various nonattainment and maintenance areas. The project-related changes in the sum of "direct" and "indirect" emissions, as defined in the conformity rules, must be estimated. If the net emission increases due to the project are less than these thresholds, then the project is presumed to conform and no further conformity evaluation is required. If the emission increases exceed the lower of these thresholds, then a conformity determination is required. The conformity determination can entail air quality modeling studies, consultation with the EPA and state air quality agencies, and commitments to implement measures to mitigate air quality impacts.

Notwithstanding these emission thresholds, a conformity determination is required if the project would be "regionally significant" as defined in the General Conformity Rule. For purposes of conformity, a project is regionally significant if the emission increase due to the project would equal or exceed 10 percent of the total emission inventory for the entire nonattainment or maintenance area.

In addition to the requirements of the General Conformity Rule, the EPA has issued rules for determining conformity of transportation projects (*i.e.*, highway or transit projects funded by the Federal Highway Administration, Federal Transit Administration, or U.S.C. Title 23) in nonattainment and maintenance areas.[3] Because the potential projects evaluated in this PEIS are not anticipated to have Federal Highway Administration or Federal Transit Administration funding or to require approval from those agencies, the Transportation Conformity Rule does not apply.

Hazardous Air Pollutants

In addition to the criteria pollutants, the Clean Air Act also authorizes the EPA to regulate emissions of hazardous air pollutants, also known as toxic air pollutants or air toxics. Hazardous air pollutants are pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects. No NAAQS have been established for hazardous air pollutants (except lead, which is regulated as a criteria pollutant and a hazardous air pollutant). The EPA is required to control 188 hazardous air pollutants; a complete list of these hazardous air pollutants can be found at http://www.epa.gov/ttn/atw/orig189.html. Two hazardous air pollutants – hydrogen chloride (HCl) and atomic chlorine (Cl) – can be components of rocket engine emissions, depending on the propellant type. FAA guidance provides that hazardous air pollutant emissions should be estimated and the results disclosed in this PEIS with a discussion of the uncertainties and limitations of the analysis (FAA 1050.1E, Change 1).

New Source Review

The EPA New Source Review program is a pre-construction permit process for new stationary sources of emissions. For locations that are in an attainment area for criteria air pollutants, the EPA Prevention of Significant Deterioration regulations (40 CFR 52.21) apply; in nonattainment areas the nonattainment New Source Review regulations (40 CFR 51.165, 51.166, 52.21, 52.24, and Part 51, Appendix S) apply. The New Source Review requirements apply to the permitting of major stationary sources. The Clean Air Act specifies 26 categories of stationary sources considered major sources if they emit or have the potential to emit 100 tons per year or more of any pollutant subject to the Clean Air Act regulation. Any other stationary source that emits or has the potential to emit 250 tons per year or more of any air pollutant subject to regulation under the Clean Air Act is considered a major source and is subject to New Source Review requirements.

[3] Transportation Conformity Rule. 40 CFR Part 51 Subpart T and Part 93 Subpart A as amended. Promulgated at 58 *FR* 62188 (November 24, 1993), major amendments promulgated at 62 *FR* 43780 (August 15, 1997).

The suborbital rockets evaluated in this PEIS are considered mobile sources, analogous to aircraft operating at an airport. Although the proposed launch and reentry of reusable suborbital rockets might include some minor stationary sources of emissions, they are not expected to include major stationary sources subject to New Source Review. Thus, the New Source Review regulations are not expected to apply to the proposed launch and reentry of reusable suborbital rockets. Minor stationary sources of emissions associated with the launch and reentry may, however, be subject to state permit requirements (*e.g.*, use of a portable generator).

Regional Haze

Section 169 of the Clean Air Act sets forth a national goal for visibility, defined as the "prevention of any future, and the remedying of any existing, impairment of visibility in Class I areas…from manmade air pollution." Regional haze is visibility impairment caused by cumulative air pollution sources over a wide geographic area. Under the regional haze rule (40 CFR 51 Subpart P, promulgated at 64 *FR* 35714, July 1, 1999), states are required to develop State Implementation Plans to address visibility at designated mandatory "Class I areas," including designated national parks, wilderness areas, and wildlife refuges. Under criteria established in the Clean Air Act, Class I areas are those of special national concern where any appreciable deterioration in air quality is considered significant. Therefore, the most restrictive increments apply in Class I areas. Class I areas include all national parks, wilderness areas, and memorial parks that exceed certain sizes. A visibility analysis is required for each Class I area within 100 kilometers (about 62 miles) of any new or modified major stationary sources whose emissions exceed Prevention of Significant Deterioration modeling thresholds.

As noted above, the suborbital rockets evaluated in this PEIS are considered mobile sources of emissions. Although the proposed launch and reentry of reusable suborbital rockets might include some minor stationary sources of emissions, they are not expected to include major stationary sources subject to the regional haze rule. Thus, the Federal regional haze rule is not expected to apply to the proposed launch and reentry of reusable suborbital rockets. States that prepare State Implementation Plans for visibility under the provisions of the Federal regional haze rule have limited authority to regulate mobile sources. Thus, if launch and reentry of reusable suborbital rockets were proposed in a state that has a visibility State Implementation Plan that affects aerospace vehicle emissions, then some visibility-related state requirements might apply.

3.1.2 Biological Resources (Fish, Wildlife, and Plants)

3.1.2.1 Definition and Description

Biological resources are native or naturalized vegetation and wildlife and their respective habitats. These resources are usually categorized as aquatic and terrestrial vegetation and wildlife, special status species (threatened, endangered, species of concern), and environmentally sensitive or critical habitats, such as wetlands. Biological resources are valued for their intrinsic, aesthetic, economic, and recreational aspects.

3.1.2.2 Regulatory Setting

NEPA analysis considers and evaluates potential impacts to all species that could be affected by the Proposed Action and its alternatives. Special emphasis is placed on species designated as sensitive. Plant and wildlife species might be designated as sensitive because of overall rarity, endangerment, unique habitat requirements, and restricted distribution. Generally, a combination of these factors leads to a sensitivity designation.

Federal Endangered Species Act

The U.S. Fish and Wildlife Service administers the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*), which states that all Federal departments and agencies shall seek to conserve endangered species and threatened species. Under the Endangered Species Act, the Secretary of the Interior creates lists of endangered and threatened species. Endangered species means any plant or animal species that is in danger of extinction throughout all or a significant portion of its range. The Act defines a threatened species as any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Species on either the threatened or endangered lists are afforded special protection.

At present, there are 747 species of plants and 1,238 species of animals listed as threatened or endangered by the Fish and Wildlife Service and that are afforded protection under the Endangered Species Act (USFWS, 2008).

Sensitive species include those identified by the Fish and Wildlife Service as candidates for possible listing as threatened or endangered pursuant to the Endangered Species Act. Candidate species are those for which the Fish and Wildlife Service has obtained substantial information on biological vulnerability and threats to support proposals to list the species as endangered or threatened. Critical habitat for a threatened or endangered species is defined as specific areas within the geographical area occupied by the species at the time it is listed, which contain the physical or biological features essential to conservation of the species and that might require special management considerations or protection. Critical habitat also includes specific areas outside the geographic area occupied by the species at the time it is listed that are essential to conservation of the species.

In accordance with Executive Order 13112, *Invasive Species*, invasive species are alien species whose introduction does or is likely to cause economic or environmental harm to human health. A species is regarded as invasive if it (1) has been introduced by human action to a location where it did not previously occur naturally; (2) becomes capable of establishing a breeding population in the new location without further intervention by humans; and (3) spreads widely throughout the new location. The Executive Order requests that actions taken by Federal agencies that affect the status of invasive species use relevant programs to prevent introducing invasive species and provide means through which to restore native species and habitat conditions to their original state.

Other Federal regulations designed to protect the Nation's biological resources include the following:

- The Fish and Wildlife Coordination Act of 1958 (16 U.S.C. 661 *et seq.*) promotes the conservation of non-game fish and wildlife and their habitats to all Federal departments and agencies.
- The Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. 703 *et seq.*), protects migratory birds by prohibiting actions such as hunting, capturing, or killing the listed species or their nests and eggs.
- The Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*) specifically protects the two species from unauthorized capture, purchase, transportation, etc., of the birds, their nests, or their eggs. Any action that might disturb the eagles would require notification of the Fish and Wildlife Service for appropriate mitigation measures.
- The Marine Mammal Protection Act of 1972, as amended (16 U.S.C. 1361 *et seq.*), was most recently reauthorized in 1994. The purpose of the Act is to protect marine mammals from human activities. The Act established a moratorium, with certain exceptions, on the taking of marine mammals in U.S. waters and by U.S. citizens on the high seas, and on the importing of marine mammals and marine mammal products into the United States.

- The Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended (16 U.S.C. 1801 *et seq.*), governs the conservation and management of ocean fishing, including Essential Fish Habitat. Essential Fish Habitat includes habitats that support the different life stages of each managed species, such as breeding, spawning, nursery, feeding, and protection functions. The Act establishes exclusive U.S. management authority over all fishing within the exclusive economic zone, all anadromous fish throughout their migratory range (except when in a foreign nation's waters), and all fish on the Continental Shelf. Each individual site may be subject to further state and local regulations.

3.1.3 Historical, Architectural, Archaeological, and Cultural Resources

3.1.3.1 Definition and Description

Cultural resources include aspects of the physical environment that are a part of traditional life ways and practices and are associated with community values and institutions. Cultural resources include prehistoric and historic resources and ethnographic resources. Paleontological resources are fossil remains of prehistoric plant and animal species and may include shells, bones, leaves, and pollens.

Prehistoric and historic resources are the tangible remains of past activities that show use or modification by people. They can include artifacts, features such as hearths, rock alignments, trails, rock art, roads, landscape alterations, or architecture. In general, prehistoric and historic resources are the loci of purposeful human activity that has resulted in the deposition of cultural materials beyond the level of a few incidental artifacts. Historic properties are defined as artifacts, archaeological sites, standing structures or other historic resources listed, or potentially eligible for listing, in the *National Register of Historic Places*, which is a list of buildings, structures, sites, districts, and objects considered significant at a national, state, or local level.

Cultural resources that have a direct association with a living culture may be considered ethnographic resources. Ethnographic resources are associated with the cultural practices, beliefs, and traditional history of a community. They are used within social, spiritual, political, and economic contexts and are important to the preservation and viability of a culture. Examples of ethnographic resources include places that play an important role in oral histories, such as a particular rock formations, the confluence of two rivers, or a rock cairn; large areas, such as landscapes and viewscapes; sacred sites and places important for religious practices; natural resources traditionally used by people such as plant communities or clay deposits; and places such as trails or camping locations. The components of an ethnographic resource can be human-made or natural. If an ethnographic resource is found to meet the criteria and requirements for listing on the National Register, it is called a traditional cultural property. A traditional cultural property is generally defined as a property "that is eligible for inclusion in the NRHP [*National Register of Historic Places*] because of its' association with the cultural practices or beliefs of a living community that are rooted in that community's history, and are important in maintaining the continuing cultural identity of the community" (FAA, 2005).

3.1.3.2 Regulatory Setting

Section 101(b)(4) of NEPA established a Federal policy for the conservation of historic, cultural, and natural aspects of the Nation's heritage. Regulations implementing NEPA stipulate that Federal agencies must consider the consequences of their undertakings on cultural resources that are included or eligible for inclusion on the *National Register of Historic Places* (40 CFR 1502.16(g)). The term "eligible for inclusion on the NRHP" includes all properties that meet the specifications set forth in U.S. Department of the Interior regulations at 36 CFR 60.4. Section 106 of the National Historic Preservation Act (16 U.S.C. 470 *et seq.*) requires that Federal agencies "take into account how each of its undertakings could affect historic properties." Sites not yet evaluated may be considered potentially eligible for listing on the National Register and are afforded the same regulatory consideration as nominated properties. Requirements of Section 106 include the following:

- The identification of significant historic properties or sites of cultural significance that could be adversely affected by a Proposed Action or undertaking;
- Consultation with the applicable State and/or Tribal Historic Preservation Officer, and as necessary, the Advisory Council on Historic Preservation; and
- The development of mitigation measures.

In addition to compliance with Section 106, a site-specific analysis should also consider Executive Order 13287, *Preserving America* (68 *FR* 10635). Executive Order 13287 provides government directives for the goals of the protection, enhancement, and contemporary use of federally owned historic properties by promoting intergovernmental cooperation and partnerships for the preservation and use of such resources. Executive Order 13287 states, "[a]gencies shall maximize efforts to integrate the policies, procedures, and practices of the NHPA [National Historic Preservation Act] and this order into their program activities in order to efficiently and effectively advance historic preservation objectives in the pursuit of their missions."

Section 110 of the National Historic Preservation Act directs Federal agencies to assume responsibility for the preservation of historic properties that are owned or controlled by such agencies. In addition to NEPA and Sections 106 and 110 of the National Historic Preservation Act, the primary laws that pertain to the treatment of cultural resources during environmental analysis are the Archaeological Resources Protection Act of 1979 (16 U.S.C. 470aa-470mm), the Antiquities Act of 1906 (16 U.S.C. 431), and the Native American Graves Protection and Repatriation Act (25 U.S.C. 3001 *et seq*.).

The Federal Government recognizes its unique relationship with Native American tribal governments and respects tribal sovereignty and self-government. Various Federal statutes have been enacted that establish and define a trust relationship with tribes. Specific statutes, regulations, and Executive Orders guide consultation with Native Americans to identify cultural resources important to tribes and to address tribal concerns about potential impacts to these resources. Those relevant to the proposed project are the National Historic Preservation Act and its implementing regulations (36 CFR 800.2), American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996), and Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments* (65 *FR* 67249). This legislation calls on agencies to consult with Native American tribal leaders and others knowledgeable about cultural resources important to them. Consultation is conducted for Federal actions with the potential to affect locations of traditional concern, religious practices and areas where they are carried out, areas of traditional cultural uses, archaeological sites, and other modern and ancestral tribal resources.

Executive Order 13007, *Indian Sacred Sites*, defines an Indian Sacred Site as "any specific, discrete, narrowly delineated location on Federal land that is identified by an Indian tribe or Indian individual determined to be an appropriately authoritative representative of an Indian religion, as sacred by virtue of its established religious significance to, or ceremonial use by, an Indian religion; provided that the tribe or appropriately authoritative representative of an Indian religion has informed the agency of the existence of such a site" (61 *FR* 26771). Under Executive Order 13007, Federal agencies, to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions, must: (1) accommodate access to and ceremonial use of Indian Sacred Sites by Indian religious practitioners, and (2) avoid adversely affecting the physical integrity of such sacred sites.

3.1.4 Floodplains

3.1.4.1 Definition and Description

Floodplains are areas of low-lying ground along a river or stream channel. Such lands can be subject to periodic or infrequent inundation due to rain or melting snow. Risk of flooding depends on topography, the frequency of precipitation events, and the size of the watershed above the floodplain. The most common regulatory definition concerning such an area concerns 100-year floodplains as determined by the Federal Emergency Management Agency (FEMA), and as depicted on Flood Insurance Rate Maps for all communities that are members of the National Flood Insurance Program. The 100-year floodplain designates the area inundated during a storm having a 1-percent chance of occurring in any given year. Often, development in floodplains is limited to passive uses, such as recreational and preservation activities, to reduce the risks to human health and safety.

3.1.4.2 Regulatory Setting

Floodplains are regulated by states based on the requirements of the National Flood Insurance Program, which FEMA oversees. Executive Order 11988, *Floodplain Management*, mandates that Federal agencies avoid construction or management practices that would adversely affect floodplains unless that agency finds that (1) no practical alternative exists, and (2) the proposed action has been designed or modified to minimize harm to or within the floodplain. Executive Order 11988 further tasks all Federal agencies to reduce the risk of flood loss; minimize the impact of floods on human safety, health, and welfare; and restore and preserve the natural and beneficial values served by floodplains in carrying out the agency's responsibilities.

3.1.5 Hazardous Materials, Pollution Prevention, and Solid Waste

3.1.5.1 Definition and Description

A hazardous material is any substance or material that has been determined to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce (49 CFR 172, Table 172.101). This includes hazardous substances and hazardous wastes. A waste is considered hazardous if it is listed in, or meets the characteristics described in 40 CFR 261, including ignitability, corrosivity, reactivity, or toxicity. A hazardous substance is any element, compound, mixture, solution, or substance defined as a hazardous substance under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and listed in 40 CFR 302. If released into the environment, hazardous substances could pose substantial harm to human health or the environment (FAA Order 1050.1E, Change 1).

Pollution prevention is reducing or eliminating waste at the source by modifying production processes, promoting the use of non-toxic or less-toxic substances, implementing conservation techniques, and re-using materials rather than putting them into the waste stream (EPA, 2007a).

Solid waste, more commonly known as trash or garbage, consists of everyday items such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries (EPA, 2007b).

Hazardous materials management is the responsibility of the authority operating facilities and installations. Maintenance and flight support operations at various locations might require the use of products containing hazardous materials including paints, solvents, oils, lubricants, acids, batteries, fuels, surface coatings, and cleaning compounds. These products would be used and stored at appropriate locations throughout each site, but would be primarily associated with industrial and maintenance activities. Site-specific plans would outline the strategies and procedures for storing, handling, and transporting hazardous materials and would detail responses to onsite or offsite spills.

Federal and state regulations require that hazardous waste be handled, stored, transported, disposed of, or recycled in compliance with applicable regulations. Aircraft and vehicle maintenance, fuel storage and dispensing, and facility and grounds maintenance activities are activities that could generate hazardous wastes. The types of hazardous waste potentially associated with launch activities include waste fuel, waste oils, spent solvents, paint waste, and used batteries. Site-specific procedures and plans would outline the steps for appropriate management of hazardous wastes, such as satellite accumulation points and properly labeled U.S. Department of Transportation (DOT)-approved containers. Wastes may be disposed of using designated hazardous waste accumulation facilities or private hazardous waste contractors, as appropriate.

3.1.5.2 Regulatory Setting

EPA regulates hazardous chemicals, substances, and wastes under the Resource Conservation and Recovery Act (RCRA), CERCLA, and the Toxic Substances Control Act. These provide requirements for the generation, storage, transportation, treatment, and disposal of hazardous materials and hazardous waste. The EPA and various states also have regulations regarding the operation and maintenance of underground and above-ground storage tanks. In addition, the Occupational Safety and Health Administration (OSHA) has definitions and workplace safety-related requirements and thresholds for approximately 400 hazardous and toxic substances, and the DOT has definitions and requirements for the safe transport of hazardous material (FAA, 2005).

Executive Order 12088, *Federal Compliance with Pollution Control Standards*, directs Federal agencies to comply with "applicable pollution control standards" in prevention, control, and abatement of environmental pollution and to consult with the EPA, state, and local agencies concerning the best techniques and methods available for prevention, control, and abatement of environmental pollution (FAA Order 1050.1E, Change 1). The CEQ Memorandum on Pollution Prevention and NEPA encourages early consideration of opportunities for pollution prevention (CEQ, 1993).

Municipal solid waste is regulated and managed at the state and community level (EPA, 2007c).

3.1.6 Health and Safety

3.1.6.1 Definition and Description

Health and safety includes consideration of any activities, occurrences, or operations that have the potential to affect the well-being, safety, or health of workers or members of the public. The primary goal is to identify and prevent potential accidents or impacts on workers and the general public. Overall public health and safety is controlled by many laws that regulate the transportation of hazardous cargo, provide for the protection of workers in the workplace, protect the public from exposure to hazardous materials, and provide for emergency preparedness.

Health and safety can be divided into occupational health and safety and environmental health and safety. Occupational health and safety is concerned with work sites and operational areas where workers could be located. Hazard analyses can be used to identify and assess credible accident scenarios at work and to establish procedures to prevent accidents and to respond to any accidents that do occur. Environmental health and safety considers environmental risks and hazards, both on and off the worksite, that could affect the health of the general public. Risk assessments can be used to identify, characterize, quantify and evaluate risks to human health and the environment, and to establish preventive and mitigating measures that would reduce risk.

The primary objective of the FAA commercial space transportation licensing program is to ensure public health and safety through the licensing of commercial space launches and reentries and the operation of launch facilities. Protection of public health and safety and the safety of property is the objective of the FAA licensing, compliance monitoring, and safety inspection process. Under the Proposed Action and its alternatives, the applicant would file full operational safety documentation with the FAA. This would include a hazard analysis, verification of operating area and key flight-safety event limitations, identification of landing and impact areas, and a mishap response plan (see Section 1.3 of this PEIS). The FAA would only issue a permit if it determined that an applicant's launch or reentry activities would not jeopardize public health and safety, safety of property, U.S. national security or foreign policy interests, or U.S. international obligations.

3.1.6.2 Regulatory Setting

CEQ NEPA implementing regulations direct agencies to evaluate health effects (40 CFR 1508.8) and to consider "the degree to which the Proposed Action affects public health and safety" (40 CFR 1508.27). OSHA regulates occupational health and safety. FAA regulations at 14 CFR 400 through 450 contain licensing requirements that include health and safety provisions. National Aeronautics and Space Administration (NASA) Safety Program requirements and U.S. Department of Defense (DoD) Range Safety Standards also apply to activities at NASA or DoD facilities.

3.1.7 Land Use (including Department of Transportation Act Section 4(f) Resources, Farmlands, Wild and Scenic Rivers, and Coastal Resources)

3.1.7.1 Definition and Description

The compatibility of existing and planned land use in the vicinity of a launch site is usually associated with the extent of the site's noise impacts (see Section 3.1.10). Generally, if the noise analysis concludes that there would be no significant impact, a similar conclusion can be drawn regarding compatible land use. However, if an action would result in other impacts exceeding thresholds of significance that have land-use ramifications (disruption of communities, relocation, and induced socioeconomic impacts), the effect on land use is analyzed and described.

The EPA defines land use as "the way land is developed and used in terms of the kinds of anthropogenic activities that occur (*e.g.*, agriculture, residential areas, industrial areas)" (FAA, 2005). Humans develop land for a variety of purposes that can include economic production, natural-resource protection, or institutional uses. Types of land use include agriculture, livestock grazing and production, conservation and recreation sites, military installations, and research sites managed by other agencies and organizations. A particular environment might include cities, towns, and rural communities of all sizes, throughout which are extensive communication systems; industrial complexes with factories and power plants; energy distribution systems for electricity, natural gas, liquid fuels, and nuclear, solar, hydro, and wind power; water treatment facilities; and waste management facilities. Wildlife refuges, national landmarks, and coastal zones present within an environment typically are afforded special status or protection.

3.1.7.2 Regulatory Setting

Land use in the United States is typically regulated in some way by land-use plans, policies, or ordinances that stipulate the permissible uses within an area. Land classification types can include agricultural, forestry, urban, inland water bodies, and other categories. Land-use classifications are often subcategorized for more specific purposes, such as low-density residential or light industrial uses. Regulations regarding land use can be established at a local, state, or Federal level to manage military installations, or to protect such sensitive areas as historic properties, prime or unique farmlands, national parks, wildlife refuges, or other areas that are afforded special status. However, land-use planning and regulations that designate acreages or parcels for residential, commercial, or industrial uses generally are established at the local and municipal levels. Additionally, lands categorized as public use can also carry special use designations, for which management guidance is provided. The Federal land management agencies (U.S. Forest Service, U.S. Bureau of Land Management, U.S. Fish and Wildlife Service, and National Park Service) have a variety of land-management plans (*e.g.*, the Forest Service develops Forest Management Plans). Public use land-use designations can include the following:

- Controlled use or wilderness areas;
- Limited-use areas designed to protect sensitive natural, physical, biological, or cultural resource values;
- Low-intensity areas, which are designed to control multiple uses of resources so that no sensitive values are diminished;
- Moderate-use areas that provide a controlled balance between higher intensity land uses and resource protection; and
- Intensive-use areas, which are designed to accommodate the concentrated use of land and resources to meet human needs.

Land-use management practices are subject to mandates of the controlling agency, while non-Federal lands are often subject to the collective guidance and regulations of local, county, and state entities. Land-use management and planning approaches are intricate processes that seek to provide protection of resource values that might be present on the site and off the site in the surrounding community.

Department of Transportation Section 4(f) Resources

The Federal statute that governs impacts on any publicly owned land is commonly known as the DOT Act, Section 4(f) provisions, although it was recodified and renumbered as Section 303(c) of Title 49 U.S.C. Appendix A of FAA Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures*, includes the following excerpt from Section 4(f) of the DOT Act:

The Secretary of Transportation will not approve any program or project that requires the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance or land from an historic site of national, state, or local significance as determined by the officials having jurisdiction thereof, unless no feasible and prudent alternative exists to the use of such land and such program, and the project includes all possible planning to minimize harm resulting from the use. In carrying out the national policy, the FAA shall cooperate and consult with the Secretaries of the Interior, Housing and Urban Development, and Agriculture, and with the states regarding potential impacts on such resources.

FAA Order 1050.1E, Change 1, outlines significant impact thresholds for Section 4(f) properties. As described in FAA Order 1050.1E, Change 1, there would be significant impacts when a Proposed Action either involves more than a minimal physical use of a Section 4(f) property or is deemed a “constructive use” substantially impairing the 4(f) property, and mitigation measures do not eliminate or reduce the effects of the use below the threshold of significance (*e.g.*, by replacement in kind of a neighborhood park). There would be substantial impairment when impacts to Section 4(f) lands were sufficiently serious that the value of the site in terms of its prior significance and enjoyment were substantially reduced or lost. If there is a physical or constructive use, the FAA is responsible for complying with Section 4(f) even if the impact would be less than significant for NEPA purposes.

Numerous land-use designations can characterize a given environment and the sites within that environment. Site-specific analysis will identify and, if appropriate, analyze potential impacts to particular land-use designations for individual sites where the Proposed Action might occur. Compliance with Federal and state regulations and local land-use plans would be required. Site-specific analysis would be coordinated with the appropriate agencies, including the Bureau of Land Management, the National Park Service, Forest Service, and state agencies, and county and municipal planning groups and local communities. At some facilities, it might be necessary to address the issue of encroachment to ensure that offsite development is not encroaching on the site where the Proposed Action might occur.

Farmlands

The Farmland Protection Policy Act (7 U.S.C. 4201 through 4209) requires the cooperation of Federal agencies to minimize their contribution to the unnecessary and irreversible conversion of farmland to non-agricultural uses and to be compatible with state and local government, and private programs and policies to protect farmland. The U.S. Department of Agriculture, National Resources Conservation Service, classifies soils, including areas of prime farmland, unique farmland, and land of statewide or local importance (FAA, 2005). Farmland subject to the Farmland Protection Policy Act requirements does not have to be currently used for farming. It can be forestland, pastureland, cropland, or other land, but not water or developed urban land. The National Resources Conservation Service uses a land evaluation and site assessment system to establish a farmland conversion impact rating score on proposed sites of federally funded and assisted projects (FAA, 2005). Based on this score, if the potential adverse impacts on the farmland exceed the recommended allowable level, then the project sponsor must consider alternative sites or implement measures to minimize impacts (FAA, 2005).

Wild and Scenic Rivers

The Wild and Scenic Rivers Act of 1968 requires that certain selected rivers that "possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values" be preserved and that "they and their immediate environments shall be protected for the benefit and enjoyment of present and future generations" (16 U.S.C. 1271 through 1287). The National Park Service designates these rivers as "Wild and Scenic." Visual resources in areas surrounding certain selected rivers are protected under The Wild and Scenic Rivers Act (Public Law 90-542, as amended) (16 U.S.C. 1271 through 1287). Agencies are required, as part of their standard environmental review processes, to consult with the National Park Service and other Federal and state agencies having jurisdiction, prior to taking any actions that could effectively foreclose or downgrade the wild, scenic, or recreational river status of rivers in the Wild and Scenic Rivers System, study rivers, river segments in the Nationwide Rivers Inventory, or rivers or river segments otherwise eligible under Section 5(d) for inclusion in the Wild and Scenic Rivers System but not on the Nationwide Rivers Inventory or under study (FAA Order 1050.1 E, Change 1) (FAA, 2005).

Coastal Resources

Federal activity in, or affecting, a coastal zone requires preparation of a Coastal Zone Consistency Determination, in accordance with the Federal Coastal Zone Management Act of 1972, as amended (16 U.S.C. 1451 *et seq*.), and implemented by the National Oceanic and Atmospheric Administration (NOAA). Congress passed the Act to preserve, protect, develop and, where possible, restore or enhance the Nation's natural coastal zone resources, which include wetlands, floodplains, estuaries, beaches, dunes, barrier islands, coral reefs and fish and wildlife and their habitat. The Act also requires the management of coastal development to minimize the loss of life and property caused by improper development in a coastal zone. Responsibility for administering the Coastal Zone Management Program has been delegated to states that have developed state-specific guidelines and requirements. A Federal agency must ensure that proposed activities within the coastal zone are consistent with that state's Coastal Zone Management Program.

3.1.8 Light Emissions and Visual Resources

3.1.8.1 Definition and Description

The FAA considers the extent to which any lighting associated with an action would create an annoyance among people in the vicinity or interfere with their normal activities. Visual and aesthetic resources refer to natural or developed landscapes that provide information for an individual to develop their perceptions of the area. Landforms, surface water, vegetation, viewpoints or viewsheds, open space, transportation structures, and human-made features are fundamental characteristics of an area that define the visual environment and form the overall impression that an observer receives of an area. The importance of visual resources and any changes in the visual character of an area is influenced by social considerations, including the public value placed on the area, public awareness of the area, and community concern for the visual resources in the area.

It is difficult to quantify impacts to visual or aesthetic resources because of subjectivity on the part of the observers and because such resources are affected by the extent to which the project contrasts with the existing environment. The visual resources of an area and any proposed changes to those resources can be evaluated in terms of "visual dominance" and "visual sensitivity." Visual dominance describes the level of noticeability as the result of a visual change in an area. The levels of visual dominance vary from "not noticeable" to a significant change that demands attention and cannot be disregarded. Visual sensitivity depends on the setting of an area. Areas such as coastlines, national parks, and recreation or wilderness areas usually are considered to have high visual sensitivity, whereas heavily industrialized urban areas tend to have the lowest visual sensitivity.

Many environments are likely to include regions of rich aesthetic and visual resources, and designated and undesignated natural areas of great beauty and scenic diversity. Visual resources can fall under several different designations, including national forest; national monument; national, state, and county parkland; national wildlife refuges; wilderness areas; wild and scenic rivers; national trails; and privately owned land. Various roads also can be designated scenic byways due to their scenic, historic, and cultural qualities, and there could be visually sensitive recreational areas or scenic highways close to the site of a Proposed Action.

3.1.8.2 Regulatory Setting

FAA Order 1050.1E, Change 1, directs the FAA to consider visual, or aesthetic, impacts and the extent to which any lighting associated with the action might create an annoyance among people in the vicinity or interfere with their normal activities.

3.1.9 Natural Resources and Energy Supply

3.1.9.1 Definition and Description

Natural resources and energy supply refers to changes in local supplies of energy or natural resources and the use of energy, water, and other resources. Proposed major changes in stationary facilities or the movement of aircraft and ground vehicles that would have a measurable effect on local supplies of energy or natural resources should be examined.

3.1.9.2 Regulatory Setting

Although there are no special-purpose laws for natural resources and energy supply, FAA Order 1050.1E, Change 1, requires that an EIS include analysis of effects on local supplies of energy or natural resources. The use of natural resources other than for fuel must be examined only if the action involves a need for unusual materials or those in short supply. Executive Order 13123, *Greening the Government Through Efficient Energy Management* (62 *FR* 30851, June 8, 1999), encourages Federal agencies to expand the use of renewable energy within their facilities and in their activities. Executive Order 13123 also requires each Federal agency to reduce petroleum use, total energy use and associated air emissions, and water consumption in their facilities.

3.1.10 Noise and Compatible Land Use

3.1.10.1 Definition and Description

Noise is unwanted sound that disturbs routine activities and peace and quiet, and can cause annoyance. Three characteristics are used to measure noise: amplitude, frequency, and duration. Amplitude is the intensity of the noise and is described in units called decibels (dB). Frequency measures the number of wavelengths received over a period of time. High-frequency noises have a high number of wavelengths per time period, and low frequency noises have fewer wavelengths per time period. An example of high frequency noise is the characteristic high pitch whine from a jet engine. Sonic booms and blast noise are examples of low frequency noise. Duration is simply the length of time over which the noise continues. Common metrics for quantifying noise include A-weighted decibels (dBA), which simulates the frequency response of the human ear, and day-night average noise level (DNL), which is a 24-hour average of noise levels with a 10 dB penalty for noises at night. The 10 dB adjustment is made to account for increased human sensitivity to noise at night.

For the aviation noise analysis, the FAA determined that the cumulative noise energy exposure of individuals resulting from aviation activities must be established in terms of annual average DNL, and recognizes community noise equivalent level as an alternative metric for California. The FAA considers that there would be a significant noise impact if analysis shows that the Proposed Action would cause noise-sensitive areas to experience a noise increase of 1.5 dBA or more at or above DNL 65 noise exposure when compared to the No Action Alternative for the same period (FAA Order 1050.1E, Change 1).

Noise-Sensitive Area

A noise-sensitive area is one in which noise interferes with normal activities. Noise-sensitive areas usually include residential, educational, health, and religious structures and sites, and parks, recreational areas (including areas with wilderness characteristics), wildlife refuges, and cultural and historical sites. The potential impact area for noise from airplanes and helicopters would include such areas within the DNL 65 noise contour. In the context of launch vehicle operations, potential noise impact areas could include such sites within about 40 miles of the launch sites of very large rockets, and such sites within about 2 miles of the launch sites of small rockets (FAA Order 10501.E, Change 1).

Exhibit 3-4 lists some common noise sources and their decibel levels (in dBA) along with typical noise sources and their associated noise levels.

Exhibit 3-4. Comparison of Noise Levels from Common Noise Sources

dBA	Overall Level	Outdoor Noise Level	Indoor Noise Level
120	Uncomfortably loud	Military jet aircraft takeoff from aircraft carrier at 50 feet	Oxygen torch
110	Very loud	Turbo fan aircraft at takeoff at 200 feet	Rock band
100		Boeing 707 or DC-8 aircraft at one nautical mile, jet flyover at 1,000 feet, Bell J-2A helicopter at 100 feet	-
90	Moderately loud	Boeing 737 or DC-9 aircraft at one nautical mile, power lawnmower, motorcycle at 25 feet	Newspaper press
80		Propeller plane flyover at 1,000 feet, diesel truck at 40 miles per hour at 50 feet	Blender, garbage disposal
70	Moderately loud	High urban ambient sound, passenger car 65 miles per hour at 25 feet	Radio, TV, vacuum cleaner
60	Quiet	Air conditioning unit at 100 feet	Dishwasher at 10 feet, conversation
50		Large transformers at 100 feet	Dishwasher in next room
40	Just audible	Lowest levels of urban ambient sound	Small theater/large conference room
10		-	Broadcast and recording studio
0	Hearing threshold	-	-

Source: FAA, 2005.

The extent of noise impacts also is associated with the compatibility of existing and planned land uses in or near an airport or airfield (see Exhibit 3-5). Special consideration needs to be given to whether Part 150 land-use categories are appropriate for evaluating the impact of noise on unique and sensitive Section 4(f) properties. For example, Part 150 land-use categories are not sufficient to determine the noise compatibility of areas within a national park or national wildlife refuge where other noise is very low and a quiet setting is a generally recognized purpose and attribute, or to address noise effects on wildlife. If the noise analysis concludes that there would no significant impact, a similar conclusion usually can be drawn regarding compatible land use (FAA Order 1050.1E, Change 1).

Engine Noise

Noise associated with rocket engines is produced when the propellant is consumed and exhausted into the atmosphere. During takeoff, the noise from rocket engines on vertically launched rockets has been measured at 80 to 120 dBA at a distance of 3 miles from the launch pad. Because rocket engine noise is a function of thrust, smaller rockets produce lower noise levels. Noise associated with launch and reentry vehicles in motion is governed by the combustion process, dynamics of the exiting gases, and flight parameters. As the rocket ascends, two principles combine to reduce the ground-level noise – (1) separation distance increases and (2) the air becomes thinner and therefore less capable of transmitting noise. As a rocket descends, the reverse occurs, the separation distance decreases and the air becomes denser and therefore more capable of transmitting noise. However, the speed of the rocket begins to decrease as it approaches Earth's surface, dropping below supersonic speeds (FAA, 2005).

Exhibit 3-5. Land-Use Compatibility with Annual Day-Night Average Sound (page 1 of 2)

Land Use	Annual Day-Night Average Sound (decibels)					
	< 65	65-70	70-75	75-80	80-85	> 85
Residential						
Residential, other than mobile homes and transient lodgings	Y	N (1)	N (1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N (1)	N (1)	N (1)	N	N
Public Use						
Schools	Y	N (1)	N (1)	N	N	N
Hospitals, nursing homes	Y	25	30	N	N	N
Churches, auditoriums, concert halls	Y	25	30	N	N	N
Government services	Y	Y	25	30	N	N
Transportation	Y	Y	Y (2)	Y (3)	Y (4)	Y (4)
Parking	Y	Y	Y (2)	Y (3)	Y (4)	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail- building materials, hardware and farm equipment	Y	Y	Y (2)	Y (3)	Y (4)	N
Retail trade-general	Y	Y	25	30	N	N
Utilities	Y	Y	Y (2)	Y (3)	Y (4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y (2)	Y (3)	Y (4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y (6)	Y (7)	Y (8)	Y (8)	Y (8)
Livestock farming and breeding	Y	Y (6)	Y (7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreation						
Outdoor sports arenas, spectator sports	Y	Y (5)	Y (5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts, camps	Y	Y	Y	N	N	N
Golf courses, riding stables, water recreation	Y	Y	25	30	N	N

Notes: Numbers in parentheses refer to notes at end of exhibit.

The designations in this table do not constitute a Federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, state, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with local authorities. The FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

Exhibit 3-5. Land-Use Compatibility with Yearly Day-Night Average Sound (page 2 of 2)

Key to Exhibit	
Y (YES)	Land Use and related structures compatible without restrictions.
N (NO)	Land Use and related structures are not compatible and should be prohibited.
NLR	Noise Level Reduction (NLR) (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.
25, 30, or 35	Land use and related structures generally compatible; measures to achieve NLR of 25, 30 or 35 decibels (dB) must be incorporated into design and construction of structure.
Notes for Exhibit	
(1)	Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor NLR of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10 or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.
(2)	Measures to achieve NLR of 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
(3)	Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
(4)	Measures to achieve NLR of 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
(5)	Land use compatible provided special sound reinforcement systems are installed.
(6)	Residential buildings require an NLR of 25.
(7)	Residential buildings require an NLR of 30.
(8)	Residential buildings not permitted

Source: FAA Order 1050.1E, Change 1.

Sonic Booms

Sonic booms occur when a rocket or jet aircraft exceeds the speed of sound (Mach 1) on takeoff or reentry (FAA, 2005). Normally, as the vehicle travels through the air, the air is displaced to make room for the vehicle, and the air returns as the vehicle passes. When a vehicle exceeds the speed of sound, the pressure wave cannot keep up and, as a result, the parting of air from the vehicle is abrupt. This creates a shock wave at the front of the vehicle when the air is displaced and at the rear of the vehicle as the air returns to the unoccupied space. The shockwave resulting from supersonic flight creates a sonic boom, which is produced without warning (FAA, 2005).

Sonic booms are highest in intensity directly over the flight path of the vehicle, and the intensity of the sonic boom decreases with increasing lateral distance from the flight path. The intensity and the duration of the sonic boom depend on the size of the vehicle and how the vehicle is operated. The larger the vehicle, the higher the intensity and the longer the duration of the sonic boom. Larger vehicles displace more air molecules, thus creating a more intense sonic boom.

The duration of a sonic boom is brief. A fighter plane-sized vehicle can create a sonic boom lasting 100 milliseconds, while a Space Shuttle sized-vehicle can create a sonic boom lasting 500 milliseconds (FAA, 2005). In general, the lower the altitude at which the vehicle is operated, the more intense the sonic boom is at ground level. Intensity also increases during flight maneuvers such as diving, accelerating, and turning. Intensity levels can decrease with an increase in altitude. However, the increase in altitude increases the area exposed to the sonic boom. For every 1,000 feet of altitude, the ground width of the boom increases 1 mile. For example, a sonic boom generated at 30,000 feet (about 5.7 miles) would create a boom exposure width of 30 miles. Conversely, the boom intensity can decrease from the use of some flight maneuvers, such as climbing and decelerating (FAA, 2005).

Depending on the vehicle altitude, a sonic boom will typically reach the ground in 2 to 60 seconds after the vehicle flies overhead. However, sometimes the sonic boom does not reach the ground even though the vehicle is flying at supersonic speeds. The speed of sound is a function of temperature (FAA, 2005). An increase or decrease in temperature corresponds to an increase or decrease in sonic speed. At ground level and a temperature of 58 degrees Fahrenheit (°F), the speed of sound is 750 miles per hour. At an altitude of 30,000 feet and a temperature of approximately -49°F, the speed of sound corresponds to 670 miles per hour (FAA, 2005). The temperature gradient between the altitudes tends to refract shock waves upward. Therefore, for a sonic boom to reach the ground, the speed of a vehicle at altitude must be equal to or greater than the speed of sound on the ground or, in this example, equal to or greater than 750 miles per hour.

3.1.10.2 Regulatory Setting

Noise is primarily regulated through local noise ordinances designed to protect noise-sensitive areas. Several Federal laws, including the Aviation Safety and Noise Abatement Act of 1979, as amended (49 U.S.C. 47501 through 47507), and various commercial standards regulate commercial aircraft noise from airports. Through 14 CFR 36, the FAA regulates noise from commercial aircraft. Land-use compatibility is federally regulated through 14 CFR 150, Airport Noise Compatibility Planning. Other Federal noise standards are designed to protect worker safety.

OSHA regulation 1910.95 establishes a maximum noise level of 90 dBA for a continuous 8-hour exposure during a working day and higher levels for shorter exposure time in the workplace. The EPA identified an average equivalent noise level of 70 dB as the maximum 24-hour exposure necessary to protect hearing, and 75 dB as a protective level for 8 hours (EPA, 1981). OSHA regulation 1910.95 also establishes a maximum level for impulse noise, which should not exceed 140 dBA. The 140 dBA threshold should be considered advisory rather than mandatory.

3.1.11 Socioeconomic Resources, Environmental Justice, and Children's Environmental Health and Safety

3.1.11.1 Definition and Description

Socioeconomic Resources

Socioeconomic resources include the social and economic indicators specific to the human environment. Social indicators include statistical data related to population distributions, ethnicity, home ownership, education levels, and the availability of medical care, fire and rescue services, educational facilities, and other public amenities such as libraries or recreational opportunities. Economic indicators are used to assess the economic health of the nation or a community, as well as to make forecasts concerning future economic conditions. Key economic indicators include employment trends and unemployment rates, income levels, retail sales, industry, factory, and agricultural activities, and home purchases or sales.

Collectively, social and economic indicators are often referred to as socioeconomics. Much of the information that assists in evaluating the socioeconomic status of a given population is available from the U.S. Census Bureau on a national, state, or regional level. Site-specific socioeconomic data are available from the U.S. Census Bureau on a county, census block, and census tract level as well. More detailed information regarding a community's educational institutions, fire and rescue or medical services, and local employment is typically available from state or county governmental offices such as local Chambers of Commerce.

The population of the United States is approximately 298.4 million, with most of the population concentrated in centers on the eastern and western coasts and in major metropolitan areas. Public services, including medical, police, and fire services, are more densely located in metropolitan areas than in rural areas. In addition, metropolitan areas tend to have more established infrastructure to provide utility services (*i.e.*, water, electricity, natural gas, and phone) and waste collection services (*i.e.*, solid waste and waste water disposal) than rural areas. To compare and track the various economic generators, the United States, Canada, and Mexico have developed the North American Industry Classification System, which has replaced the U.S. Standard Industrial Classification System. The North American System helps track the changing economy and provides new comparability in statistics about business activity across North America. North American Industry Classification System code 3364 (Aerospace Product and Parts Manufacturing), and sub-code 33641 (Aerospace Product and Parts Manufacturing) represent the aerospace industry, which falls under code 336 (Transportation Equipment Manufacturing). The Aerospace Product and Parts Manufacturing industry comprises establishments primarily engaged in one or more of the following: (1) manufacturing complete aircraft, missiles, or space vehicles, (2) manufacturing aerospace engines, propulsion units, auxiliary equipment or parts, (3) developing and making prototypes of aerospace products, (4) aircraft conversion (*i.e.*, major modifications to systems), and (5) complete aircraft or propulsion systems overhaul and rebuilding (*i.e.*, periodic restoration of aircraft to original design specifications) (FAA, 2005).

Environmental Justice

Environmental justice (Executive Order 12898, *Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations*) (is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Fair treatment means that no group of people, including a racial, ethnic, or socioeconomic group, should bear a disproportionate share of an adverse impact resulting from a major Federal action. Meaningful involvement means that potentially affected community residents have an appropriate opportunity to participate in decisions about a proposed activity that would affect their environment or health; the public's contribution can influence the regulatory agency's decision; the concerns of all participants involved would be considered in the decisionmaking process; and the decisionmakers would seek out and facilitate the involvement of those potentially affected.

Environmental justice concerns include consideration of the race, ethnicity, and poverty status of populations near the site of a proposed action. The CEQ defines "minority" to consist of the following groups: Black/African American, Asian, Native Hawaiian or Other Pacific Islander, American Indian or Alaska Native, and Hispanic populations (regardless of race). Interagency Federal Working Group on Environmental Justice guidance states that a "minority population" may be present in an area if the minority population percentage in the area of interest is "meaningfully greater" than the minority population in the general population. The CEQ defines "low-income populations" as those identified with the annual statistical poverty thresholds from the U.S. Census Bureau. The accepted rationale in determining what constitutes a low-income population is similar to minority populations, in that when the low-income population percentage within the area of interest is "meaningfully greater" than the low-income population in the general population, the community in question is considered to be low-income.

Children's Environmental Health and Safety

As defined by Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, children's environmental health risks and safety risks are "risks to health or safety that are attributable to products or substances that the child is likely to come in contact with or ingest" (*e.g.*, air, food, water, soil, products).

3.1.11.2 Regulatory Setting

Socioeconomics

Socioeconomic conditions are regulated through a host of Federal programs that provide for equal opportunity, anti-discrimination, and accessibility, as well as state and local ordinances.

Environmental Justice

Through Executive Order 12898, all Federal actions or actions funded with Federal monies that could result in significant adverse effects must be evaluated for the potential of such significant impacts on disproportionately affected minority or low-income populations. In keeping with Executive Order 12898, the FAA encourages public participation regarding Proposed Actions that have the potential to adversely affect minority or low-income populations to foster better decision-making practices. Public participation and access to information are emphasized in Executive Order 12898 and the Presidential Memorandum. The Presidential Memorandum instructs agencies to provide opportunities for community input throughout the NEPA process, including identifying potential effects and mitigation measures in consultation with the community and improving access to meetings, documents, and notices. Environmental justice analyses require information about local communities, and therefore will be analyzed in site-specific environmental documentation.

Children's Environmental Health and Safety

Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, directs Federal agencies to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children. Agencies are encouraged to ensure that their policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.

3.1.12 Water Quality

3.1.12.1 Definition and Description

Water resources include surface water, groundwater, wetlands, and floodplains. Surface water resources consist of lakes, rivers, and streams. Surface water is important for its contributions to the economic, ecological, recreational, and human health of a community or locale. Storm water flows, which can be exacerbated by high proportions of impervious surfaces (*e.g.*, buildings, roads, and parking lots), are important to the management of surface water. Storm water also is important to surface water quality because of its potential to introduce sediments and other contaminants into lakes, rivers, and streams.

Groundwater is defined as water, both fresh and saline, that is stored below Earth's surface in pores, cracks, and crevices below the water table. It is an essential resource often used for potable water consumption, agricultural irrigation, and industrial applications. Groundwater typically may be described in terms of its depth from the surface, aquifer or well capacity, water quality, surrounding geologic composition, and recharge rate.

The leading causes of degradation of water resources include pathogens (bacteria), siltation (sedimentation), overloading of nutrients, contamination by metals, and habitat alterations. The leading sources for these contaminants include agriculture, hydraulic modifications, urban runoff/storm sewers, and habitat modifications. The FAA activities that could impact water resources include those that either alter the flow of surface water, supply of groundwater, or in some way contribute foreign bodies (pollution, sediment) to these water resources.

3.1.12.2 Regulatory Setting

The Clean Water Act of 1977, as amended (33 U.S.C. 1251 *et seq.*), establishes water pollution control standards and programs with the objective of restoring and maintaining the chemical, physical, and biological integrity of U.S. water resources. The Clean Water Act and its regulations specify (1) that actions must comply with Federal and state water quality criteria, (2) that permits are required under the National Pollutant Discharge Elimination System (NPDES) for storm water discharge, and (3) that states assess non-point source water pollution problems and develop pollution management plans. The Clean Water Act requires permits for activities that result in the discharge of pollutants to water resources or the placement of fill material in waters of the U.S. Storm Water Pollution Prevention Plans are typically prepared and permitted under the NPDES program to ensure construction activities do not lead to unacceptable levels of erosion and water pollution. Other regulations relevant to the protection of freshwater systems include the Safe Drinking Water Act and Executive Order 11988 (*Floodplain Management*).

EPA regulates groundwater that is used as drinking water under the Safe Drinking Water Act. The Act allows the EPA to set maximum contaminant level standards for drinking water, allows individual states to establish wellhead protection areas, and allows the EPA to regulate and permit underground injection wells. In addition to the Safe Drinking Water Act, the EPA also regulates underground storage tanks (40 CFR 280), which allows individual states to develop underground storage tank programs. Such programs are used to monitor underground storage tanks, prevent or detect leaks early, and prevent aquifer degradation.

3.1.13 Wetlands

3.1.13.1 Definition and Description

Wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (FAA, 2005). For regulatory purposes under the Clean Water Act, the term wetlands means "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas" (40 CFR 230.3(t)).

3.1.13.2 Regulatory Setting

Wetlands are regulated under the Clean Water Act and the Rivers and Harbors Act of 1899, Section 10 (33 U.S.C. 401, *et seq*.), and implemented by individual states, the EPA, and the U.S. Army Corps of Engineers. Executive Order 11990, *Protection of Wetlands,* requires Federal agencies to minimize the destruction, loss, or degradation of wetlands. The Corps of Engineers issues permits for discharges into wetlands, with oversight by the EPA; however, some states have assumed permitting authority (*e.g.,* Michigan and New Jersey). Also, individual states may regulate activities that involve wetlands under Section 401 of the Clean Water Act.

The following sections describe the resource areas for the specific sites that could host launch and reentry events operating under experimental permits.

3.2 California Spaceport

The California Spaceport is an FAA-licensed commercial launch site occupying approximately 109 acres of land collocated at Vandenberg Air Force Base in Santa Barbara County, California, approximately 1 mile east of the Pacific coast and 13 miles southwest of the City of Lompoc. The California Spaceport provides commercial launch and payload processing services and is operated and managed by Spaceport Systems International, a limited partnership of ITT Federal Services Corporation. Launch infrastructure consists of launch pads, runways, payload processing facilities, telemetry, and tracking equipments.

Vandenberg Air Force Base encompasses more than 98,000 acres and is administratively divided into North Vandenberg and South Vandenberg. Spaceport Systems International holds a launch site operator license for SLC-8 in South Vandenberg. All launches under an experimental permit would be from Space Launch Complex (SLC)-8 (see Exhibit 3-6). SLC-8 consists of a pad deck, a support equipment building, a launch equipment vault, a launch duct, a launch stand, an access tower, communications equipment, and the Integrated Processing Facility launch control room, and the Western Range interfaces needed to support a launch.

3.2.1 Air Quality

In California, air quality is assessed on both a county and a regional basis. The Santa Barbara County Air Pollution Control District, the California Air Resources Board, and EPA Region 9 regulate air quality at South Vandenberg, including SLC-8. Stationary sources of air emissions on base (including both point and area sources) typically include abrasive-blasting operations, boilers, generators, surface-coating operations, turbine engines, wastewater treatment plants, storage tanks, aircraft operations, soil remediation, launch-vehicle fueling operations, large aircraft starting systems, and solvent use. Mobile sources of air emissions include various aircraft, missile and spacecraft launches, and numerous government and personal motor vehicles (USAF, 2006).

There are air monitoring stations near the southern end of Vandenberg Air Force Base and in the nearby community of Santa Maria. Both the EPA and California Air Resources Board have designated Santa Barbara County as in attainment of the NAAQS and CAAQS for CO, NO_2, Pb, and SO_2 (see Exhibit 3-7). The Santa Barbara County area is designated as in attainment for the Federal PM_{10} and ozone standards, but the California Air Resources Board has designated the County to be in nonattainment under the more stringent California standards for PM_{10} and 8-hour ozone. Attainment status for both NAAQS and CAAQS for $PM_{2.5}$ for Santa Barbara County has not been determined because of insufficient data for both Federal and state standards. In addition to the criteria pollutants previously discussed, California state standards also exist for sulfates, hydrogen sulfide, and visibility reducing particles. Santa Barbara County is in attainment for these pollutants (SBCPCD, 2007; EPA, 2008a).

Exhibit 3-6. California Spaceport and the Surrounding Area

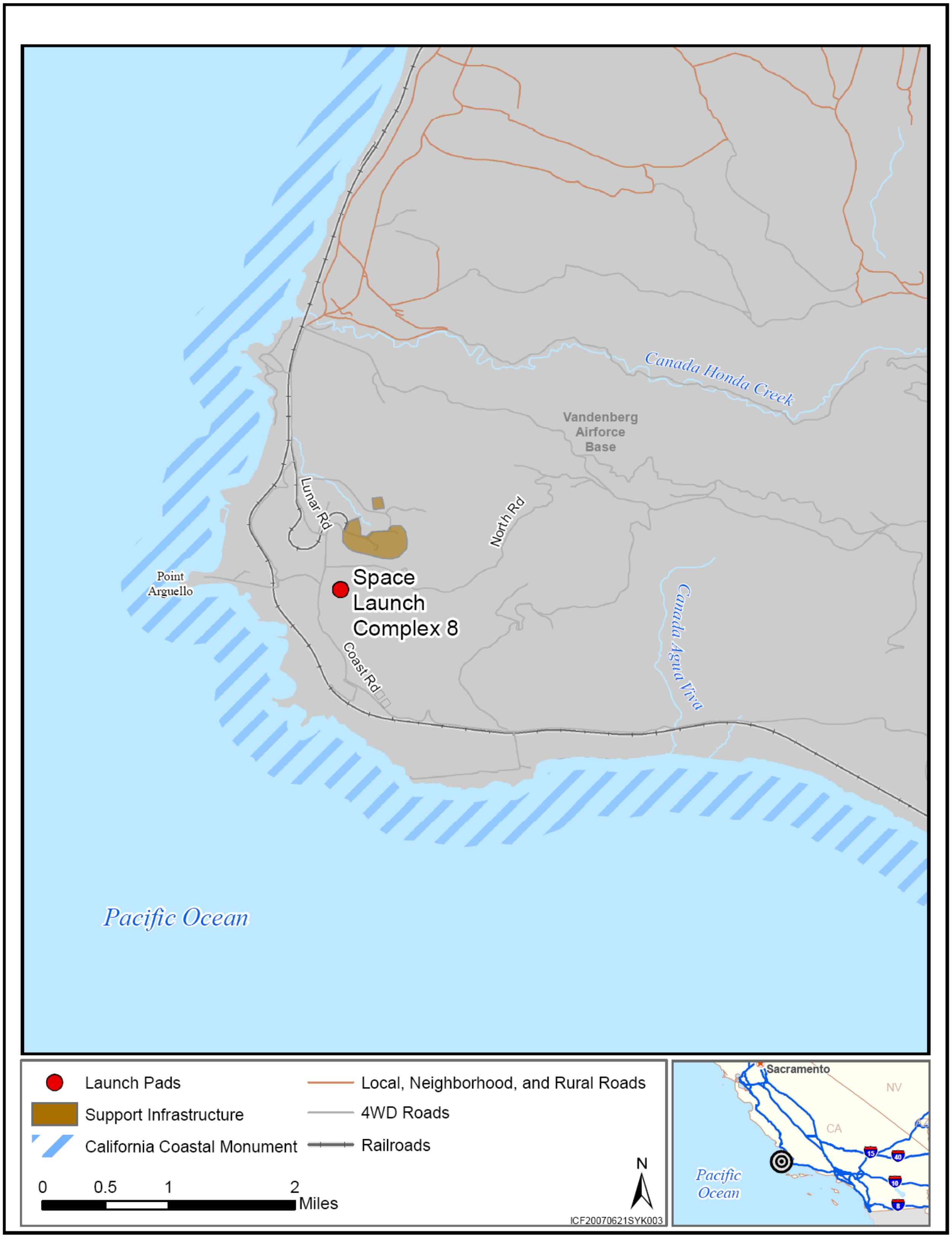


Exhibit 3-7. Attainment Status for NAAQS and CAAQS at Vandenberg Air Force Base

Pollutant	California Standard	Federal Standard
Ozone, 1 hour	Attainment	Attainment
Ozone, 8 hour	Nonattainment	Attainment
PM_{10}	Nonattainment	Attainment
$PM_{2.5}$	Unclassified	Unclassified
Carbon monoxide	Attainment	Attainment
Nitrogen dioxide	Attainment	Attainment
Sulfur dioxide	Attainment	Attainment
Lead particulates	Attainment	Attainment
Sulfates	Attainment	NA
Hydrogen sulfide	Attainment	NA
Visibility-reducing particles	Attainment	NA

Source: SBCPCD, 2007; EPA, 2008a.

3.2.2 Biological Resources (Fish, Wildlife, and Plants)

Vegetation in the vicinity of the California Spaceport is primarily central coastal scrub, coastal sage scrub, coastal dune scrub, grassland, and chaparral community types (USAF, 1995). Grass species are prominent, and huckleberry and salal are dominant on the slopes to the southeast of the Spaceport (USAF, 1995). Animal species in the area of the California Spaceport include mule deer, badger, coyote, desert cottontail rabbit, turkey vulture, and numerous birds (USAF, 1995). Exhibit 3-8 lists the state and federally protected species possibly present at South Vandenberg near the California Spaceport.

Exhibit 3-8. State and Federally Protected Species Possibly Present at South Vandenberg near the California Spaceport (page 1 of 3)

Common Name	Scientific Name	Federal Status	California Status
Plants			
Gaviota tarplant	*Hemizonia increscens* ssp. *villosa*	E	E
Beach layia	*Layia carnosa*	E	E
Seaside bird's-beak	*Cordylanthus rigidus* ssp. *littoralis*	-	E
Surf thistle	*Cirsium rhothophilum*	-	T
Beach spectacle pod	*Dithyrea maritima*	-	T
Gambel’s watercress	*Rorippa gambell*	E	T
Lompoc yerba santa	*Eriodictyon capitatum*	E	-
La Graciosa thistle	*Cirsium loncholepis*	C	T
Black flowered figwort	*Scrophularia atrata*	SC	-
Aphanisma	*Aphanisma blitoides*	SC	-
Shagbark manzanita	*Arctostaphylos rudis*	SC	-
Straight-awned spineflower	*Chorizanthe rectispina*	SC	-
Dune larkspur	*Dephinium parryi ssp blochmaniae*	SC	-
Blochman’s dudleya	*Dudleya blochmaniae ssp blochmaniae*	SC	-
Kellog’s horkelia	*Horkelia cuneata ssp sericea*	SC	-

Exhibit 3-8. State and Federally Protected Species Possibly Present at South Vandenberg near the California Spaceport (page 2 of 3)

Common Name	Scientific Name	Federal Status	California Status
Crisp monardella	*Monardella crispa*	SC	-
San Luis Obispo monardella	*Monardella frutescens*	SC	-
Fish			
Vernal pool fairy shrimp	*Branchinecta lynchi*	T	-
Tidewater goby	*Eucyclogobius newberryi*	- [a]	SC
Unarmored threespine stickleback	*Gasterosteus aculeatus williamsoni*	E	E
Steelhead trout	*Oncorhynchus mykiss*	E	SC
Arroyo Chub	*Gila orcutti*	S	SC
Reptiles and Amphibians			
California tiger salamander	*Ambystoma californiense*	E	E[b]
California red-legged frog	*Rana aurora draytonii*	T	SC
Green sea turtle	*Chelonia mydas*	T	-
Loggerhead sea turtle	*Chelonia caretta*	T	-
Pacific Ridley sea turtle	*Lepidochelys olivacea*	T	-
Leatherback sea turtle	*Dermochelys coriacea*	E	-
Western spadefoot toad	*Spea hammodnii*	SC	SC
Southwestern pond turtle	*Clemmys marmorata pallida*	SC	SC
Silvery legless lizard	*Anniella pulchra pulchra*	SC	SC
California horned lizard	*Phrynosoma coronatum frontale*	SC	SC
Two-striped garter snake	*Thamnophis hammondii*	SC	SC
Birds			
California brown pelican	*Pelacanus occidentalis californicus*	FPD	SCD
California least tern	*Sterna antillarum browni*	E	E
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	E
Western snowy plover	*Charadrius alexandrinus nivosus*	T	SC
American peregrine falcon	*Falco peregrinus anatum*	-	SCD
Little willow flycatcher	*Empidonax trailii brewsteri*	-	E
Belding's savannah sparrow	*Passerculus sandwicensis beldingi*	-	E
Bald eagle	*Haliaeetus leucocephalus*	T	E
California black rail	*Laterallus jamaicensis coturniculus*	-	T
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	-	E
Least Bell’s vireo	*Vireo bellii pusillus*	E	E
Mountain plover	*Charadrius montanus*	PT	SC
American bittern	*Botaurus lentiginosus*	MC	-
Western least bittern	*Ixobrychus exilis hesperis*	MC	SC
Ferruginous hawk	*Buteo regalis*	MC	SC
White-tailed kite	*Elanus leucurus*	MC	-
Elegant tern	*Sterna elegans*	MC	SC
Short-eared owl	*Asio flammeus*	MC	SC
Burrowing owl	*Athene cunicularia hypugea*	MC	SC

Exhibit 3-8. State and Federally Protected Species Possibly Present at South Vandenberg near the California Spaceport (page 3 of 3)

Common Name	Scientific Name	Federal Status	California Status
Black swift	*Cypseloides niger*	MC	SC
Olive-sided flycatcher	*Contopurs borealis*	MC	SC
Loggerhead shrike	*Lanius ludovicianus*	MC	SC
Tri-colored blackbird	*Agelaius tricolor*	MC	SC
Grasshopper sparrow	*Ammodramus savannarum*	MC	-
Bell's sage sparrow	*Amphispiza belli belli*	MC	SC
Lawrence's goldfish	*Carduelis lawrencei*	MC	-
Golden eagle	*Aquila chrysaetos*	P	SC
Mammals			
Southern sea otter	*Enhydra lutris nereis*	T	FP
Guadalupe fur seal	*Arctocephalus townsendi*	T	T
Steller sea lion	*Eumetopias jubatus*	T	-
Sei whale	*Balaenoptera borealis*	E	-
Blue whale	*Balaenoptera musculus*	E	-
Finback whale	*Balaenoptera physalus*	E	-
Humpback whale	*Megaptera novaeangliae*	E	-
Right whale	*Balaena glacialis*	E	-
Sperm whale	*Physeter catodon*	E	-
Pacific harbor seal	*Phoca vitulina richardii*	MMPA	-
Townsend's western big-eared bat	*Plecotus townsendii townsendii*	SC	SC
Pallid bat	*Antrozous pallidus*	S	SC
Yuma myotis	*Myotis yumanenesis*	SC	SC
Fringed myotis	*Myotis thysandodes*	SC	SC
Long-eared myotis	*Myotis evotis*	SC	-
Small-footed myotis	*Myotis ciliolabrum*	SC	SC
Western mastiff bat	*Eumops perotis*	SC	SC
Insects			
White sand bear scarab beetle	*Lichnanthe albipilosa*	SC	-
Morro Bay blue butterfly	*Icaricia icarioides moroensis*	SC	-
El Segundo blue butterfly	*Euphilotes battoides allyni*	E	-

Source: USAF, 2006; NASA, 2002b.

FP = Fully Protected; SC = Species of Concern; E = Endangered; T =Threatened; PT = Proposed Threatened; C = Candidate; MC = Management Concern; P = Protected; S = Sensitive; FPD = Federally Proposed for Delisting; SCD = State Candidate for Delisting; MMPA = Federally protected under the Marine Mammal Protection Act

[a] The tidewater goby was delisted for areas north of Orange County California, which includes the area containing the California Spaceport.

[b] The California tiger salamander is classified as an endangered species by California in Santa Barbara County.

3.2.3 Historical, Architectural, Archaeological, and Cultural Resources

Numerous surveys at Vandenberg Air Force Base have identified more than 2,200 prehistoric and historic cultural sites, many of which are in the vicinity of the launch site and have been recommended for inclusion on the *National Register of Historic Places* (USAF, 2006). The facilities directly associated with SLC-8, including the launch complex itself, the Integrated Processing Facility, and the Commercial Launch Facility, are not listed on the National Register (DOI, 2008).

The only American Indian tribe affiliated with the area encompassed by Vandenberg Air Force Base is the Chumash Indian Tribe. In 1901, the tribe was moved to the Santa Ynez Reservation approximately 20 miles east of the Air Force Base. There is one important Chumash settlement in the vicinity of South Vandenberg, the village of Nocto, approximately 2 miles south of the California Spaceport. Nocto consisted of 10 houses and is believed to have supported between 60 and 70 residents. In addition, site SBA 2032 (north of the launch site) might be associated with the village of Nocto. Both Nocto and site SBA 2032 could contain traditional resources and be considered a traditional cultural property.

3.2.4 Floodplains

South Vandenberg Air Force Base is not in a floodplain (USAF, 1995). Therefore, no further consideration of floodplain management is required.

3.2.5 Hazardous Materials, Pollution Prevention, and Solid Waste

The California Spaceport adheres to the same standards as Vandenberg Air Force Base regarding hazardous materials, pollution prevention, and solid waste. Hazardous materials and waste management activities at Air Force installations are governed by specific environmental regulations, including CERCLA, RCRA, Air Force Instruction 32-7042 (*Solid and Hazardous Waste Compliance*) and AFI 32-7086 (*Hazardous Materials Management*). On Vandenberg Air Force Base, Air Force organizations are required to manage hazardous materials through the Base HazMart Pharmacy. The HazMart is the single point of control and accountability for requisitioning, receiving, distributing, issuing, and reissuing hazardous materials. Hazardous materials obtained from off-Base suppliers are also coordinated through the HazMart Pharmacy. These procedures are in accordance with the Vandenberg Air Force Base *Hazardous Materials Management Plan* (30 SW Plan 32-7086) (USAF, 2006).

The Vandenberg Air Force Base *Spill Prevention, Control and Countermeasures Plan* (30 SW 32-4002-C) and *Hazardous Materials Emergency Response Plan* (30 SW Plan 32-4002-A) cover the prevention, control, and handling of any spills of hazardous materials. These plans ensure that adequate and appropriate guidance, policies, and protocols regarding hazardous material spill prevention, spill incidents, and associated emergency response are available to all installation personnel (USAF, 2006).

For hazardous waste, the Vandenberg Air Force Base *Hazardous Waste Management Plan* (30 SW Plan 32-7043-A) describes the procedures for packaging, handling, transporting, and disposing of such wastes. If not reused or recycled, hazardous wastes are transported off the Base for appropriate treatment and disposal. Industrial wastewaters (including rain and wash water collected from launch pad catchments) are monitored and properly disposed of in accordance with the Base *Wastewater Management Plan* (30 SW Plan 32-7041-A). All hazardous wastes are managed in accordance with RCRA requirements and with California Hazardous Waste Control Laws. U.S. Department of Transportation regulations at 49 CFR 100 through 199 (USAF, 2006) govern the transportation of hazardous materials and waste outside the boundaries of the Base.

There have been releases and disposals of hazardous materials or waste on Vandenberg Air Force Base. Significant VOC concentrations and perchlorate have been identified in the groundwater at the Site 8 Cluster, which includes both SLC-4E and SLC-4W in South Vandenberg. In November 2003, an interim remedial action began operation at the site for plume containment (USAF, 2006).

Some of the older buildings could contain other hazardous materials, including asbestos, lead-based paint, and fluorescent lighting ballasts containing polychlorinated biphenyls (commonly called PCBs). These types of hazardous materials are also managed in accordance with applicable Federal, State of California, local, and Air Force requirements (USAF, 2006).

3.2.6 Health and Safety

The California Spaceport adheres to the same standards as Vandenberg Air Force Base regarding health and safety, and adheres to all FAA-required safety considerations in the Launch Site Operator License. Establishing and managing the overall safety program is the responsibility of the 30th Space Wing Safety Office, which ensures safety during launch operations on the Base (USAF, 2006).

Air Force Policy Directive 91-2 (*Safety Programs*) establishes the Air Force key safety policies. Additional safety and safety-related U.S. Department of Defense requirements, Air Force Instructions, and other requirements and procedures pertaining to the handling, maintenance, transportation, and storage of rocket motors, and related ordnance, are listed below:

- DoD 6055.9-STD (DoD Ammunition and Explosives Safety Standards);
- AFI 91-114 (Safety Rules for the Intercontinental Ballistic Missile Systems);
- AFI 91-202 (The US Air Force Mishap Prevention Program); and
- Air Force Manual 91-201 (*Explosives Safety Standards*).

Health and safety requirements at Vandenberg Air Force Base include industrial hygiene, which is the joint responsibility of Bio-Environmental Services and the 30th Space Wing Safety Office. These responsibilities include monitoring worker exposures to workplace chemicals and physical hazards, hearing and respiratory protection, medical monitoring of workers subject to chemical exposures, and oversight of all hazardous or potentially hazardous operations. Ground safety includes both occupational and public safety. Both Air Force Occupational Safety and Health and applicable OSHA regulations and standards are used to implement safety and health requirements for all workers on the Base, including military personnel and contractors (USAF, 2006).

Air Force Space Command Manual 91-710 (*Range Safety User Requirements*) establishes range safety policy and defines requirements and procedures for ballistic and space vehicle operations at Vandenberg Air Force Base (AFSPC, 2004). Over-ocean launches must comply with DoD Directive 4540.1 (*Use of Airspace by US Military and Firings Over the High Seas*) (USAF, 2006).

The 30th Space Wing Safety Office evaluates all launch operations before rocket launches to ensure that populated areas, critical range assets, and civilian property susceptible to damage are outside predicted impact/debris limits. This includes a review of flight trajectories and hazard area dimensions, and review and approval of destruct systems. Criteria used in determining launch debris hazard risks are in accordance with the Range Commanders Council Standard 321-02 supplement, *Common Risk Criteria for National Test Ranges: Inert Debris* (USAF, 2006).

Atmospheric dispersal modeling is also performed to ensure emission concentrations from each launch do not exceed certain levels outside controlled areas. In accordance with 30th Space Wing Instruction 91-106 (*Toxic Hazard Assessments*), if HCl launch emission cloud concentrations of 10 parts per million or higher are predicted to cross outside the Base land boundary, the launch is held until meteorological conditions improve.

Notices to Mariners and Notices to Airmen are published and circulated in accordance with Space Wing Instruction 91-104 (*Operations Hazard Notice*) to warn personnel (including recreational users of the range space and controlled sea areas) concerning any potential impact areas that should be avoided. Resources such as radar, ground roving security forces, and helicopter support are used prior to operations to ensure evacuation of non-critical personnel. Nearby access roads might be closed and nearby recreational areas might be evacuated. Jalama Beach County Park, near the southern tip of the Base, is closed on average once a year, while Ocean Beach County Park, between North and South Base, is closed on average three times a year under agreement with Santa Barbara County. Also under agreement with the County and the State of California, Point Sal State Beach, at the northern end of the Base, is closed on average twice a year (USAF, 2006).

In accordance with Space Wing Instruction 91-105 (*Evacuating or Sheltering of Personnel on Offshore Oil Rigs*), the Air Force notifies oil rig companies of an upcoming launch approximately 10 to 15 days in advance. The Air Force notification, provided through the Department of the Interior's Minerals Management Service, requests that operations on the oil rigs in the path of the launch vehicle overflight be temporarily suspended and that personnel be evacuated or sheltered.

Vandenberg Air Force Base possesses significant emergency response capabilities that include its own fire department, disaster control group, and security police force, in addition to contracted support for handling accidental releases of regulated hypergolic propellants and other hazardous substances.

The Vandenberg Air Force Base Fire Department approves and maintains the business plans and hazardous material inventories prescribed by the California Health and Safety Code, which are developed by organizations assigned to or doing business on the Base. Additionally, the Base Fire Department conducts onsite facility inspections, as required, to identify potentially hazardous conditions that could lead to an accidental release. During launch operations, fire department response elements are pre-positioned to expedite response in the event of a launch anomaly (USAF, 2006).

3.2.7 Land Use (including Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)

The California Spaceport covers 109 acres of land, while the entire Vandenberg Air Force Base encompasses more than 98,000 acres (USAF, 1995). The Base occupies approximately 6 percent of the total land area of Santa Barbara County. Sixty percent of the Base consists of open space and recreation area. An additional 30 percent is used for grazing and other forms of agriculture. The remaining 10 percent of the land is occupied by facilities and operations associated with Air Force activities (USAF, 1995).

South Vandenberg is almost entirely devoted to open space and grazing uses. Isolated areas of South Vandenberg are used for Air Force activities and support space launch complexes, mountain-top tracking stations, and facilities for administrative and industrial functions (USAF, 1995).

Vandenberg State Marine Reserve was established September 27, 2008, to provide protection to marine life. The reserve covers a 3-mile area around Point Arguello in South Vandenberg and serves to provide additional protections to marine mammals and other wildlife along the California coast.

There are no Section 4(f) resources, prime or unique farmlands, wild and scenic rivers, or coastal resources at the California Spaceport. The nearest coastal resources, which are within 1 mile, are managed according to all Federal, state, and local laws.

3.2.8 Light Emissions and Visual Resources

The California Spaceport is characterized as a low visual sensitivity area because the site is considered an industrialized area. Light sources at and surrounding the California Spaceport include security and street lighting on the grounds, parking lot lighting, and safety lighting on the launch pad. The runways and airfields on Vandenberg Air Force Base contain lights and contribute to the overall light emissions from the Base. Trains passing through the Base also contribute to light emissions.

3.2.9 Natural Resources and Energy Supply

Water on Vandenberg Air Force Base is supplied from the San Antonio Aquifer and the Lompoc Terrace Groundwater Basin. The main portion of the water supply delivered to North Vandenberg Air Force Base comes from the western portion of the San Antonio Aquifer. In 2007, Vandenberg Air Force Base consumed 1.2 billion gallons of water, both purchased and produced on site (USAF, 2007a).

Vandenberg Air Force Base has three main sources of energy: electricity, natural gas, and propane. From both a cost and energy content standpoint, electrical energy comprises most (62 percent) of all energy consumed on Vandenberg. The installation's energy consumption for 2003 was 5.5 million British thermal units of electricity, 3 million British thermal units of natural gas, and 3.4 million British thermal units of propane (USAF, 2007a).

3.2.10 Noise and Compatible Land Use

Noise at the California Spaceport is typically produced by activities at Vandenberg Air Force Base, such as automobile and truck traffic, aircraft operations (approximately 32,000 a year, including landings, takeoffs, and training approaches and departures for both fixed-wing and rotary-wing aircraft), and trains passing through the Base (an average of 10 trains a day). Existing noise levels on the Base are generally low, with higher levels occurring near industrial facilities and transportation corridors (USAF, 2006).

The immediate area surrounding Vandenberg Air Force Base is largely composed of undeveloped and rural land, with some unincorporated residential areas in Lompoc and Santa Maria Valley, and Northern Santa Barbara County. The Cities of Lompoc and Santa Maria, which are the two main urban areas in the region, support a small number of industrial areas and small airports. Sound levels measured for the area are typically low, except for higher levels in the industrial areas and along transportation corridors. The rural areas of Lompoc and Santa Maria Valleys typically have low overall community noise equivalent levels, approximately 40 to 45 dBA. Occasional aircraft flyovers can increase noise levels for a short time (USAF, 2006).

3.2.11 Socioeconomic Resources, Environmental Justice, and Children's Environmental Health and Safety

3.2.11.1 Population

According to the U.S. Census Bureau (2008a), Santa Barbara County had an estimated population of 400,335 in 2006. Lompoc, with an estimated population of 39,883 in 2006, is the nearest populated area to South Vandenberg. Farther to the north, Santa Maria, with an estimated population of 84,712 in 2006, is second in size only to Santa Barbara, with an estimated population of 85,681 in 2006.

3.2.11.2 Employment and Income

The largest employers in the area of Santa Barbara County surrounding Vandenberg Air Force Base are services, retail trade, government, and manufacturing. In 2007, the County's employment level was 187,462, and the unemployment rate in the Santa Barbara/Santa Maria area was 4.4 percent.

According to the 2000 Census, there were 6,151 people, 1,707 households, and 1,601 families residing at Vandenberg Air Force Base. The median income for a household on the base was $39,444, and the median income for a family was $40,000.

3.2.11.3 Environmental Justice

Based on the 2000 Census, Santa Barbara County had a population of 399,347. Of this total, 131,784, or 33 percent, were minority, and 49,918, or 12.5 percent, were low-income.

3.2.11.4 Children's Environmental Health and Safety

The California Spaceport is not in the vicinity of schools, daycare facilities, playgrounds, or other places where children are concentrated. Therefore, no further consideration of the protection of children from environmental health and safety risks is required.

3.2.12 Water Quality

3.2.12.1 Surface Water

The western Santa Ynez Mountains receive average annual precipitation of about 16 inches per year, with a runoff rate of 2 to 3 inches per year (USGS, 1985). South Vandenberg Air Force Base has no permanent lakes, impoundments, rivers, or floodplains. However, several local drainages discharge directly into the Pacific Ocean. The flow rates associated with these drainages can be highly variable. Many of them flow only during storm events. Intense episodes would be expected to give high intermittent yields due to the relatively steep topography of the area. Some of the drainages are spring fed, although ground percolation frequently traps the water flow before it reaches the ocean.

Cañada Honda Creek occupies a watershed of about 12 square miles, which is the largest drainage in South Vandenberg (Mahrdt *et al.*, 1976). Springs associated with the Cañada Honda Fault maintain a minimal flow of water for about one-half the creek's length. The two drainages immediately adjacent to SLC-6 flow only during rainy periods. Erosion control ditches have been constructed on the north side of SLC-6 to direct surface water runoff into the Red Roof Canyon. Oil Well Canyon is fed by two springs near its upper reaches, although surface flow at its mouth is intermittent. Cañada Agua Viva is also a perennial drainage that is fed by two springs near Wild Horse Peak. Yields from this drainage are expected to be less than 5 gallons per minute, or 60 acre-feet per year. The individual watershed areas for Oil Well Canyon and Cañada Agua Viva are each about 1 square mile.

Water quality data for Oil Well Canyon and Cañada Honda Creek indicate that these streams are high in hardness, alkalinity, and specific conductance, but low in acidity, chemical oxidation demand, and total organic carbon. These streams also have high levels of certain elements such as calcium, iron, magnesium, and sodium.

3.2.12.2 Groundwater

The underlying Monterey shale supports a minimal amount of groundwater in the fracture zones (USAF, 1995). The lower member of this formation contains more water than the upper member. Depths to the water table vary from 70 feet to 131 feet (USAF, 1995).

Vandenberg Air Force Base has an extensive Installation Restoration Program designed to identify and remediate soil and groundwater contamination at sites on the base resulting from more than 50 years of operations. Groundwater sampling conducted under the Installation Restoration Program has identified contamination with perchlorate and solvents at a number of sites (VAFB, 2005).

3.2.13 Wetlands

The operating area of SLC-8 at the California Spaceport that would support the Proposed Action has been developed and contains no wetlands (USAF, 1995).

3.3 John F. Kennedy Space Center

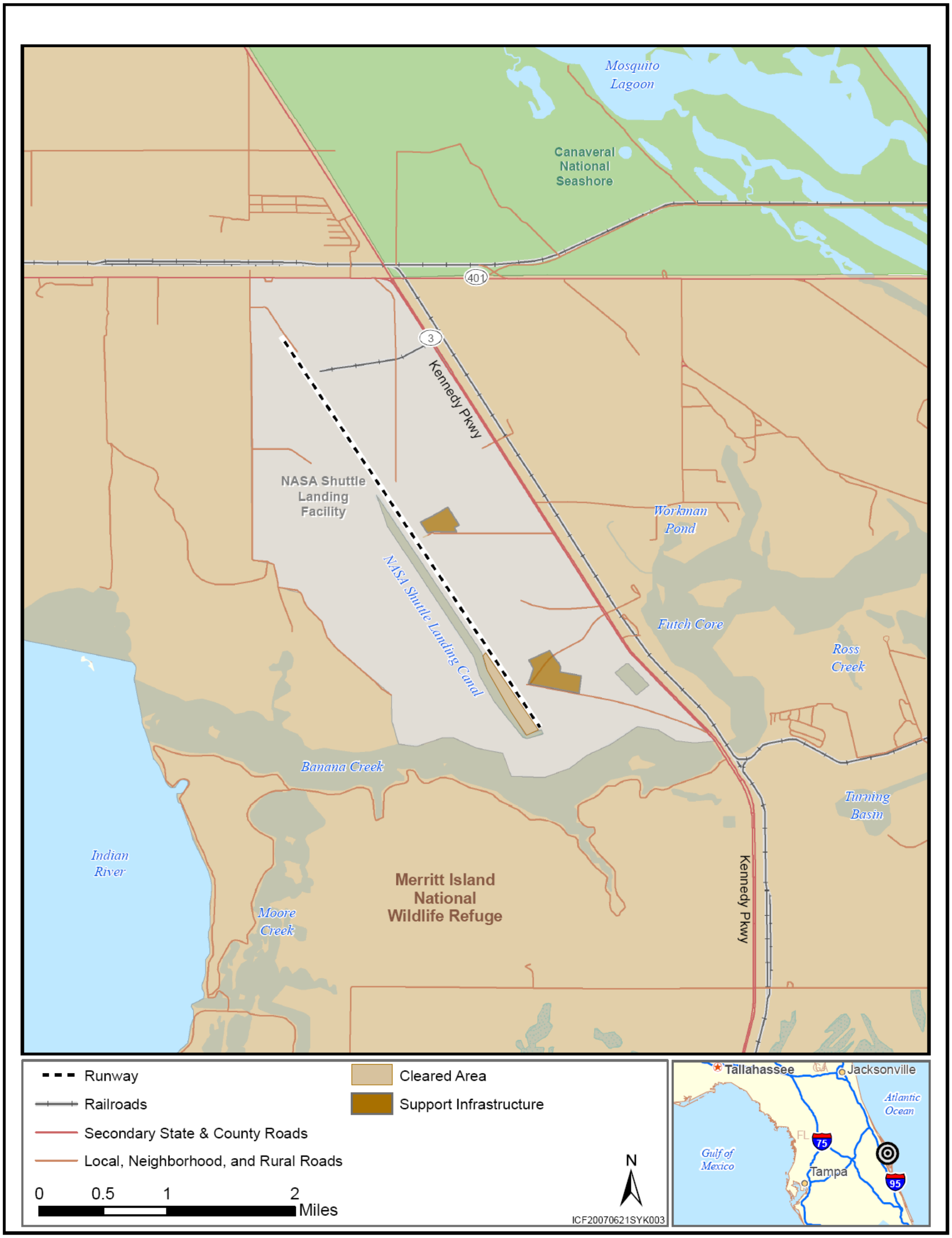
NASA's KSC is composed of 139,490 acres of land and open water resources in Brevard and Volusia Counties, Florida. KSC is on the north end of Merritt Island, which forms a barrier island complex adjacent to Cape Canaveral Air Force Station (CCAFS). The primary mission of KSC is to process and launch the Space Shuttle and future generations of crewed space vehicles and to process payloads for various expendable launch vehicles launched from CCAFS. Major launch infrastructure includes launch pads, the Vehicle Assembly Building, and the Shuttle Landing Facility.

All launches and reentries under an experimental permit would be expected to occur from the Shuttle Landing Facility, which consists of a runway 15,000 feet (about 2.8 miles) long and 300 feet wide (see Exhibit 3-9). The Landing Facility includes a parking apron, tow-way, the Orbiter Processing Facility, the Landing Aids Control Building, and four microwave scanning beam landing system ground stations equipped with navigation and landing aids. A tactical air navigation system, precision approach path indicators, and a recovery convoy staging area are located along the runway.

3.3.1 Air Quality

Ambient air quality at KSC is influenced by NASA operations, land-management practices, vehicle traffic, and emission sources outside KSC, including two regional power plants within a 10-mile radius. Space launches, wildfires, and controlled-burn operations influence air quality as episodic events. Brevard and Volusia Counties are considered to be in attainment or unclassifiable for all criteria pollutants regulated under the NAAQS and State of Florida standards (EPA, 2008a; FDEP, 2008). Ambient air quality is continuously monitored at one permanent air monitoring station at KSC. KSC is permitted as a major source of air emissions and operates under a Title V permit (NASA, 2004a; FAA, 2005).

Exhibit 3-9. John F. Kennedy Space Center and the Surrounding Area



3.3.2 Biological Resources (Fish, Wildlife, and Plants)

The KSC region has several terrestrial and aquatic conservation and special designation areas (*e.g.*, wildlife management areas and aquatic preserves). These areas serve as wildlife habitat and occupy approximately 1 million acres of the total land and water area in the surrounding region (NASA, 2008a).

Most of the land at and near KSC, including CCAFS, Merritt Island National Wildlife Refuge, Mosquito Lagoon, and the Canaveral National Seashore, is undeveloped and in a near-natural state. More than 50 percent of KSC is classified as wetlands. These areas host a variety of plant communities that support many resident and transient animal species. The aquatic environment surrounding KSC provides diverse fish habitat, which supports many shore-bird species, and sport, commercial, and recreational fishing. The Atlantic beaches at KSC, CCAFS, and the Canaveral National Seashore are important nesting areas for sea turtles. In addition, Mosquito Lagoon is considered among the best oyster- and clam-harvesting areas on the east coast (NASA, 2008a).

Exhibit 3-10 lists the state and federally protected species possibly present at KSC.

3.3.3 Historical, Architectural, Archaeological, and Cultural Resources

KSC contains over 100 known archaeological resources and many facilities listed or eligible for listing on the *National Register of Historic Places* (NASA, 2003a). The SLF and associated support facilities are not listed on the National Register, but the Shuttle Landing Facility area has preliminarily been classified as a Historic District related to the Space Shuttle Program and is awaiting approval by the Florida State Historic Preservation Office (DOI, 2008; NASA, 2007a). The Shuttle Landing Facility Area Historic District, as proposed, includes three properties: the runway, the Landing Aids Control Building, and the Mate-Demate Device. The boundary of the historic district is comprised of the footprints of the three properties (NASA, 2007b). Remains of Ais Indians might be present in the Cape Canaveral and Banana River Areas (USAF, 1998).

3.3.4 Floodplains

Most of KSC is within the 100-year floodplain, and the areas adjacent to LC-39 Pads A and B and the Industrial Area are within the 500-year floodplain (NASA,2008b).

3.3.5 Hazardous Materials, Pollution Prevention, and Solid Waste

Launch processing, construction, and associated activities at KSC generate hazardous and controlled wastes. NASA has developed a program (KHB 8800.7) for managing and handling these wastes in compliance with the provisions of RCRA and the implementing regulations adopted by the State of Florida (62-730, F.A.C.). KSC has a Florida Department of Environmental Protection operating permit for the storage, treatment, and disposal of hazardous waste, primarily at the Hazardous Waste Storage Facility (K7-165) in the Launch Complex-39 Area. KSC also has three tanks storing isopropyl alcohol, four underground storage tanks that store kerosene, gasoline, and diesel, and 25 above-ground storage tanks that store primarily diesel but also JP8, RP-1, and used oil. These tanks are managed in accordance with the KSC Storage Tank Systems Management Program (NASA, 2003a).

Exhibit 3-10. State and Federally Protected Species Possibly Present at KSC (page 1 of 3)

Common Name	Scientific Name	Federal Status	State Status
Plants[a]			
Curtiss milkweed	*Asclepias curtissii*	NL	E
Curtiss reedgrass	*Calamovilfa curtissii*	NL	T
Many-flowered grass pink	*Calopogon multiflorus*	NL	E
Sand dune spurge	*Chamaesyce cumulicola*	NL	E
Satinleaf	*Chrysophyllum oliviforme*	NL	T
Butterfly orchid	*Encyclia tampensis*	NL	C
Greenfly orchid	*Epidendrum canopseum*	NL	C
Threadroot orchid	*Harrisella filiformis*	NL	T
Crested coralroot	*Hexalectris spicata*	NL	E
East coast lantana	*Lantana depressa* var. *floridana*	NL	E
Nodding pinweed	*Lechea cernua*	NL	T
Pine pinweed	*Lechea divaricata*	NL	E
Catesby lily	*Lilium catesbaei*	NL	T
Nakedwood	*Myrcianthes fragrans*	NL	T
Hand fern	*Ophioglossum palmatum (= Cheiroglossa palmate)*	NL	E
Shell mound prickly-pear	*Opuntia stricta*	NL	T
Cinnamon fern	*Osmunda cinnamomea*	NL	C
Royal fern	*Osmunda regalis* var. *spectabiliz*	NL	C
Plume polypody	*Peclumula plumula (= Polypodium plumula)*	NL	E
Peperomia	*Peperomia humilis*	NL	E
Florida peperomia	*Peperomia obtusifolia*	NL	E
Scrub bay	*Persea borbonia* var. *humilis*	NL	T
Rose pogonia	*Pogonia ophioglossoides*	NL	T
False coco	*Pteroglossaspis ecristata (=Eulophia ecristata)*	NL	T
Beach-star	*Remirea maritime (= Cyperus pedunculatus)*	NL	E
Scaevola	*Scaevola plumieri*	NL	T
Lace-lip ladies'-tresses	*Spiranthes laciniata*	NL	T
Narrow-leaved hoary pea; coastal hoary pea	*Tephrosia angustissima* var. *curtissii*	NL	E
Giant wild pine; giant air plant	*Tillandsia utriculata*	NL	E
Sea lavender	*Tournefortia gnaphalodes (= Argusia gnaphalodes)*	NL	E
Coastal vervain	*Verbena maritime (= Glandularia maritima)*	NL	E
Tampa vervain	*Verbena tampensis (= Glandularia tampensis)*	NL	E
East coast coontie	*Zamia umbrosa (= Zamia pumila)*	NL	C

Exhibit 3-10. State and Federally Protected Species Possibly Present at KSC (page 2 of 3)

Common Name	Scientific Name	Federal Status	State Status
Amphibians and Reptiles			
American alligator	*Alligator mississippiensis*	T(S/A)	SSC
Loggerhead turtle	*Caretta caretta*	T	T
Atlantic green sea turtle	*Chelonia mydas*	E	E
Leatherback sea turtle	*Dermochelys coriacea*	E	E
Kemp's ridley sea turtle	*Lepidochelys kempi*	E	E
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E
Eastern indigo snake	*Drymarchon corais couperi*	T	T
Gopher tortoise	*Gopherus polyphemus*	T	T
Atlantic salt marsh snake	*Nerodia fasciata taeniata*	T	T
Florida gopher frog	*Rana capito aesopus*	NL	SSC
Florida pine snake	*Pituophis melanoleucus mugitus*	NL	SSC
Birds			
Roseate spoonbill	*Ajaia ajaja*	NL	SSC
Florida scrub jay	*Aphelocoma coerulescens*	T	T
Piping plover	*Charadrius melodus*	T	T
Little blue heron	*Egretta caerulea*	NL	SSC
Reddish egret	*Egretta rufescens*	NL	SSC
Snowy egret	*Egretta thula*	NL	SSC
Tricolored heron	*Egretta tricolor*	NL	SSC
White ibis	*Eudocimus albus*	NL	SSC
Arctic peregrine falcon	*Falco peregrinus tundrius*	NL	E
Birds (continued)			
Southeastern American kestrel	*Falco sparverius paulus*	NL	T
Bald eagle	*Haliaeetus leucocephalus*	NL	-[b]
Wood stork	*Mycteria americana*	E	E
Eastern brown pelican[c]	*Pelecanus occidentalis carolinensis*	NL	SSC
Least tern	*Sterna antillarum*	NL	T
Black skimmer	*Rynchops niger*	NL	SSC
Snail kite	*Rosthrhramus sociabilis*	E	E
Audubon's crested caracara	*Polyborus plancus audubonii*	T	T
Roseate tern	*Sterna dougallii*	T	T
Mammals			
Southeastern beach mouse	*Peromyscus polionotus niveiventris*	T	T

Exhibit 3-10. State and Federally Protected Species Possibly Present at KSC (page 3 of 3)

Common Name	Scientific Name	Federal Status	State Status
Florida mouse	*Podomys floridanus*	NL	SSC
West Indian manatee	*Trichechus manatus*	E	E

Sources: NASA, 2004a; FNAI, 2007.
[a] No federally protected plant species are known to be present at KSC.
[b] The bald eagle is federally protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq*.).
[c] The Brown Pelican is a federally listed endangered species, except in Florida and Alabama, where it was delisted due to recovery (50 *FR* 4938 through 4945, February 4, 1985).
E = Endangered; T = Threatened; SSC = Species of Special Concern; NL = Not Listed; C = Candidate

The KSC Pollution Prevention Program addresses source reduction, waste minimization, recycling, and reuse. The components of this program include:

- Pollution Prevention Opportunities;
- Pollution Prevention Activities;
- Pollution Prevention Partnering;
- Emergency Planning and Community Right-to-Know Material Safety Data Sheet;
- EPCRA Toxic Releases Inventory;
- EPCRA Tier II Data;
- Affirmative Procurement Program;
- Recycling Program;
- Alternative Fueled Vehicles;
- Ozone Depleting Substances;
- Environmental Justice Plan; and
- Stormwater Pollution Prevention Plan (NASA, 2003a).

There are two landfills at KSC – the Schwartz Road Class III landfill, which was closed in 1996, and the KSC/Schwartz Road Class III landfill. The KSC/Schwartz landfill accepts construction, demolition and maintenance debris, sandblast media, unserviceable furniture, wood and plastic products, and yard waste and is expected to handle solid waste disposal needs for an estimated 13 to 49 years.

3.3.6 Health and Safety

The Occupational Health Facility at KSC provides emergency medical services for KSC and CCAFS personnel. Nearby public hospitals outside KSC provide additional health care services. Three onsite fire stations provide fire protection. The joint base operations support contractor at KSC and CCAFS provides police protection. In addition, there is a mutual-aid agreement between KSC, the City of Cape Canaveral, Brevard County, and the range contractor at CCAFS for reciprocal support in the event of an emergency or disaster. CCAFS and the Brevard County Office of Emergency Management have agreements for communications and early warning in the event of a launch accident (NASA, 2008a).

KSC is divided into three graduated levels of security, or zones. The public security zone includes areas accessible to the public and is monitored and maintained so access can be controlled during times of emergency or times when program operations require more restricted access. The administrative security zone is separated from public zones by a secure perimeter with access controlled via access gates or card-control entrances. Operational safety zones include areas dedicated to launch, launch support, space-related operations, and all other areas at KSC. Operational zones are separated from public and administrative zones by a secure perimeter with access control and security monitoring along the entire perimeter. KSC is zoned this way to protect personnel and facilities from launch hazards (NASA, 2003a).

During launch periods, Launch Range Safety at CCAFS monitors launch surveillance areas to ensure that risks to people, aircraft, and surface vessels are within acceptable limits. Control areas and airspace are closed to the public as required and Notices to Mariners and Notices to Airmen are issued prior to launch. In addition, warning signs are posted in various Port Canaveral areas for vessels leaving port. Patrick Air Force Base also maintains an Internet website and toll-free telephone number with information about launch hazard areas for mariners and information about restricted airspace for pilots (NASA, 2008a).

3.3.7 Land Use (including Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)

KSC occupies 139,490 acres, of which approximately 95 percent is undisturbed, including uplands, wetlands, mosquito-control impoundments, and areas of open water. Almost 40 percent of KSC consists of areas of open water, including portions of the Indian River, Banana River, Mosquito Lagoon, and all of Banana Creek. The area not used for operations is delegated to the U.S. Fish and Wildlife Service and National Park Service to manage the Merritt Island National Wildlife Refuge and the Canaveral National Seashore, which are the nearest properties that could be considered Section 4(f) resources (NASA, 2003a, 2004).

Brevard County and the City of Cape Canaveral are the local planning authorities for incorporated and unincorporated areas near KSC. The City of Cape Canaveral Comprehensive Plan designates residential, commercial, industrial, public facilities and recreation, and open-space land-use areas, with continued commercial and industrial uses planned for Port Canaveral. CCAFS, which is south and east of KSC, includes predominantly industrial uses associated with Air Force programs. All zoning and land-use planning at KSC is under NASA directive for implementation of the Nation's Space Program (USAF, 1998; NASA, 2003a).

There are no prime or unique farmlands on KSC.

There are no wild and scenic rivers at KSC; however, the Indian River Lagoon system is partially contained within KSC and is designated as an Estuary of National Significance, containing Outstanding Florida Waters (all surface waters within the Merritt Island National Wildlife Refuge), and an Aquatic Preserve (NASA, 2004a, 2003; USAF, 1998).

In Brevard County, the Florida Coastal Management Program, formed by the Florida Coastal Management Act, applies to activities occurring in or affecting the coastal zone. The entire state is defined as being within the coastal zone. In Brevard County, the no-development zone extends from the mean high water level inland 50 feet (Chapter 62B-33 F.A.C.).

3.3.8 Light Emissions and Visual Resources

The KSC operational area is within a developed area; therefore, visual sensitivity is categorized as low. CCAFS has implemented a Light Management Plan to reduce the impact of artificial lighting on the KSC beach and reduce disorientation of marine turtle hatchlings. The Light Management Plan states that photocells should only be used to support security or other mission-specific requirements that regularly occur each night. The Plan suggests timers or motion detectors to minimize the impacts of evening lighting. Additionally, a temporary Light Management Plan is in place for LC-39 at KSC (NASA, 2003a, 2007a).

3.3.9 Natural Resources and Energy Supply

KSC obtains its potable water under contract from the City of Cocoa, which draws its supplies from the Floridian Aquifer. KSC uses approximately 1.3 million gallons of water per day (NASA,2008b).

KSC purchases energy utility services as a retail customer. Its incoming facility energy mix is more than 71 percent electricity and more than 28 percent natural gas; the remainder is fuel oil and propane. In Fiscal Year 2005, KSC used 257,808 megawatt hours of electricity, 346,476 dekatherms of natural gas, and 56,280 gallons of fuel oil (NASA, 2008a).

3.3.10 Noise and Compatible Land Use

Noise in the vicinity of the Shuttle Landing Facility can be attributed to six general sources: (1) Space Shuttle reentry sonic booms, (2) launches, (3) aircraft movements, (4) industrial operations, (5) construction, and (6) traffic. Sonic booms associated with Space Shuttle reentry at KSC are not expected after 2010. The 24-hour average ambient noise level on KSC is appreciably lower than 65 dBA. The areas of KSC and the Merritt Island National Wildlife Refuge away from operational areas are exposed to relatively low ambient noise levels in the range of 35 to 40 dBA.

3.3.11 Socioeconomic Resources, Environmental Justice, and Children's Environmental Health and Safety

3.3.11.1 Population

According to the U.S. Census Bureau (2008b), Brevard County had an estimated population of 534,359 in 2006. Most of Brevard County's population resides along the Indian River and the Atlantic Ocean. In 2000, the most populous incorporated areas were Palm Bay (79,413), Melbourne (71,382), Titusville (40,670), Rockledge (20,170), Cocoa (16,412), and Cocoa Beach (12,482). The unincorporated area of Merritt Island had a population of 36,090 in 2000.

3.3.11.2 Employment and Income

In Brevard County, Florida, the available work force (persons over the age of 16) numbers approximately 256,701. More than 39,000 are employed in the educational services and health care and social assistance fields, followed by the professional, scientific, management and administrative, and waste management service industry (34,146), and retail trade (33,985). The unemployment rate in 2007 was 4.4 percent (Enterprise Florida, 2008).

The adjusted median household income for 2006 in Brevard County was $46,335, which is slightly less than the U.S. average of $48,451. The median family income is $31,243 per year.

According to the 2000 Census, the median household income for residents of Titusville was $35,607.

3.3.11.3 Environmental Justice

Between 1990 and 2000, the minority population within 60 miles of KSC nearly doubled, and by 2000, minority persons comprised nearly 30 percent of the residents in the area. "Hispanic or Latino" and "Black or African American" groups comprised approximately 86 percent of the potentially affected minority population in 2000. Blacks or African Americans are the most numerous resident minorities in the large area east of the City of Orlando. Due to the relatively large concentration of Hispanics or

Latinos in Orlando, Hispanics or Latinos comprise the largest group of minority residents in the area (NASA, 2002a).

About 10 percent of the population of Brevard County reported incomes that were below the poverty threshold, with about 15 percent of persons below the age of 18 living below the poverty level. Three communities (City of Cocoa, City of Oak Hill, and Mims) have low-income populations above the State of Florida average. The City of Cocoa reported nearly one-quarter of its residents below the poverty level, more than twice the state average. The portion of the population living below poverty level in the three communities did not change appreciably between 1989 and 1999 (NASA, 2004a).

3.3.11.4 Children's Environmental Health and Safety

The Shuttle Landing Facility is not near schools, daycare facilities, playgrounds, or other places where children are concentrated (NASA, 2004a). Therefore, no further consideration of the protection of children from environmental health and safety risks is required.

3.3.12 Water Quality

3.3.12.1 Surface Water

Surface waters at KSC are considered fresh waters, with the primary sources being rainfall or groundwater. Storm water runoff might also contribute to the ditches in the area. Waters associated with perched water table wetland systems will typically have low pH (less than 6 units) as a result of acid soils, acid rainfall, organic acids from plant material decomposition, and dissolved CO_2 associated with plant respiration and the decomposition of plant materials. Dissolved oxygen values are typically below 5 milligrams per liter, but high primary production during periods of rapid plant growth can sometimes lead to saturation of dissolved oxygen levels. Total dissolved solids in perched water table systems at KSC typically range from 150 and 500 milligrams per liter (Bionetics, 1987). Wetlands often serve to increase water quality of adjacent surface water bodies. Wetland soils are effective at removing nitrate nitrogen, phosphorus, and pollutants from surface runoff. The vegetative growth of wetlands slows the flow of surface water, resulting in the deposition of coarse sediments. In low flow or standing water areas, finer particles of sediment would also be filtered out.

Several waterbodies near KSC have been designated as Outstanding Florida Water in Chapter 62-3 of the Florida Administrative Code, including most of Mosquito Lagoon and the Banana River, Indian River Aquatic Preserve, Banana River State Aquatic Preserve, Pelican Island National Wildlife Refuge, and Canaveral National Seashore (USAF, 1998).

The Indian River Lagoon system has been determined to be an estuary of national significance and has been designated a National Estuary Program (EPA, 2007d). EPA established the National Estuary Program to improve the quality of estuaries of national importance by maintaining and restoring the water quality and biological resources of each estuarine system (EPA, 2007a). All of Mosquito Lagoon is designated by the State of Florida as Class II water for shellfish harvesting (USAF, 1994). The Banana River has been designated a Class III surface water as defined in the Clean Water Act. Class III standards are intended to maintain a level of water quality suitable for recreation and the production of fish and wildlife communities (USAF, 1998).

3.3.12.2 Groundwater

KSC is underlain by three aquifers, including the surficial aquifer, the secondary semi-confined aquifer, and the Floridian Aquifer (NASA,2008b). The surficial aquifer is largely recharged by rainfall percolation and surface runoff and is used by the areas near KSC for nonpotable uses. However, Mims and Titusville, located approximately 10 miles northwest of KSC, and Palm Bay, located approximately 40 miles south of KSC, use this aquifer for public water supply. Surface recharge of the secondary, semi-confined aquifer is minor and depends on leakage through surrounding lower-permeability soils. The Floridian aquifer is the primary source of potable water in central Florida (NASA, 2003a; USAF 1998).

In the immediate vicinity of KSC, groundwater from the Floridian Aquifer is highly mineralized (NASA,2008b). Water quality in the secondary, semi-confined aquifer varies from moderately brackish to brackish. Groundwater quality in the surficial aquifer at KSC is generally good due to immediate recharge, active flushing, and a lack of development. Groundwater from the surficial aquifer meets Florida's criteria for potable water and national drinking water criteria for all parameters other than iron and total dissolved solids (USAF, 1998).

3.3.13 Wetlands

Most of the land at and near KSC, including CCAFS, Merritt Island National Wildlife Refuge, Mosquito Lagoon, and the Cape Canaveral National Seashore, is undeveloped and in a near-natural state. More than 50 percent of KSC is classified as wetlands (NASA, 2008a). The USFWS National Wetlands Inventory conducted in 1994 identified a total of 2,235 acres of wetlands on CCAFS (USAF, 2006). These areas host a variety of plant communities that support many resident and transient animal species.

3.4 Kodiak Launch Complex

KLC is an FAA-licensed commercial launch site occupying 3,717 acres at Narrow Cape on Kodiak Island, Alaska. The State of Alaska owns KLC, and Alaska Aerospace Corporation, a public company created by the Alaska state legislature, operates the Complex. KLC provides processing, integration, and checkout services for orbital and sub-orbital rocket launches. Launch infrastructure consists of a launch control center, payload processing facility, integration and processing facility, orbital and suborbital launch pads, and maintenance and storage facilities.

Launches under an experimental permit would be expected to occur from one of the two launch pads (LPs) available at KLC – LP-1 or LP-2 (see Exhibit 3-11). LP-1 is serviced by the Launch Service Structure and LP-2 is serviced by the Spacecraft and Assemblies Transfer Facility. The Launch Service Structure and Spacecraft and Assemblies Transfer Facility allow for the transfer of payloads to the launch site without exposure to the outside environment and allow for all-weather launch operations.

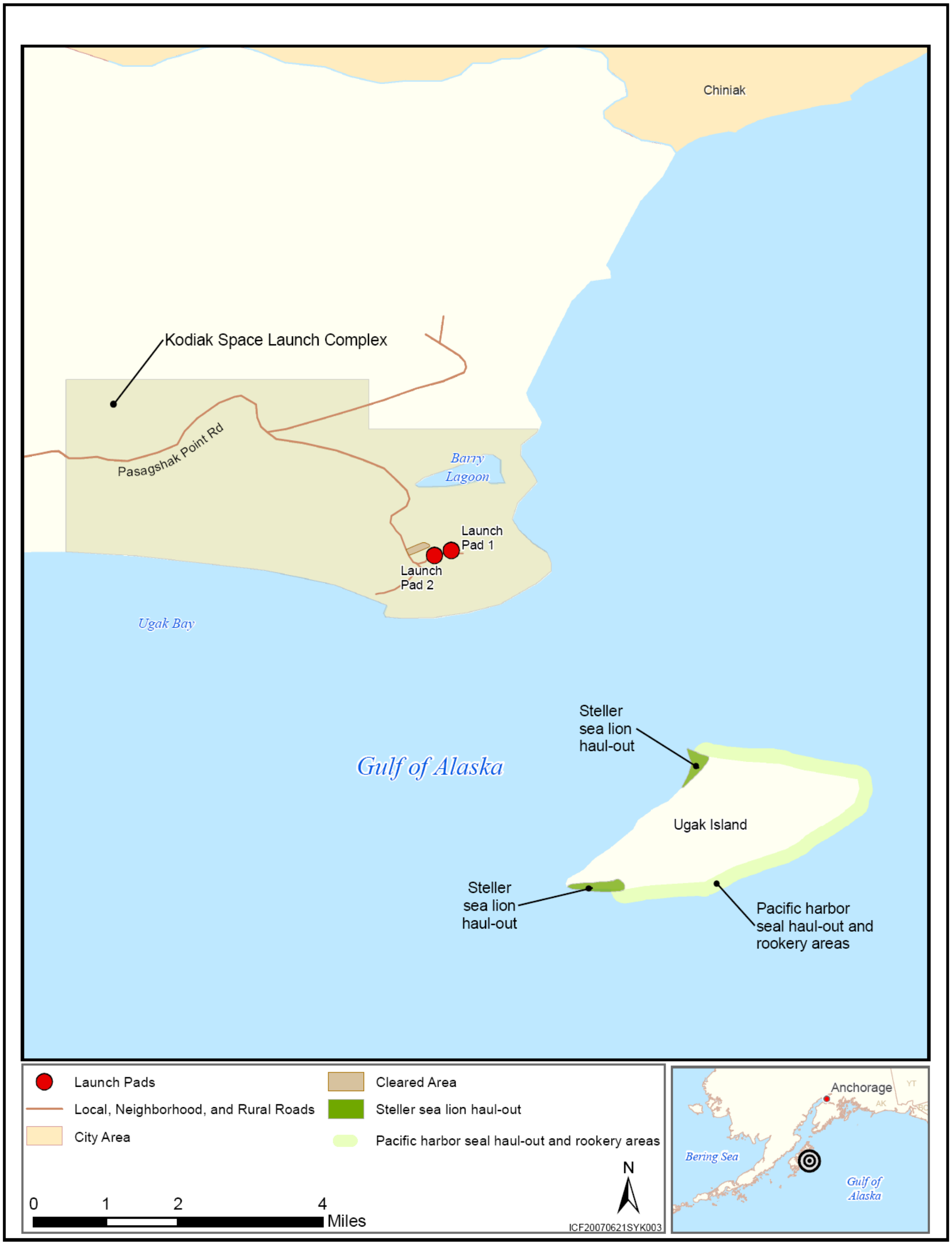
3.4.1 Air Quality

Air quality at KLC is regulated by Alaska Department of Environmental Conservation Regulations [Title 18 of the Alaska Administrative Code, Chapter 50], and EPA Region 10. Exhibit 3-2 lists the Alaska Ambient Air Quality Standards. Kodiak Island Borough meets all of the Federal and state standards for criteria air pollutants (EPA, 2008a). Kodiak Island Borough is considered unclassifiable for state standards for reduced sulfur compounds and NH_3 (ADEC, 2008). No ambient air quality data are available for the vicinity of KLC; the nearest monitoring station is 130 miles north (USAF, 2006).

3.4.2 Biological Resources (Fish, Wildlife, and Plants)

KLC is on Kodiak Island within the Narrow Cape region of Alaska. Predominant vegetation types in the KLC area include hairgrass-mixed forb and open willow-hairgrass-mixed forb meadow, shrublands,

Exhibit 3-11. Kodiak Launch Complex and the Surrounding Area



wetlands, and intermittent stands of spruce (MDA, 2003). Grazing from farmed cattle, bison, and horses has affected the vegetation community structure. Some of the most common plants are hairgrass, meadow fescue, alder, willow, and Sitka spruce. Fishery resources on and adjacent to KLC include freshwater, anadromous, and marine species. Because streams and lakes at KLC are relatively small and shallow, freshwater fishery resources are limited. Coho salmon, sculpin, and stickleback have been captured or observed in streams draining from the site (USAF, 2006).

More than 140 bird species can be found near KLC, including loons, grebes, kingfishers, black scooters, sparrows, and terns (MDA, 2003). Common terrestrial mammals found at KLC include the little brown bat, red fox, river otter, and short-tailed weasel. The Narrow Cape region also supports various marine mammal species including harbor seals and northern fur seals (USAF, 2006).

No state or federally protected species are known to be present within the KLC site; however, some protected species could inhabit the area surrounding KLC. Exhibit 3-12 lists the state and federally protected species possibly present near KLC.

Exhibit 3-12. State and Federally Protected Species Possibly Present Near KLC

Common Name	Scientific Name	Federal Status	State Status
Birds			
Short-tailed albatross	*Phoebastria albatrus*	E	E
Steller's eider	*Polysticta stelleri*	T	SC
Animals			
Northern sea otter	*Enhydra lutris kenyoni*	T	SC
Steller sea lion	*Eumetopias jubatus*	E	SC
Pacific harbor seal	*Phoca vitulina richardsi*	MMPA	-
Northern right whale	*Balaena glacialis*	E	E
Sei whale	*Balaenoptera borealis*	E	-
Blue whale	*Balaenoptera musculus*	E	E
Fin whale	*Balaenoptera physalus*	E	-
Humpback whale	*Megaptera novaeangliae*	E	E
Sperm whale	*Physeter macrocephalus*	E	-

Sources: USAF, 2006; MDA, 2003.
E = Endangered; T = Threatened; SC = Species of Concern; MMPA = Protected under the Marine Mammal Protection Act

During summer, the federally listed endangered short-tailed albatross could be present in the nearshore waters, approximately 1.3 miles from the launch pads. However, no short-tail albatrosses were sighted during biological monitoring conducted for the first five launches from KLC from 1998 to 2001 (MDA, 2003). The federally listed threatened Steller's eider is present only in the offshore waters of Kodiak Island during the winter months, generally mid-October through March.

The federally protected Steller sea lion uses critical habitat on the eastern shoreline of Cape Chiniak, Gull Point, and Ugak Island (MDA, 2003). Steller sea lions can typically be found along with the harbor seal, which is protected under the Marine Mammal Protection Act, at the closest haul-out area on Ugak Island, approximately 3 miles southeast of KLC. The federally listed threatened northern sea otter can be found off Narrow Cape, approximately 2 miles from the launch pad. In addition, up to six northern sea otters have been seen in the near-shore waters of KLC on an irregular basis in recent years. The humpback whale is also common to Ugak Bay, particularly during summer (USFWS, 2003). Additionally, the waters south of Kodiak Island, including the Narrow Cape vicinity, are essential fish habitat for commercial fish species.

3.4.3 Historical, Architectural, Archaeological, and Cultural Resources

There are several sites in the City of Kodiak listed on the *National Register of Historic Places*, including the Alaska Heritage Resource Survey Site KOD-207 and the Kodiak 011 site (DOI, 2008). The addresses of these locations are restricted, but previous environmental documentation noted that two archaeological sites and a World War II bunker are located within 1 mile of the Launch Complex facilities (FAA, 1996). Prior archaeological surveys did not identify any evidence of cultural resources in the vicinity of KLC (FAA, 1996). Paleontological resources, including shallow-water marine invertebrates of the Oligocene and Miocene ages, are generally found in the Narrow Cape formation below the surface soils (MDA, 2003).

3.4.4 Floodplains

KLC is not in a floodplain (FAA, 1996). Therefore, no further consideration of floodplain management is required.

3.4.5 Hazardous Materials, Pollution Prevention, and Solid Waste

KLC stores diesel fuel in above-ground storage tanks. Petroleum, oil, and lubricants are stored in accordance with EPA requirements at 40 CFR 112 and Alaska requirements at 18 AAC 75. KLC does not use underground storage tanks. Fuels are handled and stored in accordance with the KLC Safety Policy, the KLC Emergency Response Plan, and KLC Contamination Control Procedures (USAF, 2006).

Hazardous materials and waste are managed in accordance with the facility's Safety Policy, Emergency Response, and Contamination Control Procedures; Alaska Aerospace Corporation's HazCom Program; the Kodiak Area Emergency Operation Plan; and all applicable Federal and state environmental laws. Pollution prevention, waste minimization, and recycling procedures are indicated in the KLC Spill Prevention Control and Countermeasures Plan, Emergency Response Plan, and Contamination Control Procedures (USAF, 2006).

Hazardous materials handled at KLC include hydrazine propellants, solid rocket fuel, isopropyl alcohol, paints, thinners, and solvents. Alaska Aerospace Corporation is authorized to operate KLC as a Small Quantity Generator according to the Alaska Hazardous Waste Management Regulations (Alaska Administrative Code 62). With this designation, KLC can produce up to 2,220 pounds of hazardous waste per month, which normally amounts to just under five drums of liquid hazardous waste. Because there are no permitted hazardous waste treatment or disposal facilities on Kodiak Island, all hazardous waste must be shipped offsite for appropriate treatment or disposal (MDA, 2003).

3.4.6 Health and Safety

The KLC Range Safety Manual sets forth the range safety policies and criteria governing all launch support operations at the facility; these policies and criteria apply to all Alaska Aerospace Corporation personnel, Development Corporation contractors, tenants, experimenters, and range users. Health and safety procedures prescribed by the manual are in accordance with applicable Department of Defense, Federal, and State of Alaska regulations, standards, and procedures, including the following:

- DoD 6055.9-STD (DoD Ammunition and Explosives Standards);
- AFSPCMAN 91-710 (Range Safety User Requirements); and

- RCC 321-02 Supplement (Common Risk Criteria for National Test Ranges: Inert Debris).

These procedures provide for ground safety, flight safety, range clearance and surveillance, sea-surface area clearance and surveillance, and commercial air traffic control. They include disseminating Notices to Mariners and Notices to Airmen, and coordination with the U.S. Coast Guard and the FAA (USAF, 2006).

The Range Safety Officer at KLC provides range safety policy guidance and direction, and operational oversight during range missions. The Range Safety Officer or designee implements the measures specified in ground and flight safety plans during test range operations. A launch-specific safety plan would be prepared prior to any potentially hazardous operation or launch conducted at the facility. This plan would identify the potential hazards and describe the system designs and methods employed to control the hazards (USAF, 2006).

The Alaska Aerospace Corporation determines those areas that require evacuation for each launch to ensure that the public is not exposed to unacceptable levels of risk, that physical security and safety measures can be enforced, and that adverse environmental effects are minimized. The size of the evacuation areas is based on the potential for variability of the impact resulting from influences of local weather conditions, and small variances in the launch vehicle guidance and engineering systems. Criteria used in determining launch debris hazard risks are consistent with those employed by other national ranges (USAF, 2006).

To ensure public safety during launch days, KLC security personnel would close Pasagshak Point Road and not allow unauthorized personnel to enter the Ground Hazard Area. The safety zone is under constant surveillance during the day of launch and during any hazardous operations. If the safety zone would be compromised, the launch is delayed until the area is confirmed clear (USAF, 2006).

The Kodiak Fire Department does not provide general/routine firefighting service for KLC, but, under an agreement with the Alaska Department of Natural Resources, Division of Forestry, will respond to wildland fires at the facility. KLC personnel cross-trained in firefighting provide first line fire response at the Complex. KLC maintains and operates a pumper truck for this purpose. The Kodiak Fire Department also provides ambulance service and emergency medical response at the advanced and basic life support levels for KLC. The Kodiak Fire Marshal provides fire-code enforcement, fire-cause investigation, and other fire-prevention services for the Alaska Aerospace Corporation. The KLC Emergency Response Procedure details actions and responsibilities for handling various emergency situations that might occur at the facility (USAF, 2006).

3.4.7 Land Use (including Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)

Alaska Aerospace Corporation manages KLC, which is within the Kodiak Island Borough on a 3,717-acre coastal plateau leased from the Alaska Department of Natural Resources, Division of Land, through an interagency land-management agreement. KLC consists of primary facilities and a number of support facilities, which cover approximately 43 acres. Approximately 1 percent of KLC is considered disturbed; the remainder is in its natural state. Traditionally used for ranching and recreation, the Narrow Cape area is underdeveloped and very sparsely populated. KLC is surrounded by Alaska-owned land, which serves as a buffer between small amounts of privately owned property (MDA, 2003).

The Pasagshak State Recreation Area is approximately 6 miles northwest of KLC. There are a number of hiking trails in the vicinity of KLC. Fossil Beach and East Twin Lake are on KLC and offer limited access for general beach activities. KLC is in the “zone of direct influence” of the coastal environment.

All Federal development projects and all Federal activities must be reviewed to determine their consistency with the local Coastal Zone Management Plan (MDA, 2003).

3.4.8 Light Emissions and Visual Resources

Kodiak Island consists primarily of mountainous terrain, with most mountain peaks ranging from 3,000 to 4,000 feet. The Narrow Cape area of Kodiak Island, in the vicinity of KLC, has low, grass-covered mountains that level off into a plateau. The varied terrain, extensive vegetative cover, and generally scenic shorelines all contribute to a high visual quality for much of Kodiak Island. The Narrow Cape area has been previously disturbed by commercial launch facilities, a ranch, and a U.S. Coast Guard facility (MDA, 2003).

Narrow Cape is in a relatively remote area of Kodiak Island. Potentially concerned persons who might have views of KLC include recreational users (*e.g.*, fishers, hunters, and hikers); employees and visitors at the U.S. Coast Guard Loran (Long Range Navigation) Station (approximately 1 mile from the launch site), Kodiak Ranch (approximately 4 miles from the launch complex); and passengers on offshore vessels. Pasagshak State Recreation Area, a small park that contains seven campsites, is about 6 miles northwest of Narrow Cape. There are approximately a dozen small vacation homes in the Pasagshak Bay area. The Kodiak Island Highway, which runs from Kodiak to Narrow Cape, is primarily undeveloped (MDA 2003).

Light sources at KLC include security lighting on the ground, which remains on overnight.

3.4.9 Natural Resources and Energy Supply

Kodiak Electric Association, which has a capacity of 1,050 kilowatts, provides electricity to KLC. A cooperative facility, Kodiak Electric Association operates and purchases power from the Alaska-owned Terror Lake Hydroelectric Facility. Backup power is provided by diesel-driven standby generators at the Launch Control Center (with a capacity of 350 kilowatts, 400 horsepower), Payload Processing Facility (with a capacity of 500 kilowatts), and the Launch Pad-1/Integration and Processing Facility (with a capacity of 600 kilowatts) (FAA, 1996). Peak power demand for KLC has been 825 kilowatts (DoD, 2003).

Though the City of Kodiak is the supplier of water services in and around the City, outlying residents rely on private wells, as does KLC, which maintains water supply wells on KLC property.

Three identical packaged domestic water supply systems provide pressurized domestic water service for the Launch Control Center (7 gallons per minute of output and a system design capacity of 2,500 gallons per day), Payload Processing Facility (3 gallons per minute of output and a system design capacity of 300 gallons per day), and Integration and Processing Facility (well abandoned, system design capacity of 650 gallons per day). The Integration and Processing Facility uses a water storage tank with a 165,000-gallon capacity.

Water system demand for the Launch Control Center, Payload Processing Facility, and Integration and Processing Facility during a mission has been estimated at 50 percent of the available design capacity of 3,450 gallons per day. During non-mission status, the demand has been estimated at 5 percent of this available capacity (DoD, 2003).

3.4.10 Noise and Compatible Land Use

Based on the land use of the Narrow Cape area, the most common noise sources are from occasional traffic on the road from the City of Kodiak to Narrow Cape, nearby off-road recreational vehicles, standby generators at the nearby U.S. Coast Guard Loran Station, and occasional rocket launches.

Noise exposure limits for workers at KLC are established by OSHA requirements at 29 CFR 1910.95. There are few inhabited areas or other noise-sensitive receptors near the Complex. The nearest residence to the launch site is a ranch 3.8 miles away, and the Pasagshak State Recreation Area (the nearest public facility) is about 4.5 miles away. A church camp that previously operated just outside the west complex boundary is now rented, in part, for KLC security personnel. Existing noise levels in these areas are expected to be characteristic of quiet rural areas (*i.e.*, about 30 dBA) (USAF, 2006; MDA, 2003).

Prior rocket launches at KLC have been associated with the Air Force Atmospheric Interceptor Technology Program, the Quick Reaction Launch Vehicle Program, Strategic Target System, and Athena, the latter being the largest vehicle licensed to be launched from KLC. Near the northern spit of Ugak Island, about 3.5 miles from the launch site, the recorded launch A-weighted sound level has ranged from 80 dB for the Quick Reaction Launch Vehicle to 101 dB for the Athena (USAF, 2006).

Although rocket launches from KLC can generate sonic booms during the vehicle's ascent, the resulting overpressures are directed out over the ocean in a southerly direction along the launch trajectory, and generally do not affect Kodiak or Ugak Islands (USAF, 2006).

3.4.11 Socioeconomic Resources, Environmental Justice, and Children's Environmental Health and Safety

3.4.11.1 Population

The population on Kodiak Island is concentrated primarily in Kodiak and in other smaller population centers along the roadway in the northeastern part of the island. According to the 2000 Census, Kodiak had a population of 6,334. According to the 2000 Census, Kodiak Island Borough had a population of 13,913. The rest of the island is largely uninhabited, with Kodiak National Wildlife Refuge comprising roughly two thirds of the western side of the island (ENRI, 1995c).

3.4.11.2 Employment and Income

Seafood processing and harvesting is the largest employment sector in the Kodiak Island Borough, with approximately 41 percent of total employment (ISER, 1996). Income generated from fishing and fish processing forms the economic base and livelihood for many of the communities in the Borough.

Government employment is the second largest sector and accounts for about 25 percent of total employment (ISER, 1996). The U.S. Coast Guard, which maintains a station near Womens Bay, is the largest government employer on the island. Other key private-sector industries on Kodiak Island include logging and tourism. In 2004, Kodiak had an unemployment rate of 5 percent and the median household income was $52,734 (U.S. Census Bureau, 2008c).

3.4.11.3 Environmental Justice

Census data from 2000 shows the Kodiak population as 52.3 percent minority. An examination of Census data by tracts and block groups identifies only the six traditional villages (Akhiok, Karluk, Larsen Bay, Old Harbor, Ouzinkie, and Port Lions) as communities considered as minority communities under

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*. The population of these traditional villages is more than 83 percent Native American, predominately Aleut.

According to the 2000 Census, 3.7 percent of the families (or 7.4 percent of individuals) in Kodiak had incomes below the poverty level in 1999.

3.4.11.4 Children's Environmental Health and Safety

KLC is not near schools, daycare facilities, playgrounds, or other places where children are concentrated. Therefore, no further consideration of the protection of children from environmental health and safety risks is required.

3.4.12 Water Quality

3.4.12.1 Surface Water

The principal streams in the northeastern part of Kodiak Island flow from the mountains and hills into the steep-walled bays along the irregular coastline. These streams, generally less than 10 miles long, flow mostly through fairly narrow, flat-bottomed valleys bordered by strips of rolling or hilly land (USDA, 1960). At KLC, the topography is relatively flat and low-lying; the streams draining this area are generally less than 2 miles long, are small, and have an average discharge of less than 46 cubic feet per second (ENRI, 1995a).

Water quality was sampled twice in 1994 in the vicinity of the KLC. The conductivity, pH, dissolved oxygen, and alkalinity of the surface water in the vicinity of KLC are within typical ranges found at Kodiak Island. The conductivity, pH, and dissolved oxygen content of the surface waters near KLC are suitable for a range of aquatic organisms. In addition, biological toxicity testing of sediments collected from these surface water sampling sites indicates that the sediments have no potential toxicity (ENRI, 1995a).

3.4.12.2 Groundwater

Bedrock was sampled at KLC in 1994 at four locations to depths of approximately 25 feet. While the presence of water-bearing zones within the underlying bedrock was found in three of the bedrock borings, information concerning water quality or potential groundwater yields is not available (ENRI, 1995b).

3.4.13 Wetlands

Vegetation covers approximately 88 percent (2,730 acres) of KLC. Of the 88 percent, 29 percent are wetlands (790 acres) (FAA, 1996). Vegetated wetlands at KLC include semi-permanently flooded areas, saturated emergent wetlands, and marshes.

Although upland soils at KLC are well drained, they are always moist due to frequent rainfall. These moist soils support vegetation normally associated with wetlands, seemingly independent of slope and elevation. As a result, plants such as alder and willows are sometimes found on the site on slopes and hillsides, particularly when seeps are present (FAA, 1996).

3.5 Mid-Atlantic Regional Spaceport

MARS is an FAA-licensed commercial launch site within the NASA Goddard Space Flight Center Wallops Flight Facility in Accomack County, Virginia. Virginia and Maryland jointly operate the Spaceport through a bi-state agreement. Wallops Flight Facility encompasses more than 6,500 acres over three different land parcels: the Main Base, the Mainland, and the Wallops Island Launch Site, where MARS is located. MARS provides launch support services and facilities to a variety of Federal, commercial, and academic users. Launch infrastructure consists of two orbital launch pads, payload processing and integration facilities, vehicle storage and assembly buildings, mobile liquid fueling capability, on-site and downrange telemetry and tracking, and payload recovery capability.

Launches under an experimental permit would be expected to occur from one of the two LPs available at MARS, LPs 0-A or 0-B (see Exhibit 3-13). LP 0-A can support small launch vehicles with gross liftoff weights of up to 200,000 pounds. LP 0-A has an 82-foot service tower. LP 0-B is capable of supporting small to medium launch vehicles with gross liftoff weights of up to 501,000 pounds.

3.5.1 Air Quality

In Virginia, air quality is assessed on both a county and regional basis. Air quality at Wallops Flight Facility is regulated under the Virginia Administrative Code (9 VAC 5-30) and EPA Region 3. The Virginia Ambient Air Quality Standards are not significantly different from the NAAQS listed in Exhibit 3-2. Accomack County meets all of the Federal and Commonwealth of Virginia standards for criteria pollutants (EPA, 2008a). Wallops Flight Facility has an air permit from the Virginia Department of Environmental Quality for emissions of criteria pollutants and hazardous air pollutants below major source thresholds (NASA, 2005).

3.5.2 Biological Resources (Fish, Wildlife, and Plants)

Wallops Island is a barrier island southeast of the Chincoteague National Wildlife Refuge and the Assateague Island National Seashore, separated by the Chincoteague Inlet. Wallops Island contains various stages of ecological succession, including beaches, dunes, swales, marsh, and some maritime forests. On the eastern side of the island, an extensive seawall, built where the upper beach zone would normally exist, protects facilities from beach erosion. Dominant species within the dune system include seabeach orach, common saltwort, sea rocket, American beachgrass, and seaside goldenrod. The central portion of the island is dominated by common reed grass, an invasive species. Areas off the western side of the island are mostly tidal marsh wetlands with intertwining creeks. The low marsh, which is flooded at high tide, is dominated by saltmarsh cordgrass. Salt meadow cordgrass predominates in the high marsh areas, which are flooded by approximately 50 percent of the high tides. Vegetation around facilities and launch pads are maintained by mowing and clearing, and through the use of herbicides, providing a buffer between the facilities and the native habitats (USAF, 2006).

Exhibit 3-13. Mid-Atlantic Regional Spaceport and the Surrounding Area

The wide range of terrestrial and aquatic environments found at Wallops Island provides habitat for numerous wildlife species. Amphibians and reptile species, including the northern fence lizard, snapping turtle, and Fowler's toad, can be found on Wallops Island and in the local estuaries and tidal flats. Mammalian species found on the island include raccoon, opossum, and white-tailed deer. Because of its coastal location along the Atlantic Flyway route, Wallops Island is an important stop for migratory ducks, geese, shorebirds, songbirds, and raptors (USAF, 2006). In addition, many of the embayments, estuaries, and ocean waters surrounding Wallops Island support essential fish habitat for a wide array of fish species.

Exhibit 3-14 lists Virginia and federally listed protected species possibly present on Wallops Island.

Exhibit 3-14. Virginia and Federally Listed Protected Species Possibly Present on or Within the Vicinity of Wallops Island

Common Name	Scientific Name	Federal Status	Virginia Status
Animals			
Piping plover	*Charadrius melodus*	T	T
Wilson's plover	*Charadrius wilsonioa*	NL	E
Gulled-billed tern	*Sterna nilotica*	NL	T
Upland sandpiper	*Bartramia longicauda*	NL	T
Peregrine falcon	*Falco peregrinus*	NL	T
Bald eagle	*Haliaeetus leucocephalus*	NL	T
Leatherback sea turtle	*Dermochelys coriaces*	E	E
Hawksbill sea turtle	*Eretmochelys imbricate*	E	E
Kemp's ridley sea turtle	*Lepidechelys kempi*	E	E
Loggerhead sea turtle	*Caretta caretta*	T	T
Atlantic green sea turtle	*Chelonia mydas*	T	T
Sperm whale	*Physeter catodon (= macrocephalus)*	E	E
Fin whale	*Balaenoptera physalus*	E	E
Humpback whale	*Megaptera novaeangliae*	E	E
North Atlantic right whale	*Eubalaena glacialis*	E	E
Sei whale	*Balaenoptera borealis*	E	E
Blue whale	*Balaenoptera musculus*	E	E
Florida manatee	*Trichechus manatus latirostrus*	E	E

Sources: USAF, 2006; NASA, 2005; VDGIF, 2009.
E = Endangered; T = Threatened, NL = Not Listed

3.5.3 Historical, Architectural, Archaeological, and Cultural Resources

The 2003 Cultural Resources Assessment of Wallops Flight Facility examined each of the three land areas of the facility: Wallops Main Base, Wallops Mainland, and Wallops Island. The Cultural Resources Assessment established a predictive model for understanding the archaeological potential over the entire property and determined that among cultural resources at Wallops Flight Facility are six archaeological sites, two of which are historic sites on Wallops Island. Two sites have been determined eligible for listing on the *National Register of Historic Places* and *Virginia Landmarks Register* — the Wallops Coast Guard Lifesaving Station and its associated Coast Guard Observation Tower. The other resources were determined not to be eligible for listing on the *National Register of Historic Places* because they lack the historical significance or integrity necessary to convey significance (NASA, 2009).

3.5.4 Floodplains

Wallops Island is entirely within the 100-year floodplain. In addition, the 100-year and 500-year floodplains surround the perimeter of the Main Base, along Mosquito Creek, Jenneys Gut, and Simoneaston Creek, and the 100-year and 500-year floodplains border the eastern edge of Wallops Mainland along Arbuckle Creek and Hog Creek (NASA, 2003b).

3.5.5 Hazardous Materials, Pollution Prevention, and Solid Waste

MARS adheres to the same standards as Wallops Flight Facility regarding hazardous materials, pollution prevention, and solid waste. The EPA has assigned Wallops Island and Wallops Mainland a single hazardous waste generator number and they are classified as Large Quantity Hazardous Waste Generators. Hazardous wastes may be stored onsite at the accumulation areas for up to 90 days after the date of initial accumulation (USAF, 2006). At present, propellants, including ammonium perchlorate/aluminum, nitrocellulose/nitroglycerin, and hydrazine are used in rocket operations at Wallops Flight Facility. Additionally, payload-processing operations utilize hazardous materials and generate hazardous waste, such as cutting-fluid waste, solvent waste, lead paste, and waste thinner (NASA, 2005).

In accordance with the Federal Hazard Communication Program, the Wallops Flight Facility Environmental Office has prepared an Integrated Contingency Plan that combines requirements for the implementation of the following:

- Spill Prevention Control and Countermeasures Plan, as required by 40 CFR 112 and 9 VAC 25-91-170;
- Hazardous Substance Contingency Plan, as required by 40 CFR 262.34 (which references 40 CFR 265, Subpart D) and 9 VAC 20-60-265;
- Hazardous Waste Operations and Emergency Response, in accordance with 29 CFR 1910.120; and
- Storm Water Pollution Prevention Plan, as required by 9 VAC 25-31-120 pursuant to the current Virginia Pollutant Discharge Elimination System Permit #VA0024457.

Wallops Flight Facility has an Environmental Management System in place, which includes pollution prevention requirements. Pollution prevention teams are formed as needed to address specific waste minimization and pollution prevention opportunities (USAF, 2006).

On the south end of Wallops Island, Wallops Flight Facility operates an Open Burn Area for the treatment of hazardous waste rocket motors and igniters. The Virginia Department of Environmental Quality issued the Flight Facility a permit for the open burning of hazardous waste, which became effective on October 20, 2005. This permit limits Wallops Flight Facility to treatment of 75 tons net explosive weight of propellant per year.

3.5.6 Health and Safety

MARS adheres to the same standards as Wallops Flight Facility regarding health and safety. The Flight Facility Safety Office is responsible for approving project-specific ground and flight safety plans, while management is responsible for approving the Operations and Safety Directive for each activity or mission. The following documentation is in place to provide specific guidance for safety and emergency response:

- Integrated Contingency Plan, March 2008;
- Range User's Handbook, March 2008;
- Range Safety Manual for Goddard Space Flight Center/Wallops Flight Facility (RSM-2002, Rev. A), November 2006;
- Wallops Safety Manual for Wallops Flight Facility (WSM-2002), August 2002;
- Goddard Space Flight Center/Wallops Flight Facility Launch Site Safety Assessment, March 1999;
- NASA Department Operating Guideline, Hydrazine Response Plan, 2004;
- NASA Safety Manual (NPR 8715.3), March 2004; and
- NASA Safety Standard for Explosives, Propellants and Pyrotechnics (NASA-STD-8719.12) (USAF, 2006).

These procedures provide for ground safety, flight safety, range clearance and surveillance, sea-surface area clearance and surveillance, and commercial air traffic control. They include issuing Notices to Mariners and Notices to Airmen, and coordination with the U.S. Coast Guard and the FAA. Criteria used in determining launch debris hazard risks are consistent with those employed by other national ranges, such as CCAFS and VAFB, and with RCC 321-02 (USAF, 2006).

The Range Safety Officer at Wallops Flight Facility provides range safety policy guidance and direction and operational oversight during test range missions. The Range Safety Officer acts as the approval authority for Ground and Flight Safety Risk Analyses and Safety Plans. The Range Safety Officer or designee implements the measures specified in Ground and Flight Safety Plans during test range operations (USAF, 2006).

Wallops Flight Facility maintains 24-hour fire protection stations on the Main Base and on Wallops Island. Response personnel are trained in hazardous materials emergency response, crash rescue, and fire suppression. Mutual aid agreements have been established between the Flight Facility and the local community volunteer fire companies for any additional assistance (USAF, 2006).

3.5.7 Land Use (including Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)

Wallops Flight Facility has its own land-use classification based on operational areas on the Main Base, Wallops Mainland, and Wallops Island (NASA, 2005). Wallops Island comprises 4,600 acres, most of which is marshland, and includes launch and testing facilities, blockhouses, rocket storage buildings, assembly shops, dynamic balancing facilities, tracking facilities, U.S. Navy facilities, and other related support structures (NASA, 2005).

Accomack County, Virginia, has zoned most of Wallops Island for industrial use. The County's land-use plan classifies the marsh area between Wallops Mainland and Wallops Island as marshland and does not include the marshland in the industrial-use zone. The area surrounding Wallops Flight Facility consists of rural farmland and small villages and is regulated by local County government and several town councils (NASA, 2005).

The closest Section 4(f) resource is the Chincoteague National Wildlife Refuge, under the jurisdiction of the U.S. Fish and Wildlife Service, 6 miles to the northeast of Wallops Flight Facility. Assateague Island National Seashore is north of the Chincoteague National Wildlife Refuge. Additionally, The Nature Conservancy owns a portion of Metompkin Island, which is open to the pubic for low-impact, recreational day use such as hiking, fishing, bird watching, and photography (VDEQ, 2007). Metompkin Island is immediately south of Assawoman Island.

Most of the agricultural land surrounding Wallops Flight Facility, and part of the Main Base, is designated as prime or unique farmland based on the soil classification (NASA, 2005).

There are no wild and scenic rivers on or near Wallops Flight Facility.

The Virginia Department of Environmental Quality is the lead agency for the Virginia Coastal Resources Management Program, which NOAA has authorized to administer the Coastal Zone Management Act. Under the Act, Federal agency development in Virginia's Coastal Management Area must be consistent with the enforceable policies of the Virginia Coastal Resources Management Program. Although Federal lands are excluded from Virginia's Coastal Management Area, any activity on Federal land that has reasonably foreseeable effects on coastal areas must be consistent with the Virginia Coastal Resources Management Program (NASA, 2005).

3.5.8 Light Emissions and Visual Resources

The conditions at Wallops Flight Facility are characterized as low visual sensitivity because of existing development. The viewshed at the Flight Facility includes structures such as rocket storage buildings and blockhouses, and a continuous stream of aircraft operations. The area surrounding the Flight Facility includes agricultural and rural residential land. The topography is mostly flat and typical of the Mid-Atlantic coastal region. There are no sensitive receptors identified within 1 mile of the launch and reentry site (NASA, 2005).

Light sources at Wallops Flight Facility include security lighting on the grounds and safety lighting on the runways, which remain on overnight.

3.5.9 Natural Resources and Energy Supply

Wallops Flight Facility has seven water supply wells in the Yorktown-Eastover Multiaquifer System, which the EPA protects as a sole-source aquifer (NASA, 2008b).

NASA operates five supply wells on the Main Base and two on Wallops Mainland, NOAA operates one well, and the Town of Chincoteague operates seven wells under easement on the Main Base. Most of the supply wells are several hundred feet deep and are constructed to withdraw water from one of the Yorktown Aquifers. Three of the wells operated by the Town of Chincoteague (near the eastern boundary of the Main Base) are 60 feet or less in depth and withdraw water from the Columbia Aquifer. Four of the wells operated by the Town of Chincoteague draw from the deep Yorktown-Eastover Multiaquifer System (NASA, 2008b).

Groundwater is the sole source of potable water for Wallops Flight Facility and the general vicinity. No major streams or other fresh surface water supplies are available as alternative sources of water for human consumption. In addition to the groundwater management program that has been established by the Virginia Department of Environmental Quality for the entire Eastern Shore, a Groundwater Committee was established in 1990 to ensure an optimal balance between groundwater withdrawals and recharge rates. This balance helps to minimize the problems of water quality due to saltwater intrusion, aquifer de-watering, and well interference in the general area (NASA, 1999).

3.5.10 Noise and Compatible Land Use

Sources of noise at Wallops Flight Facility include aircraft operations, vehicular traffic, and occasional rocket launches. The MARS launch pads on the island are approximately 2.5 miles from the mainland. Noise-sensitive receptors in the area include several small towns (such as Atlantic, Assawoman, and Temperanceville), and other rural homes and farms. The Wallops Island National Wildlife Refuge and Assateague Island National Seashore also lie a few miles to the northeast.

Existing noise levels from vehicular traffic and aircraft operations can be expected to range from 30 dBA in quiet rural areas, up to 64 dBA during peak traffic periods along the major roads. Rocket launches from the Wallops Island Launch Site elevate noise levels. Scout, Black Brant, Terrier, and numerous other sounding rockets have been launched from the island. The Conestoga is the largest rocket launched from Wallops Island to date. For its launch, an overall sound pressure level of approximately 107 dB was projected at 7.5 miles from the launch site. Equivalent A-weighted sound levels would be substantially lower (USAF, 2006).

Although rocket launches from Wallops Flight Facility can produce sonic booms during the vehicle's ascent, the resulting overpressures are directed out over the ocean in the direction of the launch azimuth. In conducting launches, NASA only permits sonic booms over the open ocean to prevent affecting populated areas along the coast (NASA, 2005).

3.5.11 Socioeconomic Resources, Environmental Justice, and Children's Environmental Health and Safety

3.5.11.1 Population

Wallops Flight Facility is in Accomack County, Virginia, which is the northernmost of the two Virginia counties on the southern end of the Delmarva Peninsula. Wallops Flight Facility is in a rural area, and year-round population densities of neighboring areas are low. According to the U.S. Census Bureau, the estimated population of Accomack County was 39,345 in 2006 (U.S. Census Bureau, 2008d).

Chincoteague Island, Virginia, is approximately 8 miles northeast of Wallops Island. It is the largest densely populated area near Wallops Flight Facility, with a resident population of 4,317. Area populations fluctuate seasonally. During summer, the population increases due to tourism and vacationers who visit the nature reserve and beaches of Assateague Island. Daily populations often reach up to 15,000 in summer.

3.5.11.2 Employment and Income

The unemployment rate in Accomack County is approximately average for the region. In October 2008, the unemployment rate was 6.1 percent (Bureau of Labor and Statistics, 2008). It is also notable that employment fluctuates seasonally in this region, with lower unemployment June through October. Unemployment typically falls to between 4 and 6 percent during these months (NASA, 2003b).

In 2008, Wallops Flight Facility employed a total of 1,485 persons; 1,027 of those supported NASA (including 238 civil service personnel and 789 contractors), MARS employed 3 full-time people, and the remainder worked for either NOAA or the U.S. Navy (NASA, 2008c). NASA is the fourth largest employer in Accomack County (NASA, 2009). Other large employers on the Eastern Shore are Perdue Farms (1,900 employees) and Tyson Foods (950 employees) (ESVEDC, 2004).

Employment categories at Wallops Flight Facility consist largely of managerial, professional, and technical disciplines with higher than regional average salaries. The mean salary of Flight Facility civil service employees for fiscal year 2008 was $88,047 (NASA, 2008a). Wallops Flight Facility mean annual income exceeds the median family income of $32,837 for Accomack County in 2005. Due to the wide gap between salaries of Flight Facility employees and most area residents, the facility contributes significantly to the local economy (NASA, 2008a).

3.5.11.3 Environmental Justice

Wallops Flight Facility has prepared an Environmental Justice Implementation Plan (NASA, 1996) to comply with Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations*. There are minority and low-income communities in the vicinity of the Flight Facility. Chincoteague Island is the closest populated area to the seaward side of Wallops Island. There are no minority or low-income communities on the portion of Chincoteague Island that lies within a 2.5-mile radius of Wallops Island (NASA, 2005).

3.5.11.4 Children's Environmental Health and Safety

The Wallops Flight Facility Environmental Justice Implementation Plan identifies the closest daycare centers, schools, camps, nursing homes, and hospitals. MARS is not near these facilities. Therefore, no further consideration of the protection of children from environmental health and safety risks is required.

3.5.12 Water Quality

3.5.12.1 Surface Water

Numerous inlets, marshes, bays, creeks, and tidal estuaries are found in and around all three Wallops Flight Facility installation areas (NASA, 2005). There is a section of the Virginia Inside Passage west of Wallops Island and east of the Main Base and Wallops Mainland. The Atlantic Ocean lies to the east of Wallops Island. Surface waters in the vicinity of the Flight Facility are saline to brackish and are influenced by the tides (NASA, 2005).

The Virginia Department of Environmental Quality has designated surface waters in the vicinity of Wallops Flight Facility as Class II – Estuarine Waters (NASA, 1999). The Atlantic Ocean is designated as Class I – Open Ocean. Surface waters in Virginia must meet the water quality criteria specified in 9 VAC 25-260-50. These criteria establish limits for minimum dissolved oxygen concentrations, pH, and maximum temperature for the different surface water classifications in Virginia. In addition, Virginia surface waters must meet the surface water criteria specified in 9 VAC 26-260-140. These criteria provide numerical limits for various potentially toxic parameters. For the Class I and II waters in the vicinity of the Flight Facility, the saltwater numerical criterion is applied. The Commonwealth of Virginia uses both sets of standards to protect and maintain surface water quality.

3.5.12.2 Groundwater

Past contamination at three sites on the Main Base has affected groundwater quality at Wallops Flight Facility. Chemical releases at the former Fire Training Area, Waste Oil Dump, and Old Aviation Fuel Tank Farm resulted in contaminant plumes that have affected local groundwater quality in the Columbia Aquifer. Water quality in the underlying Yorktown Aquifer has not been affected due to the presence of the intervening aquitard, which prevents affected groundwater from flowing down from the Columbia Aquifer. The principal chemicals in the plumes include components of fuels and oils (in all three plumes) and solvents (chiefly in the former Fire Training Area plume) (NASA, 2004b).

None of the 14 water supply wells on the Main Base have been affected by the contaminant plumes. Most of the supply wells are in the Yorktown Aquifer, which is protected from the plumes by an aquitard. The wells in the Columbia Aquifer have not been affected because the plumes are not large enough to reach them. NASA regularly samples the supply wells and the area groundwater to ensure that the plumes are not expanding and that there is no impact on the drinking water supply.

The results of comprehensive investigations indicate that each of the plumes is either at a steady-state or is receding, and none are continuing to expand. NASA has imposed institutional controls (restriction zones), intrinsic remediation, and long-term monitoring to mitigate the adverse impact of contaminants on groundwater. NASA is working with Federal and Commonwealth environmental agencies to ensure that plumes do not expand and to restore groundwater to natural conditions (NASA, 2004b).

3.5.13 Wetlands

Extensive marsh wetland systems border all three areas at Wallops Flight Facility. The Main Base has tidal and non-tidal wetlands along its perimeter in association with Mosquito Creek, Jenneys Gut, Simoneaston Bay, and Simoneaston Creek. Wallops Island has non-tidal freshwater emergent wetlands and several small freshwater ponds in its interior and freshwater forested/shrub wetlands, estuarine intertidal emergent wetlands, and maritime forests on its northern and western edges. Marsh wetlands also fringe Wallops Mainland along Arbuckle Creek, Hogs Creek, and Bogues Bay (NASA, 2003b).

3.6 Mojave Air and Space Port

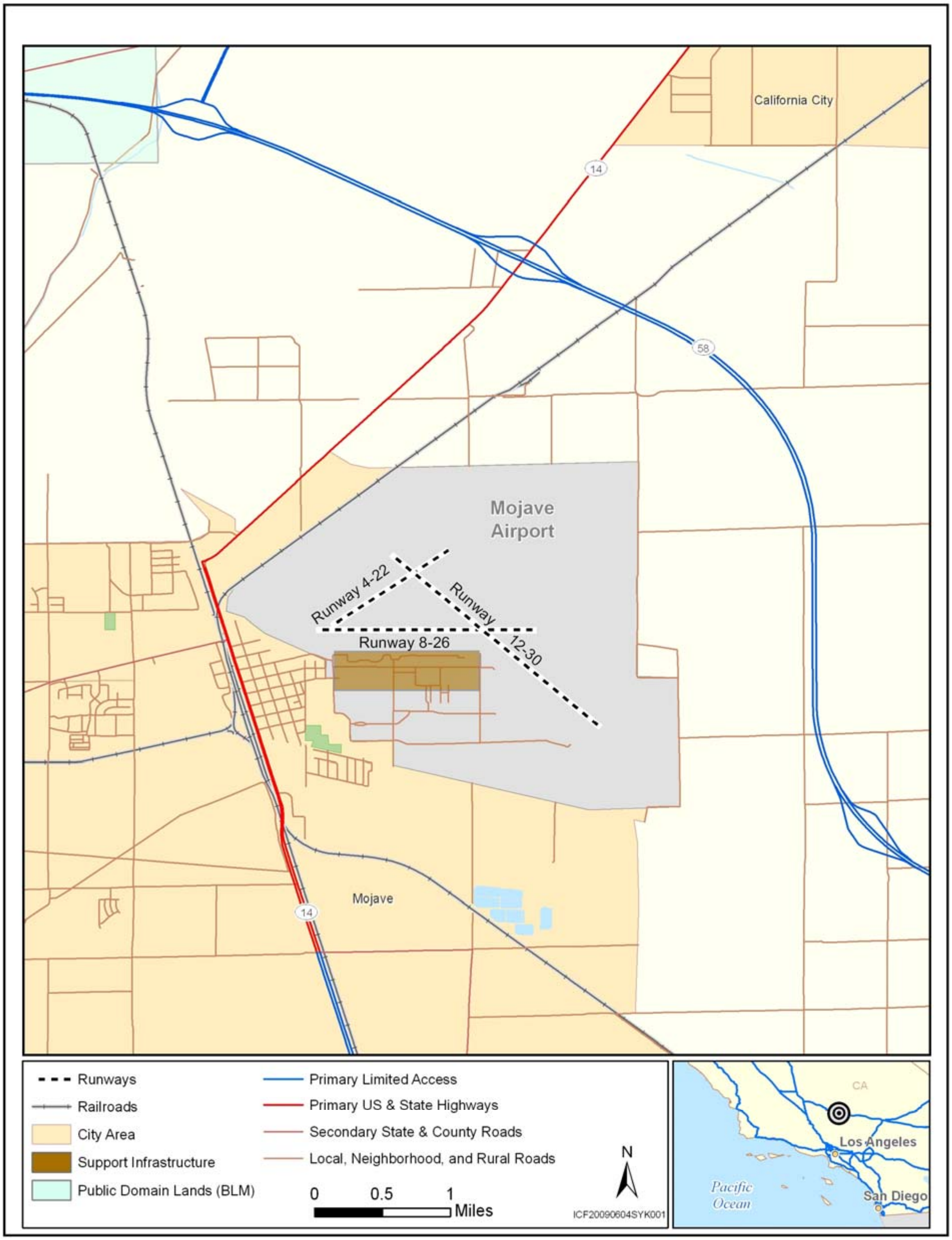
The Mojave Air and Space Port is an FAA-licensed commercial launch site comprising an area of approximately 3,000 acres in Kern County, California. East Kern Airport District manages the site, which is east of the unincorporated town of Mojave. In addition to being a general-use public airport, Mojave Air and Space Port supports flight testing, space industry development, and aircraft maintenance activities. Launch infrastructure consists of an air traffic control tower, three runways (Runway 12-30, Runway 8-26, and Runway 4-22), a rotor test stand, engineering facilities, and a high bay building. More than 300 acres are zoned specifically for rocket motor testing and development.

Horizontal launches under an experimental permit would be expected to occur from one of the existing runways (see Exhibit 3-15). Runway 12-30 is 12,500 feet (about 2.4 miles) long and is the primary runway for large air carrier jets, high-performance civilian and military jet aircraft, and horizontal launch spacecraft. Runway 8-26 is 7,050 feet (about 1.3 miles) long and is primarily used by general aviation jet and propeller aircraft. Runway 4-22 is 3,943 feet (about 0.7 mile) long and is used by smaller general aviation propeller aircraft and helicopters. Vertical launches (hover) would occur from an existing or temporary concrete pad in a designated vertical launch area.

3.6.1 Air Quality

The Mojave Air and Space Port is within the Kern County Air Pollution Control District. Eastern Kern County is in Federal nonattainment and state nonattainment for the 8-hour ozone standard and state nonattainment for the 1-hour ozone standard (EPA, 2008a; KCAPDC, 2008). In an effort to reach attainment status, Kern County Air Pollution Control District has developed several planning documents, including the Federal Ozone Attainment Demonstration Plan, which have been approved by the EPA and are included in the California Ozone State Implementation Plan. The documents outline baseline and

Exhibit 3-15. Mojave Air and Space Port and the Surrounding Area



future regional emission inventories, mandated emission reductions, and computer modeling to attain the Federal ozone standard. Kern County has also developed the California Clean Air Act Kern County Ozone Air Quality Attainment Plan (November 15, 2000). Exhibit 3-16 lists the Kern County Air Pollution Control District status for criteria pollutants.

3.6.2 Biological Resources (Fish, Wildlife, and Plants)

The Mojave Air and Space Port is situated on the western portion of the Mojave Desert in California. The site is adjacent to the Transverse Ranges, the Sierra Nevada, the Colorado Desert, and the Great Basin (FAA, 2004). The Mojave Specific Plan identifies Mojave Airport as an "urbanized non-sensitive area" that has already been developed (County of Kern, 2003).

The area surrounding Mojave Air and Space Port is rich in biological diversity because of its varied vegetation communities and distinct landforms (FAA, 2004). The region surrounding the Space Port to the east consists of Mojave creosote bush scrub, which may be intermixed with chenopod scrub formations. Joshua tree habitats can be seen in western portions of the region. There are no permanent surface water or wetlands within the Mojave Air and Space Port.

Exhibit 3-16. Current Kern County Air Pollution Control District Status of Criteria Pollutants

Pollutant	California Standard	Federal Standard
Ozone, 1 hour	Nonattainment	Attainment/maintenance
Ozone, 8 hour	Nonattainment	Nonattainment
PM_{10}	Nonattainment	Unclassifiable/attainment
$PM_{2.5}$	Unclassified	Unclassifiable/attainment
Carbon monoxide	Unclassified	Unclassifiable/attainment
Nitrogen dioxide	Unclassified	Unclassified
Sulfur dioxide	Unclassified	Unclassified
Lead particulates	Unclassified	Unclassified

Source: KCAPCD, 2008.

Wildlife in the region of the Mojave Air and Space Port includes invertebrates, reptiles, mammals, and migrant and local birds. Because there is little rainfall and only intermittent streams, there are no fish in this area (FAA, 2004). Desert tortoises could be present anywhere in the area, but there is no designated critical habitat for the desert tortoise within the Mojave Air and Space Port. The Mojave ground squirrel, which is threatened in California, is present in all desert scrub habitats and could inhabit parts of the Mojave Air and Space Port.

Exhibit 3-17 lists the state and federally protected species possibly present in the area surrounding the Mojave Air and Space Port.

Exhibit 3-17. State and Federally Protected Species Possibly Present at Mojave Air and Space Port

Common Name	Scientific Name	Federal Status	State Status
Plant Species			
Cushenberry buckwheat	*Erigonum ovalifolium* var. *vineum*	E	NL
Cushenberry milkvetch	*Astragalus albens*	E	NL
Lane mountain milkvetch	*Astragalus jaegerianus*	E	NL
Parish's daisy	*Erigeron parishii*	T	NL
Mojave tarplant	*Hemizonia mohavensis*	NL	E
Animal Species			
Arroyo toad	*Bufo californicus*	E	NL
California condor	*Gymnogyps californianus*	E	E
California red-legged frog	*Rana aurora draytonii*	T	NL
Desert tortoise	*Gopherus (=Xerobates) agassizii*	T	T
Least bell's vireo	*Vireo bellii pusillus*	E	E
Mojave ground squirrel	*Spermophilus mohavensis*	NL	T
Mojave tui chub	*Hemizonia mohavensis*	E	E
Swainson's hawk	*Buteo swainsoni*	NL	T
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	NL
Yellow-billed cuckoo	*Coccyzus americanus*	C	NL

Source: FAA, 2004.
E = Endangered; T = Threatened; NL = Not Listed; C = Candidate

3.6.3 Historical, Architectural, Archaeological, and Cultural Resources

There are no recorded cultural resources in the launch area and no sites at the Mojave Air and Space Port are listed on the *National Register of Historic Places* (DOI, 2008; FAA, 2004). In addition, no designated tribal lands are on Mojave Air and Space Port property, although Southern Paiute, Western Shoshone, Yokuts, and Mojave descendants reside in the surrounding region (FAA, 2004).

3.6.4 Floodplains

The Mojave Airport is outside the boundaries of the 100-year floodplain (FAA, 2004). Therefore, no further consideration of floodplain management is required.

3.6.5 Hazardous Materials, Pollution Prevention, and Solid Waste

Mojave Air and Space Port uses hazardous materials for various institutional activities, which in turn generate hazardous wastes. Such waste is managed in accordance with applicable Federal, state, and local rules and regulations for managing hazardous materials and waste. Most of the hazardous materials at the Space Port are airplane fuels. Other hazardous materials used and stored onsite include acetylene, paints, used motor and hydraulic oil, gear lubricant, and hydraulic fluid.

There is a bulk tank farm onsite with seven above-ground storage tanks that stock Jet-A and low-lead fuels. East Kern Airport District has a Spill Prevention Control and Countermeasures Plan in place that outlines operating procedures used to prevent spills. All above-ground storage tanks are monitored daily for spills, and the inspections are formally documented.

3.6.6 Health and Safety

In accordance with the Fueling Policy for Jet-A and low-lead fuels, only East Kern Airport District personnel can conduct fuel service activities. The Kern County Air Pollution Control District issued the East Kern Airport District a Permit to Operate for each of its fuel and gasoline storage and dispensing systems. The permits have operational, air quality, testing, and emissions limit requirements. The Airport District Administrative Code, Section 4-2.11, Fuel Handling, addresses safety measures that Airport District personnel and customers must follow before, during, and after providing fuel services. The Spill Prevention Control and Countermeasures Plan provides guidance for operation of the above-ground storage tanks used for fuel storage.

Emergency response services at Mojave Air and Space Port consist mainly of the East Kern Airport District Aerospace Rescue Fire Fighting unit. The fire fighting crew is trained and qualified in fire and rescue techniques, and its response requirements follow the guidelines of the National Fire Protection Standard 402 and the U.S. Air Force Defense Logistics Agency Manual 8210.1. The Kern County Fire Department, 0.25 mile from the Mojave Air and Space Port, provides 24-hour support to the Aerospace Rescue and Fire Fighting unit. Hall Ambulance provides onsite, 24-hour, land-based emergency medical services, and Mercy Air provides onsite, 24-hour, air-based emergency medical services. Edwards Air Force Base, approximately 30 miles east of Mojave Air and Space Port, provides additional local emergency response services via the mutual aid system and can provide Aerospace Rescue and Fire Fighting crews, security forces, and emergency medical services. A community response plan is in place to communicate and coordinate emergency alerts and responses to the surrounding community. Additionally, Mojave has been considering plans for a crash and fire rescue response facility that would provide immediate support for reusable launch vehicles that land with technical difficulties or crew medical emergencies.

A Launch Site Accident Investigation Plan contains detailed procedures for reporting, responding to, and investigating launch site accidents at the Mojave Air and Space Port, as defined at 14 CFR 420.05.

3.6.7 Land Use (including Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)

The Mojave Air and Space Port consists of roughly 3,000 acres, 200 of which are developed. The Space Port is in an area zoned for industrial use. The area east of the Space Port includes residential, commercial, industrial, resource management, public facilities, state, Federal, and undeveloped land uses. There are no designated recreational land uses at the Space Port.

The closest Section 4(f) resources are U.S. Bureau of Land Management conservation areas several miles from the Mojave Air and Space Port, including the Middle Knob Conservation Area to the north, the Barstow Woolly Sunflower Conservation Area and North Edwards Conservation Area to the east, and the Alkali Mariposa Lily Conservation Areas to the south-southeast.

The Mojave Air and Space Port does not contain any prime or unique farmland, farmland of statewide importance, or general farmland. There are no wild and scenic rivers or coastal resources on or near the Space Port.

3.6.8 Light Emissions and Visual Resources

The conditions at the Mojave Air and Space Port are characterized as low visual sensitivity because the site is an industrialized area. Approximately 300 planes use the three runways each day. Numerous airplanes are continuously parked at the Air and Space Port, which can be seen from two highways that intersect in the community of Mojave. Two rail lines also intersect in Mojave. Light sources at the Air and Space Port include security lighting on the grounds and safety lighting on the runways, which are on overnight.

3.6.9 Natural Resources and Energy Supply

The Mojave Public Utility District provides water supply services to the Mojave Air and Space Port. The Public Utility District operates seven groundwater wells that provide 75 percent of the total water supply. The wells are tapped into the Chaffee and Proctor subunits of the Antelope Valley basin (Kern County, 2003b). The Antelope Valley basin is recharged by surface runoff from the surrounding mountains (Kern County, 2003b). The existing wells can supply approximately 800 to 900 million gallons of water per year (Kern County, 2003b). The other 25 percent of the water is from surface water sources and is supplied by the Antelope Valley-East Kern Water Agency (Kern County, 2003b).

Southern California Edison provides electricity to the Mojave Air and Space Port and the Mojave community (Kern County, 2003a). The Mojave community uses an estimated 20 megawatts of electrical power per year. The Southern California Gas Company provides natural gas service to the Mojave community (Kern County, 2003a). The high-pressure gas service line originates in Texas and goes through several regulator stations to convert the gas to medium pressure for residential, commercial, and industrial use (Kern County, 2003a).

3.6.10 Noise and Compatible Land Use

Noise at Mojave Air and Space Port originates from four primary sources: roadways, railroads, aircraft, and research and development facilities (County of Kern, 2003). Aircraft activities are the primary source of noise at Mojave Airport. Exposure to aircraft noise occurs mainly in the vicinity of the runways and taxi areas.

Approximately 1,226 jet aircraft take off and land at the Mojave Airport annually. Of those, about 710 are military jet aircraft, such as the F-4 and the Saab Draken. In addition, aerospace companies based at the Mojave Airport periodically test experimental rocket engines (NASA, 2005).

3.6.11 Socioeconomic Resources, Environmental Justice, and Children's Environmental Health and Safety

3.6.11.1 Population

The 2000 Census reported the populations of the Mojave Census Designated Place and Kern County to be 3,836 and 661,645, respectively. Kern County grew almost 22 percent between 1990 and 2000; however, the population of the Mojave Census Designated Place increased at less than one-tenth the rate observed throughout the rest of the Kern County – only 2 percent between 1990 and 2000. Population growth trends differ significantly between the county and local community levels.

3.6.11.2 Employment and Income

According to the 2000 Census, 55.7 percent of individuals 16 years and older (1,396 of 2,507 total persons) were in the labor force in the Mojave Census Designated Place, compared to 56.6 percent in Kern County. The 2000 Census reported that unemployment rates in Mojave and Kern County were 8.2 percent and 6.7 percent, respectively. In Mojave, the top industries were education, health, and social services; art, entertainment, recreation, accommodation, and food services; manufacturing; and transportation, warehousing, and utilities. In Kern County, the top industries were education, health and social services; agriculture, forestry, fishing, hunting, and mining; retail trade; and public administration. As of July 2003, 950 individuals were employed by businesses at the Mojave Airport.

In 1999, the median household income for the Mojave Census Designated Place and Kern County was $24,761 and $35,446, respectively. The national median household income was $41,994.

3.6.11.3 Environmental Justice

Of the 3,836 persons living in the Mojave Census Designated Place in 2000, 1,433, or 37.3 percent, were minority, and 1,303, or 36.2 percent, had incomes below the poverty level.

3.6.11.4 Children's Environmental Health and Safety

The Mojave Air and Space Port is not near schools, daycare facilities, playgrounds, or other places where children are concentrated. Therefore, no further consideration of the protection of children from environmental health and safety risks is required.

3.6.12 Water Quality

3.6.12.1 Surface Water

The Mojave Desert is one of the most arid places in the United States (Kern County, 2003a). Average annual rainfall in the area is approximately 5 inches and average annual evaporation is 11 inches (DoD, 2002). Surface water flows resulting from storm events have high sediment concentrations, and water found in playas can have high concentrations of fine sediments due to wind forces (Kern County, 2003a). There are no streams with perennial water flow and no bodies of standing surface water at the Mojave Airport. However, there is a series of drainage channels to the east and southwest of the runways.

The State Water Resources Control Board and the Lahontan Region of the California Regional Water Quality Control Board (Water Board) regulate discharges to protect water quality. The Water Quality Control Plan for the Lahontan Region (Basin Plan) provides guidance regarding water quality and how the Water Board may regulate activities that have the potential to affect water quality within the region. The Basin Plan includes prohibitions, water quality standards, and policies for implementation of standards.

3.6.12.2 Groundwater

Water quality throughout the area varies. In general, groundwater closer to the recharge source is less mineralized than water farther away (Kern County, 2003a). Water at the discharge points can have high concentrations of sodium, potassium, chloride, sulfate, and tritium (Kern County, 2003a). At present, the Antelope Valley groundwater basin is in a state of overdraft.

3.6.13 Wetlands

There are no jurisdictional wetlands at the Mojave Air and Space Port. However, a series of drainage channels located to the east and southwest of the runway operating area could be considered non-jurisdictional wetlands.

3.7 Oklahoma Spaceport

The Oklahoma Spaceport is an FAA-licensed commercial launch site within the Clinton-Sherman Industrial Airpark in Washita County, Oklahoma. The Airpark occupies 2,700 acres adjacent to the town of Burns Flat. The Oklahoma Space Industry Development Authority operates the Oklahoma Spaceport, which is included within a 107,520-acre area designated by the Oklahoma State Legislature as the Oklahoma Spaceport Territory. The Airpark is a public-use airport used by both military and civilian aircraft primarily as a training facility. Launch infrastructure consists of a 13,500-foot (about 2.6-mile) runway, a 5,200-foot (about 1-mile) runway, a 50,000-square foot manufacturing facility, large maintenance, repair, and storage hangars, and a control tower.

Horizontal launches under an experimental permit would be expected to occur from one of the existing runways (see Exhibit 3-18). Vertical launches would occur from an existing or temporary concrete pad in a designated vertical launch area.

3.7.1 Air Quality

The Oklahoma Spaceport is in Southwestern Oklahoma Air Quality Control Region 189. This area has been designated as unclassifiable/attainment for all Federal and State of Oklahoma ambient air quality standards (EPA, 2008a; ODEQ, 2008). The Spaceport is in a Prevention of Significant Deterioration Class II area. Emissions of pollutants from current Clinton-Sherman Industrial Airpark operations are below Federal and state permitting requirements.

3.7.2 Biological Resources (Fish, Wildlife, and Plants)

The Oklahoma Spaceport is situated in an ecological region identified as the North American Grasslands and is included within a sub-region described as the Bluestem-Grama Prairie (Samson *et al*. 1998, 2000). This sub-region is named for the most dominant types of prairie grass (*Andropogon* spp. and *Bouteloua* spp.) in the area. The two most common grass species occurring at the Oklahoma Spaceport are bermuda grass and weeping love grass. Types of woody vegetation in Washita County include elm, cedar, dogwood, oak, walnut, and cottonwood.

Skunks, foxes, rabbits, squirrels, and coyotes are the most commonly sighted mammals at the Oklahoma Spaceport. The Oklahoma Natural Heritage database does not contain any records of occurrences of state or federally designated protected species at the Spaceport (USACE, 1999). In addition, a U.S. Corps of Engineers Final Remedial Investigation report noted that there were no federally protected species in the region of the Spaceport. Previous studies indicate that the endangered whooping crane could be found in or near the wetlands at the Oklahoma Spaceport during its spring and fall migration (FAA, 2006d); however, no critical habitat for the whooping crane has been identified at the Spaceport.

Suitable habitat has been identified at the Oklahoma Spaceport for a number of state listed species of special concern. Exhibit 3-19 lists the species of special concern possibly present at the Spaceport because of the presence of suitable habitat (USACE, 1999).

Exhibit 3-18. Oklahoma Spaceport and the Surrounding Area

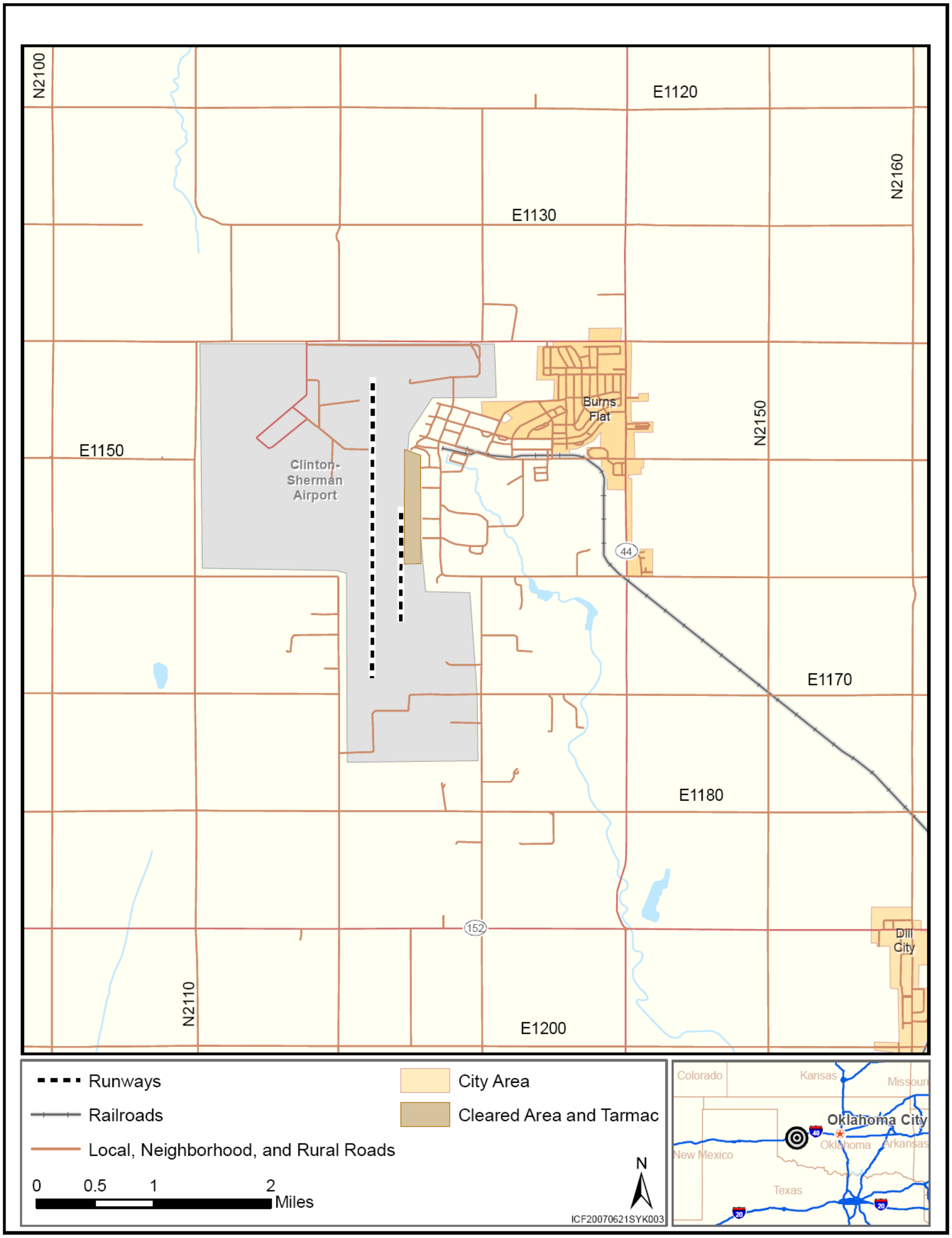


Exhibit 3-19. State and Federally Protected Species Possibly Present at the Oklahoma Spaceport

Common Name	Scientific Name	Federal Status	State Status
Bird Species			
Barn owl	*Tyto alba*	NL	SS2
Ferruginous hawk	*Buteo Regalis*	NL	SS1
Prairie falcon	*Falco mexicanus*	NL	SS1
Swainson's hawk	*Buteo swainsoni*	NL	SS2
Whopping crane	*Grus americana*	E	E
Animal Species			
Desert shrew	*Notiosorex crawfordi*	NL	SS2
Earless lizard	*Holbrookia maculata*	NL	SS2
Texas horned lizard	*Phrynosoma cornutum*	NL	SS2
Texas longnosed snake	*Rhinocheilus lecontei tessellatus*	NL	SS2

Source: USACE, 1999.

E = Endangered; NL = Not Listed; SS2 = State species of special concern, Category 2; SS1 = States species of special concern, Category 1

3.7.3 Historical, Architectural, Archaeological, and Cultural Resources

Much of the Oklahoma Spaceport has been disturbed by past U.S. Navy and Air Force activities. No prehistoric or historic archaeological sites or homesteads have been recorded within the boundary of the Clinton-Sherman Industrial Airpark (FAA, 2006d). However, prehistoric and historic archaeological sites have been identified in the surrounding area, the nearest of which is approximately 0.5 mile from the north boundary of the Airpark. No buildings or structures at the Oklahoma Spaceport are listed on the *National Register of Historic Places* (DOI, 2008).

The Oklahoma Spaceport is within the Cheyenne-Arapaho Nation. The FAA has identified seven Native American tribes of interest in the area of the Clinton-Sherman Industrial Airpark – Wichita, Apache, Caddo, Kiowa, Comanche, Cheyenne-Arapaho, and Chickasaw (FAA, 2006d).

3.7.4 Floodplains

Washita County participates in the National Flood Insurance Program; FEMA has not published any Flood Insurance Rate Maps for the Clinton-Sherman Industrial Airpark or the surrounding area. However, FEMA has approved an Airpark floodplain map prepared by the Oklahoma Water Resources Board. There are floodplains along the tributaries of Little Elk River and Base Lake (FAA, 2006d).

3.7.5 Hazardous Materials, Pollution Prevention, and Solid Waste

Oklahoma Spaceport adheres to the same standards as the Clinton-Sherman Industrial Airpark regarding hazardous materials, pollution prevention, and solid waste. Standard operating procedures have been established for hazardous waste operations, which include controls to protect personnel and the environment during operations involving hazardous materials. The Airpark follows directives on the applicable Material Safety Data Sheets and Right-to-Know directives for any hazardous materials/waste with which employees come in contact.

The Airpark stores Jet-A and low-lead fuels in above-ground storage tanks that have been installed and are maintained in compliance with appropriate local, state, and Federal standards and regulatory requirements. Other hazardous materials used and stored onsite include acetylene, paint, used hydraulic and motor oil, gear lubricant, and hydraulic fluid.

There have been releases of hazardous substances and petroleum products at the Clinton-Sherman Industrial Airpark as a result of Air Force and Navy activities. Numerous remediation actions, such as removing underground and above-ground storage tanks and excavating contaminated soils, have been taken. There were three Superfund sites near the Airpark, but none are on the National Priorities List, and the EPA has classified them as "no further remedial action planned."

3.7.6 Health and Safety

Oklahoma Spaceport adheres to the same standards as the Clinton-Sherman Industrial Airpark regarding health and safety, which includes adhering to National Fire Protection Association, OSHA, and applicable state and Federal guidelines. The Southwestern Oklahoma Development Authority is responsible for compliance with these regulations; however, the Oklahoma Space Industry Development Authority would evaluate flight hazards and conduct safety reviews for vehicles launched from the Oklahoma Spaceport.

Health and safety requirements at the Clinton-Sherman Industrial Airpark include industrial hygiene and ground safety. Industrial hygiene is the joint responsibility of the facility operator (the Southwestern Oklahoma Development Authority) and contractor safety departments. Responsibilities include monitoring contract and base worker exposure to workplace chemicals and physical hazards, hearing and respiratory protection, medical monitoring of contractor and base workers subject to chemical exposures, and oversight of all hazardous or potentially hazardous operations.

Ground safety includes protection from hazardous situations and hazardous materials. If personal protective equipment must be used, a general description of the equipment must be provided along with the hazardous qualities of the material, and data showing compliance with allowable limits for airborne vapors for workplace, workplace emergencies, and public exposures.

As the airpark manager, the Southwestern Oklahoma Development Authority conducts regular safety inspections at the Clinton-Sherman Industrial Airpark and has established standard operating procedures to meet occupational and system safety requirements. The Airpark has an onsite fire department and emergency response capabilities that could be available during launches. Additionally, the Clinton-Sherman Fire Department has developed a set of *Tactical Guidelines for Fuel Spill Procedures*, which establishes responsibility, outlines personnel duties, and provides resources and guidelines for use in control, clean up, and emergency response for spills or releases.

3.7.7 Land Use (including Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)

The geographical area of the Oklahoma Spaceport Territory is within the limits of Washita County and includes the communities of Burns Flat, Foss, and Canute. The Oklahoma Space Industry Development Authority was given municipal authority within the Territory, and the authority to establish specific development criteria for any space industry development within the Territory. Title to the Clinton-Sherman Industrial Airpark transferred from the City of Clinton to Oklahoma Space Industry Development Authority in December 2006.

The Clinton-Sherman Industrial Airpark encompasses an area of approximately 2,700 acres and measures approximately 2.4 miles from east to west, and 3.5 miles from north to south at its widest points. The

1996 Airport Master Plan defined seven categories of land use at the site. With the exception of residential, all land uses identified in the Master Plan still apply. Land use of the Airpark can be broken down into the following categories:

- Open space, 1,956 acres;
- Airfield pavement, 248 acres;
- Industrial, 238 acres;
- Outdoor recreation, 221 acres;
- Aircraft operations/maintenance, 29 acres; and
- Administrative, 8 acres.

Agricultural activities dominate land use in the area surrounding the Airpark. There are no prime or unique farmlands at the Oklahoma Spaceport, nor are there any wild and scenic rivers or coastal resources in the vicinity. The nearest Section 4(f) resource is Washita National Wildlife Refuge 12 miles north of the Airpark.

3.7.8 Light Emissions and Visual Resources

The conditions at the Oklahoma Spaceport are characterized as low visual sensitivity because the site is an industrialized area. The existing viewshed at the Spaceport includes such structures as hangars, warehouses, administrative buildings, and a manufacturing facility, and a continuous stream of aircraft operations. The area surrounding the Oklahoma Spaceport includes agricultural areas and sparsely occurring trees.

Light sources at the Oklahoma Spaceport include security lighting on the grounds and safety lighting on the runways, which are on overnight. Light is also generated from existing nighttime aircraft operations.

3.7.9 Natural Resources and Energy Supply

There are six actively used wells at the Clinton-Sherman Industrial Airpark (FAA, 2006d). One (well 424) is the primary source of water. Use of wells 108, 253, and 462 is limited to peak usage periods due to the presence of tricholoroethylene in concentrations above the maximum contaminant level. Six additional water wells were drilled offsite to restore the supply of water lost because of the excessive tricholoroethylene concentrations in some onsite wells. These wells have a combined yield of 100 to 150 gallons per minute (USACE, 1999).

Oklahoma Natural Gas Company maintains and operates gas distribution lines at the Spaceport. AEP Public Service Company provides electric power to the Spaceport (SWODA, 2009).

3.7.10 Noise and Compatible Land Use

The primary existing noise sources at Oklahoma Spaceport are aircraft operations at the Clinton-Sherman Industrial Airpark. There are residential structures in the vicinity of the Airpark, including a single-family house immediately north, approximately 2,000 feet to the northwest of the end of Runway 17R. However, ongoing activities have not resulted in significant noise complaints. The existing DNL 65 contour at the Airpark has been previously delineated and includes approximately 11,871 acres on and around the Airpark. Exhibit 3-20 shows the current DNL contours at the Clinton-Sherman Industrial Airpark.

3.7.11 Socioeconomic Resources, Environmental Justice, and Children's Environmental Health and Safety

3.7.11.1 Population

According to the 2000 Census, the Southwestern Oklahoma Development Authority region is home to a total population of 108,990, which is 3.2 percent of Oklahoma's total population. The Development Authority's average population density is 15.5 persons per square mile.

3.7.11.2 Employment and Income

At present, there are seven tenants leasing facilities at the Clinton-Sherman Industrial Airpark, including a restaurant, the Southwestern Oklahoma Development Authority, the Oklahoma Space Industry Development Authority, the Oklahoma Highway Patrol, the Oklahoma Department of Environmental Quality, a Fixed Base Operator, and a medical clinic. Some vacant facilities are occasionally leased on a monthly basis for storage.

According to the 2000 Census, management and professional occupations comprised 30.3 percent of the total workforce in the Development Authority region. The unemployment rate was 2.9 percent, which was below state and national averages. The median household income for Washita County was $32,842 in 2004.

3.7.11.3 Environmental Justice

Minority populations represent approximately 16.7 percent of the Development Authority region. Regardless of racial category, 9.3 percent of the population is of Hispanic or Latino origin. According to the 2000 Census, 17.9 percent of individuals living in the Development Authority region were below the poverty level.

3.7.11.4 Children's Environmental Health and Safety

Will Rogers Elementary School is the nearest public school to the Clinton-Sherman Industrial Airpark. The school is approximately 2 miles from the Airpark, on State Highway 44 adjacent to the housing area northeast of the Airpark. The Western Technology Center, Burns Flat Campus, adjoins a portion of the eastern boundary of the Airpark.

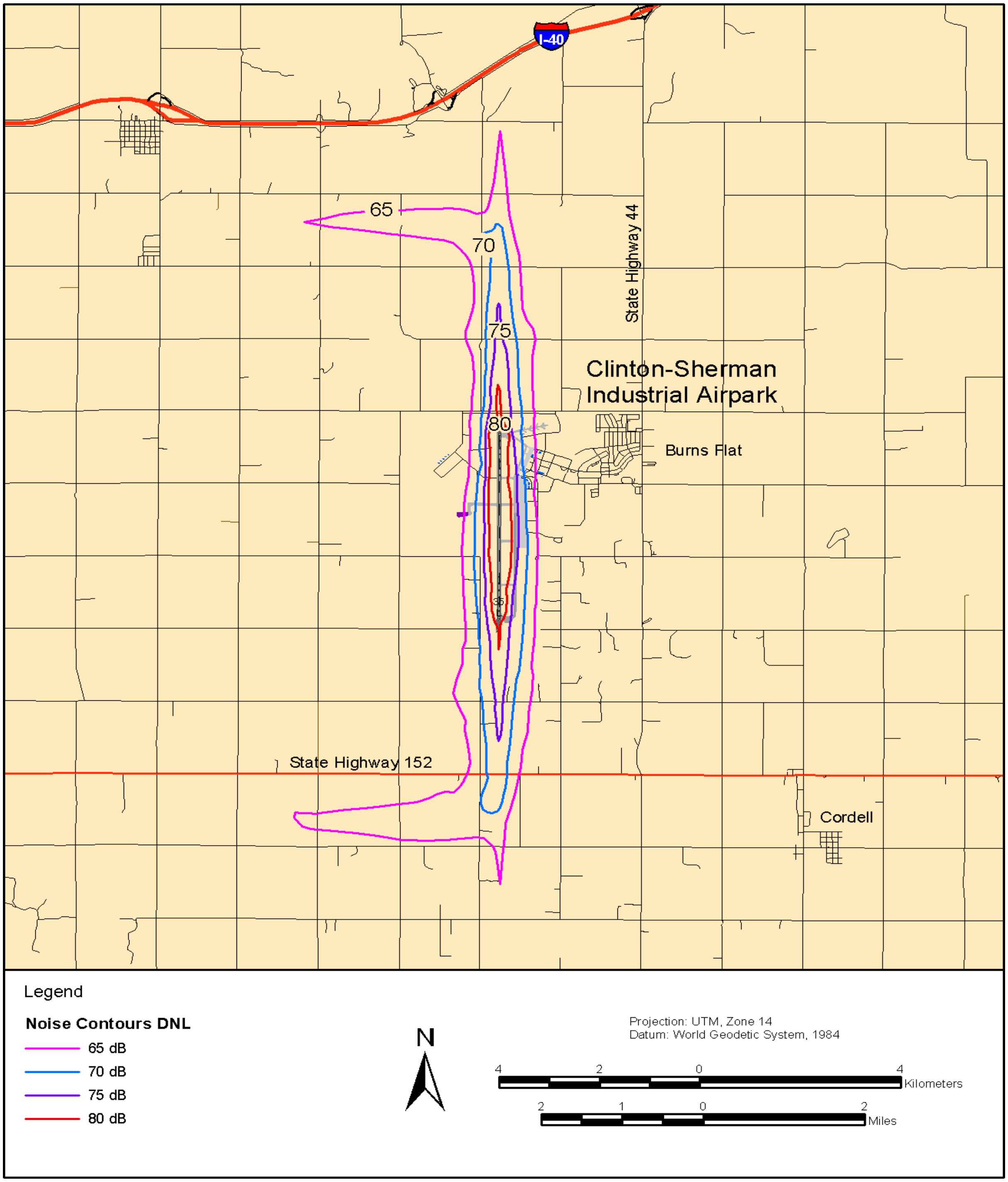
Census 2000 data shows that the Southwestern Oklahoma Development Authority region has a slightly smaller percentage of children under the age of 5 and 18 years compared to the United States, Oklahoma, Washita County, and the town of Burns Flat.

3.7.12 Water Quality

3.7.12.1 Surface Water

Washita County has an average annual precipitation of 28.4 inches (USACE, 1999). Most precipitation never becomes surface runoff, because a large percentage of the precipitation is intercepted by evaporation and vegetation or is stored in local depressions. The average annual surface runoff at the Clinton-Sherman Industrial Airpark varies from 1.0 to 1.5 inches per year (Oklahoma Geologic Survey, 1976).

Exhibit 3-20. Current Day-Night Average Sound Level Contours at the Clinton-Sherman Industrial Airport



Source: FAA, 2006d.

There is a ridgeline that crosses the northern portion of the runway in an east to west direction, and surface waters south of the ridgeline flow in a south to southeasterly direction into Base Lake or a nearby ditch. Both the lake and the ditch discharge into the headwaters of Little Elk Creek. Little Elk Creek flows south-southeast into Lake Hobart, also known as Rocky Lake. Lake Hobart is in Kiowa County and is formed by a dam on Little Elk Creek. Lake Hobart empties into Little Elk Creek, which flows into Elk Creek. Elk Creek flows into the North Fork of the Red River and eventually into the Red River (Benham Group, 1996; USGS, 1990). The North Fork of the Red River is identified on Oklahoma's 303(d) list as a water body that does not meet its designated water quality standards. The North Fork of the Red River is impaired with metals (selenium), pathogens, turbidity, chlorides, and total dissolved solids, with no potential sources (EPA, 2005).

Surface waters north of the ridgeline flow toward Monument Creek, Sand Creek, and other, unnamed, tributaries of Turkey Creek in a north and northeasterly direction. Turkey Creek eventually flows into the Washita River (Benham Group, 1996; USGS, 1990). The Washita River is identified on Oklahoma's 303(d) list as a water body that does not meet its designated water quality standards. The Washita River is impaired with pathogens and turbidity (FAA, 2006d).

3.7.12.2 Groundwater

The Elk City Sandstone is the major aquifer in the vicinity of the Clinton-Sherman Industrial Airpark. There are three sources of groundwater at the Airpark – the Elk City Sandstone, the shallow soils above the Elk City Sandstone less than 40 feet below ground surface, and the Doxy Shale. The groundwater gradient in the Elk City Sandstone is 0.0091 foot per foot to the southeast, the groundwater gradient in the shallow source is 0.0048 foot per foot to the southeast, and groundwater flow in the Doxy Shale is 0.0039 foot per foot to the south. The shallow source is not used for potable water supply (USACE, 1999).

There has been groundwater contamination at the Airpark from historical military operations at the site. Solvents, metals, and organics have been identified and have resulted in the abandonment of several water wells. A summary of the nature and extent of groundwater contamination identified during Phases I, II, and III of the remedial investigations conducted at the Airpark is contained in the *Final Data Evaluation Document in Support of the Remedial Investigation at the Clinton-Sherman Industrial Airpark* (FAA, 2006d) and the U.S. Army Corps of Engineers *Final Remedial Investigation Report Clinton-Sherman Industrial Airpark Burns Flat, Oklahoma* (USACE, 1999).

3.7.13 Wetlands

The U.S. Fish and Wildlife Service National Wetlands Inventory Map indicates that the wetlands at the Clinton-Sherman Industrial Airpark are concentrated along the tributaries of Little Elk Creek and include Base Lake. Base Lake covers an area of 6 acres and has a storage capacity of 83 acre-feet (Oklahoma Water Resources Board, 1990). Because the wetlands are hydraulically connected to waters of the U.S., the wetlands associated with the tributaries – Little Elk Creek and Base Lake – are jurisdictional wetlands. All of the wetlands at the Airpark are classified as part of the palustrine system.

3.8 Space Florida

Space Florida manages and operates an FAA-licensed commercial launch site collocated with CCAFS in Brevard County, Florida. Space Florida holds a Launch Site Operator License for Launch Complex (LC)-46 and provides commercial launch services (see Exhibit 3-21). LC-46 is situated on the Canaveral Peninsula and is bordered on the east by the Atlantic Ocean, on the west by the Banana River, on the north by KSC, and on the south by Port Canaveral.

3.8.1 Air Quality

Brevard County has been designated by the EPA and the Florida Department of Environmental Protection to be in attainment for Federal and State of Florida ambient air quality standards (EPA, 2008a; FDEP, 2008). Stationary point sources of air emissions onsite typically include launch vehicle processing, fueling, and other point sources such as heating/power plants, generators, incinerators, and storage tanks.

Mobile sources include support equipment, commercial transport vehicles, rocket launch vehicles, and personal motor vehicles. CCAFS operates under a Title V permit (USAF, 1998, 2006).

3.8.2 Biological Resources (Fish, Wildlife, and Plants)

CCAFS is situated on the central east coast of Florida on 15,800 acres of a barrier island, south Merritt Island Wildlife Refuge, and KSC (USAF, 1998). CCAFS contains a series of ridges and swales already fragmented by construction for previous launch activities (USAF, 1998). CCAFS contains wetlands, estuaries, and lagoons and associated vegetation communities, such as the indigenous Florida coastal scrub, coastal and sea grasses, and xeric and maritime hammocks.

CCAFS is in an aquatic transition zone between temperate and subtropical climates, resulting in diverse aquatic biota. Marine species that inhabit areas around CCAFS include bottlenose dolphins, spotted dolphins, and manatees (USAF, 1998). Manatees inhabit salt-water lagoon systems, and the U.S. Fish and Wildlife Service has designated the Indian and Banana Rivers as critical manatee habitat. Additionally, each year more than 3,000 loggerhead turtle nests and 100 green sea turtle nests are deposited on CCAFS beaches, which are protected nesting habitat for these federally protected sea turtles (USAF, 2007b). The area is also habitat for many commercially harvested marine species. However, there is no designated critical habitat under Section 4 of the Endangered Species Act at LC-46.

Many terrestrial animal species, including white-tail deer, armadillos, bobcats, feral hogs, raccoons, long-tail weasels, and round-tail muskrats inhabit CCAFS. It is also home to the Florida mouse (USAF, 1998). The gopher tortoise, a state-protected species, is also present at CCAFS. The coastal dunes at CCAFS are a core Florida scrub jay habitat. Wood storks have also been observed feeding in the CCAFS drainage canal system (USAF, 2007b), and least terns nest on gravel beaches on the southern section of CCAFS. Exhibit 3-22 lists the state and federally protected species possibly present at CCAFS. CCAFS is also home to numerous migratory seabird species, which have been observed nesting in the area and in the adjacent Canaveral National Seashore and Merritt Island National Wildlife Refuge (USAF, 1998, 2006).

3.8.3 Historical, Architectural, Archaeological, and Cultural Resources

Cultural facilities at CCAFS include the Air Force Space and Missile Museum and the original NASA Mission Control Center. Many archaeological sites at CCAFS/KSC containing prehistoric and/or historic components have been identified (USAF, 1998). Many of these sites are listed or deemed eligible for listing on the National Register of Historic Places. A number of launch pads and the original Mission Control Center at CCAFS are listed on the National Register and form a National Historic Landmark District (DOI, 2008).

3.8.4 Floodplains

The 100-year floodplain is within the boundary of LC-46 (USAF, 2007b).

Exhibit 3-21. Space Florida and the Surrounding Area

Exhibit 3-22. State and Federally Protected Species Possibly Present at Cape Canaveral Air Force Station

Common Name	Scientific Name	Federal Status	State Status
Plant Species			
Giant leatherfern	*Acrostichum danaeifolium*	NL	T
Curtiss' milkweed	*Asclepias curtissii*	NL	E
Satin-leaf	*Chrysophyllum olivaeforme*	NL	E
Coastal vervain	*Glandulareia maritima*	(C2)	E
Nodding pinweed	*Lechea cernua*	NL	E
Hand fern	*Ophioglossum palmatum*	NL	E
Golden polypody	*Phlebodium aurea*	NL	T
Beach-star	*Remirea maritima*	NL	E
Reptiles and Amphibians			
Gopher frog	*Rana capito*	E	SSC
American alligator	*Alligator mississippiensis*	T	SSC
Eastern Indigo snake	*Drymarchon corais couperi*	T	T
Gopher tortoise	*Gopherus polyphemus*	T	T
Green turtle	*Chelonia mydas*	E	E
Hawksbill sea turtle	*Eretmochelys imbricata imbricata*	E	E
Loggerhead turtle	*Caretta caretta*	T	T
Leatherback turtle	*Dermochelys coriacea*	E	E
Kemp's Ridley turtle	*Lepidochelys kempi*	E	E
Birds			
Wood stork	*Mycteria americana*	E	E
Peregrine falcon	*Falco peregrinus*	-	E
Florida scrub jay	*Aphelocoma coerulescens coerulescens*	T	T
Piping plover	*Charadrius melodus*	T	T
Least tern	*Sterna antillarum*	-	T
Southeastern American kestrel	*Falco sparverius paulus*	T	T
Mammals			
Southeastern beach mouse	*Peromyscus polionotus niveiventris*	T	T
West Indian (Florida) manatee	*Trichechus manatus*	E	E
Finback whale	*Balaenoptera physalus*	E	E
Humpback whale	*Megaptera novaeangliae*	E	E
Northern right whale	*Eubalaena glacialis*	E	E
Sei whale	*Baeaenoptera borealis*	E	E
Sperm whale	*Physeter catadon*	E	E

Sources: USAF, 1998, 2007b; FNAI, 2007.

C = Candidate (former Category C1); C2 = Former Category 2; E = Endangered; SSC = State species of special concern; NL = Not listed; T = threatened

3.8.5 Hazardous Materials, Pollution Prevention, and Solid Waste

Space Florida adheres to the same standards as CCAFS regarding hazardous materials, pollution prevention, and solid waste. Numerous types of hazardous materials are used to support various missions and general maintenance operations at CCAFS. Hazardous materials are managed using a HazMart Pharmacy, and the Joint Propellants Contractor controls the purchase, transport, and temporary storage of hazardous propellants. CCAFS operates 40 hazardous waste satellite accumulation points and 14 90-day accumulation areas on the station. The one permitted storage facility is allowed to store hazardous wastes for up to 1 year. Response to hazardous spills is covered under the Consolidated Comprehensive Emergency Management Plan (USAF, 1998, 2006).

The 1996 Storm Water Pollution Prevention Program Guide and Pollution Prevention Management Action Plan satisfy requirements of the Pollution Prevention Act of 1990, as amended (42 U.S.C. 13101 *et seq*.). The Pollution Prevention Program Guide establishes the overall strategy, delineates responsibilities, and sets forth specific objectives for reducing pollution of the ground, air, surface water, and groundwater. Specific goals include implementation of management practices that eliminate or reduce the use of hazardous materials, increase efficiency in the use of raw materials, protect natural resources, and encourage source reduction through recycling, treatment, and disposal practices (USAF, 1998).

A private contractor collects general solid refuse at CCAFS and disposes of it offsite at the Brevard County Landfill, a 192-acre Class I landfill near the City of Cocoa. CCAFS also operates a 182-acre onsite landfill that accepts construction and demolition debris and material containing asbestos (USAF, 1998).

3.8.6 Health and Safety

Space Florida adheres to the same standards as CCAFS regarding health and safety. The range contractor at CCAFS, the City of Cape Canaveral, Brevard County, and KSC have a mutual-aid agreement in the event of an on- or off-station emergency. Each organization may request equipment and manpower in the event of a fire or other emergency. During launch activities, communication is maintained between Brevard County Emergency Management, KSC, the Florida Marine Patrol, the U.S. Coast Guard, and the State Warning Point, Division of Emergency Management, in Tallahassee, Florida. The Launch Disaster Control Group is an emergency response team formed before each launch and situated at a fall-back location to respond to launch accidents to save lives, protect property, control fires, limit the extent of damage, prevent adverse public relations, and return to normal launch operations as soon as possible after an accident (USAF, 1998).

Range Safety personnel monitor launch activities to ensure that risks to people, aircraft, and surface vessels are within acceptable limits. Launches are not allowed if an undue hazard exists for persons and property due to potential dispersion of hazardous materials or propagation of blast. The Toxic Hazard Control Plan details the procedures to be used to control heated toxic gas hazards, which are predicted using air dispersion computer models (USAF, 1998).

3.8.7 Land Use (including Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)

CCAFS encompasses 15,800 acres, representing approximately 2 percent of the total land area of Brevard County. Brevard County and the City of Cape Canaveral are the local planning authorities for incorporated and unincorporated areas near CCAFS. The City of Cape Canaveral Comprehensive Plan designates residential, commercial, industrial, public facilities and recreation, and open space land-use areas, with continued commercial and industrial uses planned for Port Canaveral. Neither Brevard County nor the City of Cape Canaveral has land-use authority over CCAFS because it is federally owned. CCAFS designates its own land-use and zoning regulations. KSC, which is north and west of CCAFS, includes predominantly industrial uses associated with NASA launch programs and open space associated with the Merritt Island National Wildlife Refuge and nearby Canaveral National Seashore, which are the nearest Section 4(f) resources. Uses of the river and ocean water areas surrounding CCAFS include commercial fishing, marine recreation, and marine transportation (USAF, 1998).

There are no prime or general farmlands at CCAFS. There are no wild and scenic rivers at LC-46; however, several nearby water bodies have been designated as Outstanding Florida Water, including most of Mosquito Lagoon and the Banana River, Indian River Aquatic Preserve, Banana River State Aquatic Preserve, Pelican Island National Wildlife Refuge, and Canaveral National Seashore (USAF, 1998).

In Brevard County, the Florida Coastal Management Program, formed by the Florida Coastal Management Act, applies to activities occurring in or affecting the coastal zone. The entire state is defined as being within the coastal zone, and in Brevard County the no-development zone extends from the mean high water level inland 50 feet (Chapter 62B-33 F.A.C.). CCAFS has additional siting and facility design standards for construction near the coast that require facilities to be set back at least 150 feet from the coast.

3.8.8 Light Emissions and Visual Resources

The launch area contains and is surrounded by major infrastructure; therefore, visual sensitivity is categorized as low. CCAFS has developed Local Space Wing instructions to reduce the impact of artificial lighting on the beach and reduce disorientation of marine turtle hatchlings. The instructions state that photocells should only be used to support security or other mission-specific activities that occur on a regular schedule each night. Timer or motion detectors are suggested to minimize the impacts of evening lighting.

3.8.9 Natural Resources and Energy Supply

The water delivered to CCAFS, which has a system capacity of 3 million gallons per day, comes from the Floridian Aquifer and is delivered by the City of Cocoa's water distribution system. Additionally, eight ground-level tanks, with a total capacity of 5.2 million gallons, are used to store deluge water, which is supplied to the launch pads (USAF, 1998).

Electric lines enter CCAFS at three locations – the southwestern boundary, across the NASA Causeway, and from Merritt Island. The capacity of the three substations is 55 megawatts, and they are capable of providing 1,320 megawatt hours of electricity per day. There are also 170 substations on CCAFS that convert the voltage to user voltages (USAF, 1998).

3.8.10 Noise and Compatible Land Use

Most of the area to the east and west of CCAFS is open water. With KSC to the north, the nearest residential areas are to the south at the City of Port Canaveral, where noise levels are normally low (45 to 55 dBA). The launch of space vehicles does generate intense, but relatively short-duration, noise levels of low frequencies. The highest recorded levels in the area are those associated with the Space Shuttle launch at KSC, which can exceed 160 dBA in the launch vicinity (*i.e.*, the launch pad and its supporting facilities) (USAF, 1998). Although rocket launches can produce sonic booms during the vehicle's ascent, the resulting overpressures are directed out over the ocean in the direction of the launch azimuth and generally do not affect the Florida coast.

3.8.11 Socioeconomic Resources, Environmental Justice, and Children's Environmental Health and Safety

3.8.11.1 Population

CCAFS is in eastern Brevard County, Florida, approximately 14.5 miles northeast of the City of Cocoa and approximately 19.5 miles southeast of Titusville. See Section 3.3.11 for population statistics for Brevard County, Florida.

3.8.11.2 Employment and Income

See Section 3.3.11 for information on employment and income for Brevard County, Florida.

3.8.11.3 Environmental Justice

About 10 percent of the population of Brevard County reported incomes that were below the poverty threshold, with about 15 percent of persons below the age of 18 living below the poverty level. Three communities (City of Cocoa, City of Oak Hill, and Mims) have low-income populations above the state average. The City of Cocoa reported nearly one-quarter of its residents below the poverty level, more than twice the state average. The portion of the population living below the poverty level in the three communities has not changed appreciably between 1989 and 1999 (NASA, 2004a).

3.8.11.4 Children's Environmental Health and Safety

The school nearest the launch site is Cape View Elementary School in the City of Cape Canaveral. The school is approximately 6.3 miles southwest of LC-46 along the Atlantic shoreline.

3.8.12 Water Quality

3.8.12.1 Surface Water

Cape Canaveral is within the Florida Middle East Coast Basin and situated on a barrier island that separates the Banana River from the Atlantic Ocean. There are three estuarine lagoons in proximity to CCAFS – the Banana River, 4 miles immediately west of LC-46; Mosquito Lagoon, 16 miles north; and the Indian River, 11.4 miles west – separated from the Banana River by Merritt Island. Several waterbodies in the Middle East Coast Basin have been designated as Outstanding Florida Water in Chapter 62-3 of the Florida Administrative Code, including most of Mosquito Lagoon and the Banana River, Indian River Aquatic Preserve, Banana River State Aquatic Preserve, Pelican Island National Wildlife Refuge, and Canaveral National Seashore. These waterbodies are afforded the highest level of protection, and any compromise of ambient water is prohibited (USAF, 1998).

The Indian River Lagoon system has been determined to be an estuary of national significance and has been designated a National Estuary Program (EPA, 2007d). EPA established the National Estuary Program to improve the quality of estuaries of national importance by maintaining and restoring the water quality and biological resources of each estuarine system (EPA, 2007a). All of Mosquito Lagoon is designated by the State of Florida as Class II water for shellfish harvesting (USAF, 1994). The Banana River has been designated a Class III surface water as defined in the Clean Water Act. Class III standards are intended to maintain a level of water quality suitable for recreation and the production of fish and wildlife communities (USAF, 1998).

Inland surface waters west of LC-46 have generally good water quality, little to no tidal influences (relying instead on wind-driven currents), and are subject to thermal and oxygen stratification in deeper channel areas. There is a natural pond and a freshwater borrow pit south of Camera B Road. There is a drainage system at LC-46 approximately 700 feet from the launch pad (USAF, 1994).

3.8.12.2 Groundwater

The surficial and Floridian aquifer systems underlie CCAFS (USAF, 1998). Within the project area, depth to groundwater in the surficial aquifer is typically not more than 3 feet below ground surface. The bottom of the surfical aquifer at CCAFS is about 100 feet below ground surface. Groundwater under LC-46 in the surficial aquifer flows to the east toward the Atlantic Ocean (Reynolds, Smith and Hills, Inc., 2006). The Floridian Aquifer is overlain by confining beds 80 to 120 feet thick that will not readily transmit water (Reynolds, Smith and Hills, Inc., 2006; USAF, 1998).

A below-grade water line supplies potable water for the LC-46 facilities. Because of the current lack of activity at LC-46, water quality is not being monitored for compliance with drinking water standards. From 1954 to 1965, there was a firefighting training pit, designated as Solid Waste Management Unit 32 (Fire Training Area No. 1), 200 feet southeast of the current launch pad. During that time, petroleum oil and lubricant waste, halogenated and non-halogenated solvents, and contaminated fuels were applied to the soil and ignited. Installation Restoration Program investigations in 2004 found arsenic contamination in the groundwater. The Installation Restoration Program is designed to evaluate potential contamination at DoD installations throughout the country. Several of the launch complexes at CCAFS have been found, preliminarily, to have surface and subsurface contamination from past operational practices (USAF, 1994). Institutional controls are in place to restrict contact with and use of groundwater at this location (Reynolds, Smith and Hills, Inc., 2006).

3.8.13 Wetlands

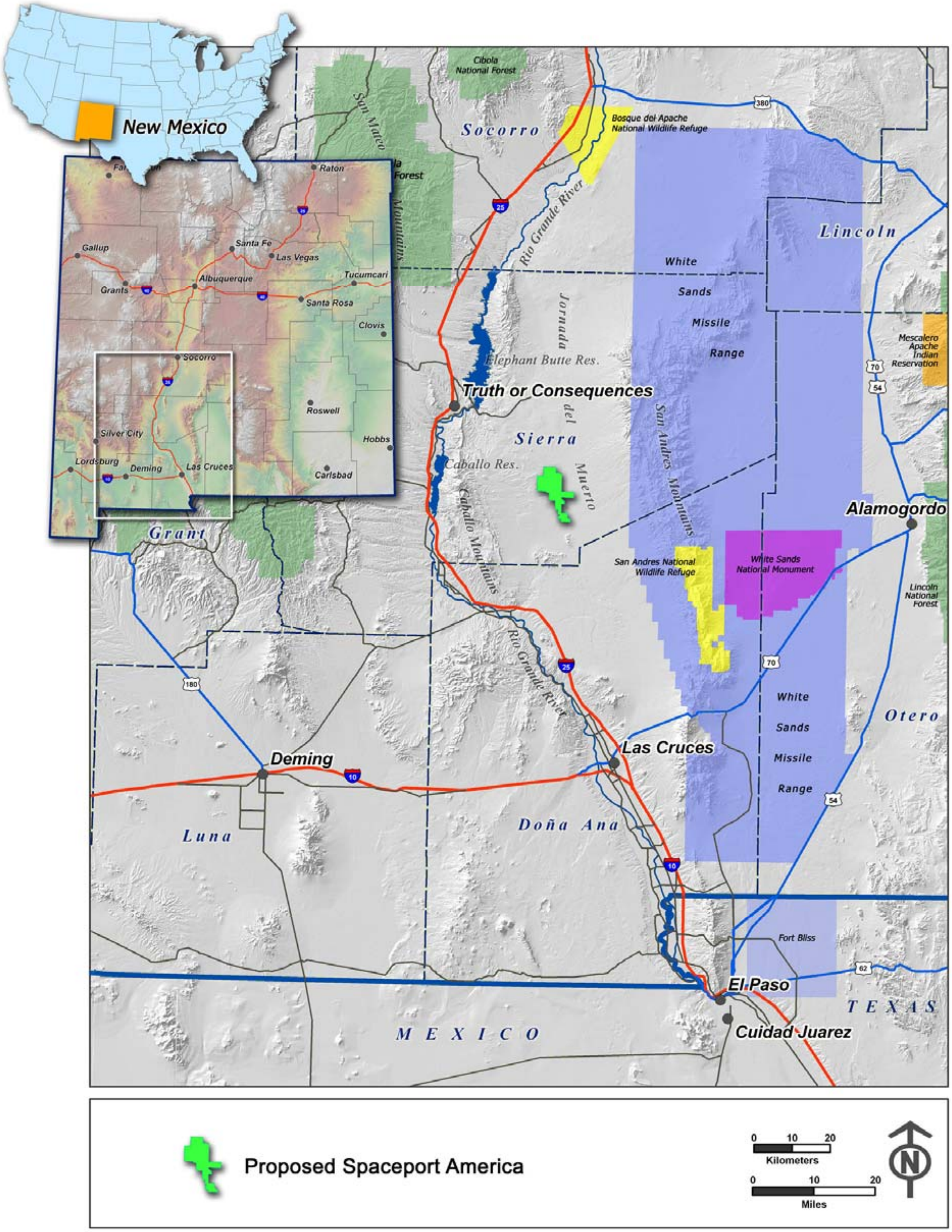
There are several large palustrine, emergent wetland areas approximately 750 feet from the LC-46 launch pad (USAF, 2006).

3.9 Spaceport America

Spaceport America will be an FAA-licensed commercial launch site occupying approximately 145 acres of land in Sierra County in south-central New Mexico, about 45 miles north of Las Cruces and 30 miles southeast of the town of Truth or Consequences (Exhibit 3-23). This facility has yet to be constructed; however, it has received an FAA Launch Site Operator License and is expected to be operational by 2010.

FAA issued the Final EIS for Spaceport America in November 2008. The launch site will be 9 miles west of the U.S. Army's White Sands Missile Range and approximately 18 miles east of Interstate 25 (I-25). The site will be operated by the New Mexico Spaceport Authority, a branch of the New Mexico Economic Development Department, in conjunction with the State of New Mexico, and will provide a variety of commercial launch services. Horizontal launch vehicles would launch and land at the Spaceport America airfield. Vertical launch vehicles would launch from Spaceport America and would either land at Spaceport America or at the Missile Range. Other potential activities at Spaceport America include transport of launch vehicles to the assembly or staging areas, transport and storage of rocket propellants and other fuels, vehicle recovery activities, ground-based tests and static firings, and training. Spaceport America could also host the X Prize Cup, a week-long event which will feature competitions, demonstrations, and displays centered on space travel and exploration.

Exhibit 3-23. Spaceport America and the Surrounding Area



Launch infrastructure (Exhibit 3-24) at Spaceport America will consist of a 10,000-foot (about 1.9-mile) north-south runway for horizontal launches, an array of buildings and facilities including a static rocket test stand, vehicle assembly buildings, launch control facilities, and propellant storage facilities constructed in a "campus" setting at the northern end of the runway, and a vertical launch development area surrounding the existing amateur launch pad (FAA, 2008a).

3.9.1 Air Quality

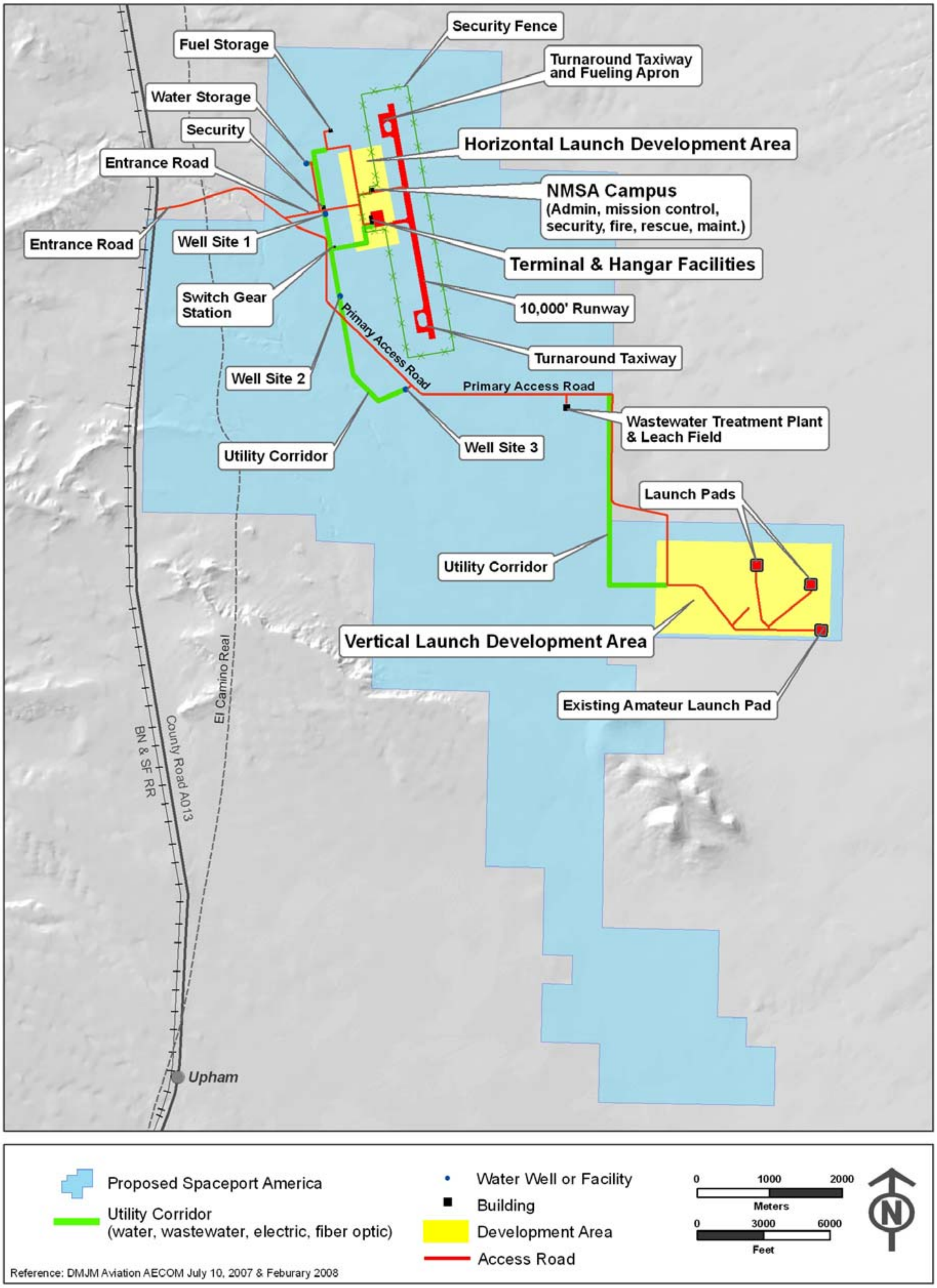
Spaceport America will be in Sierra County, New Mexico, just northeast of Upham, about 45 miles north of Las Cruces, and about 30 miles southeast of Truth or Consequences. Sierra County is part of the El Paso-Las Cruces-Alamogordo Interstate Air Quality Control Region (AQCR 153). In addition to the criteria pollutants covered by the NAAQS, the New Mexico Environment Department has promulgated ambient air quality standards for total suspended particulates (TSPs), hydrogen sulfide (H_2S), total reduced sulfur, and a 24-hour NO_2 standard, as shown in Exhibit 3-2. Sierra County, including the site of Spaceport America, is in attainment of Federal and New Mexico Ambient Air Quality Standards. The nearest nonattainment area is Anthony, about 70 miles south of Spaceport America, which is in nonattainment for PM_{10}. This nonattainment is thought to result primarily from non-anthropogenic sources and heavy traffic on unpaved roads in the Anthony area (FAA, 2008a). In contrast, the Spaceport America site is currently undeveloped. There are few anthropogenic emissions in the Spaceport America area, and traffic volumes on unpaved roads are as low as 20 vehicles per day (FAA, 2008a). No measurements of existing air quality have been made near Spaceport America. The nearest New Mexico Environmental Department monitoring stations are in the Las Cruces area, about 40 miles south of the site (NMED, 2006a, as cited in FAA, 2008a). The Las Cruces area is in attainment for all pollutants. Given the scarcity of emission sources in the region around the Spaceport America site, existing air quality at the site is expected to be within the Federal and New Mexico ambient air quality standards.

3.9.2 Biological Resources (Fish, Wildlife, and Plants)

The area surrounding Spaceport America is an arid desert environment with no perennial water to support fish or other aquatic organisms. Vegetation in the vicinity encompasses three major vegetation types – semi-desert grassland, plains-mesa sand scrub, and Chihuahuan desert scrub. Grass species are prominent, and trees, shrubs, and succulents primarily include honey mesquite, creosote bush, desert sumac, yucca, tarbush, ocotillo, long-leaf ephedra, broom snakeweed, Russian thistle, white horsenettle, and buffalo gourd. The New Mexico Department of Game and Fish considers semi-desert grasslands to be a "key terrestrial habitat" in need of preservation and restoration. Therefore, the Department is working to restore grassland habitat on nearly 100,000 acres of rangelands adjacent to the launch pad site as part of the Jornada del Muerto Wildlife Habitat Management Plan and Jornada del Muerto Grassland Restoration projects (FAA, 2008a).

The Spaceport America site is within the Jornada del Muerto region, which has a high degree of biological diversity. A large number of birds use the Rio Grande Flyway, which is 15 to 25 miles west of the Spaceport America site. Forty avian species were observed during biological surveys of the site and associated corridors, and most of the observed birds are protected under the provisions of the Migratory Bird Treaty Act and New Mexico statutes. Four avian species – the Swainson's hawk, scaled quail, northern harrier, and loggerhead shrike – observed during site surveys are considered priority (migratory bird) species for local habitats (FAA, 2008a). Additionally, all raptors have protected status under New Mexico statutes.

Exhibit 3-24. Proposed Spaceport America Infrastructure Components and Locations



Other animal species in the area of Spaceport America include mule, pronghorn antelope, mountain lion, and African oryx. The population of oryx, a nonnative species, is increasing in the Spaceport America area. In addition, a small population of desert bighorn sheep, a State of New Mexico endangered species, inhabits the upper reaches of the San Andres Mountains on the White Sands Missile Range along the eastern boundary of Spaceport America. Exhibit 3-25 lists the state and federally protected species possibly present near Spaceport America.

Exhibit 3-25. State and Federally Protected Species Listed for Sierra and Doña Ana Counties, New Mexico (page 1 of 4)

Common Name	Scientific Name	Federal Status	State Status
Birds			
Northern goshawk	*Accipiter gentilis*	SOC, S	-
Baird's sparrow	*Ammodramus bairdii*	SOC, S	T
Northern gray hawk	*Asturina nitida maximus*	SOC, S	-
Burrowing owl	*Athene cunicularia hypugaea*	SOC, S	-
Common black-hawk	*Buteogallus anthracinus anthracinus*	SOC	T
Lucifer hummingbird	*Calothorax lucifer*	-	T
Costa's hummingbird	*Calypte costae*	-	T
Buff-collared nightjar	*Caprimulgus ridgwayi ridgwayi*	-	E
Mountain plover	*Charadrius montanus*	SOC	-
Black tern	*Chlidonias niger surinamensis*	SOC, S	-
Yellow-billed cuckoo	*Coccyzus americanus*	C	
Common ground-dove	*Columbina passerine pallescens*	-	E
Broad-billed hummingbird	*Cyanthus latirostris magicus*	-	T
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	-
Northern Aplomado falcon	*Falco femoralis septentrionalis*	E	E
American peregrine falcon	*Falco peregrinus anatum*	SOC	T
Artic peregrine falcon	*Falco peregrinus tundrius*	SOC	T
Bald eagle	*Haliaeetus leucocephalus*	DL, SOC	T
Loggerhead shrike	*Lanius ludovicianus*	S	-
Varied bunting	*Passerina versicolor*	-	T
Brown pelican	*Pelecanus occidentalis carolinensis*	-	E
Neotropic cormorant	*Phalacrocorax brasilianus*	-	T
Interior least tern	*Sterna antillarum athalassos*	E	E
Mexican spotted owl & Designated Critical Habitat	*Strix occidentalis lucida*	T	-
Elegant trogon	*Trogon elegans canescens*	-	E
Thick-billed kingbird	*Tyrannus crassirostris*	-	E
Bell's vireo	*Vireo bellii*	SOC	T

Exhibit 3-25. State and Federally Protected Species Listed for Sierra and Doña Ana Counties, New Mexico (page 2 of 4)

Common Name	Scientific Name	Federal Status	State Status
Gray vireo	*Vireo vicinior*	-	T
Fish			
Longfin dace	*Agosia chrysogaster*	S	T
Desert sucker	*Catostomus clarki*	SOC	-
White Sands pupfish	*Cyprinodon tularosa*	SOC	T
Rio Grande silvery minnow	*Hybognathus amarus*	E	E
Rio Grande cutthroat trout	*Oncorhynchus clarki virginalis*	SOC,S	-
Gila trout	*Oncorhynchus gilae*	T	T
Mammals			
Mexican gray wolf	*Canis lupus bailiey*	E	-
Pale Townsend's big-eared bat	*Corynorhinus townsendii*	SOC, S	-
Black-tailed prairie dog	*Cynomys ludovicianus*	SOC	-
Spotted bat	*Euderma maculatum*	-	T
Organ Mountains Colorado chipmunk	*Eutamias quadrivittus australis*	SOC, S	T
Desert pocket gopher	*Geomys arenius arenius*	SOC, S	-
Allen's big-eared bat	*Idionycteris phyllotis*	SOC	-
Western red bat	*Lasiurus blossevillii*	SOC	-
Southwestern otter	*Lutra canadensis sonorae*	SOC	-
Black-footed ferret	*Mustela nigripes*	E	-
Western small-footed myotis bat	*Myotis ciliolabrum melanorhinus*	S	-
Long-eared myotis bat	*Myotis evotis evotis*	S	-
Fringed myotis bat	*Myotis thysanodes thysanodes*	S	-
Long-legged myotis bat	*Myotis volans interior*	S	-
Yuma myotis bat	*Myotis yumanensis yumanensis*	S	-
White sands woodrat	*Neotoma micropus leucophaea*	SOC	-
Allen's big free-tailed bat	*Nyctinomops macrotis*	S	-
Pecos River muskrat	*Ondatra zibethicus ripensis*	SOC, S	-
Desert bighorn sheep	*Ovis canadensis mexicana*	-	E
Amphibians			
Arizona toad	*Bufo microscaphus microscaphus*	S	-
Chiricahua leopard frog	*Rana chiricahuensis*	T	-

Exhibit 3-25. State and Federally Protected Species Listed for Sierra and Doña Ana Counties, New Mexico (page 3 of 4)

Common Name	Scientific Name	Federal Status	State Status
Reptile			
Texas horned lizard	*Phrynosoma cornutum*	S	
Invertebrates			
Desert viceroy butterfly	*Limenitis archippus obsolete*	SOC	-
Anthony blister beetle	*Lytta mirifica*	SOC	-
Mineral Creek mountain snail	*Oreohelix pilsbryi*	-	T
Doña Ana talus snail	*Sonorella todseni*	SOC	T
Plants			
Grayish-white giant hyssop	*Agastache cana*	SOC	SOC
Castetter's milkvetch	*Astragalus castetteri*	SOC	SOC
Sandhill goosefoot	*Chenopodium cycloides*	SOC	-
Wright's marsh thistle	*Cirsium wrightii*	SOC	E
Warner's dodder	*Cuscuta warnerii*	SOC	SOC
Metcalfe's ticktrefoil	*Desmodium metcalfei*	SOC	SOC
Mogollon whitlowgrass	*Draba mogollonica*	SOC	SOC
Standley's whitlowgrass	*Draba standleyi*	SOC, S	SOC
Rock fleabane	*Erigeron scopulinus*	SOC, S	SOC
Duncan's pincushion cactus	*Escobaria duncanii*	SOC, S	E
Sandberg pincushion cactus	*Escobaria sandbergii*	SOC, S	SOC
Sneed's pincushion cactus	*Escobaria sneedii var. sneedii*	E, S	E
Villard pincushion cactus	*Escobaria villardii*	SOC, S	E
New Mexico gumweed	*Grindelia arizonica var. neomexicana*	SOC	SOC
Todsen's pennyroyal & Designated Critical Habitat	*Hedeoma todsenii*	E, S	E
Arizona coralroot	*Hexalectris spicata var. arizonica*	SOC, S	E
Vasey's bitterweed	*Hymenoxys vaseyi*	SOC	SOC
Organ Mountain evening primrose	*Oenothera organensis*	SOC,S	E
Dune prickley pear cactus	*Opuntia arenaria*	SOC, S	E
Night-blooming cereus cactus	*Peniocereus greggii var. greggii*	SOC, S	E
Alamo beard tongue	*Penstemon alamosensis*	SOC	-
Metcalfe's penstemon	*Penstemon metcalfei*	SOC	SOC
Nodding rock daisey	*Perityle cernua*	SOC	SOC
San Andres rock daisey	*Perityle staurophylla var. homoflora*	SOC	SOC
New Mexico rock daisey	*Perityle staurophylla var. staurophylla*	SOC, S	SOC
Goodding's bladderpod	*Physaria gooddingii*	SOC	SOC
Mescalero milkwort	*Polygala rimulicola var. mescalerorum*	SOC	-

Exhibit 3-25. State and Federally Protected Species Listed for Sierra and Doña Ana Counties, New Mexico (page 4 of 4)

Common Name	Scientific Name	Federal Status	State Status
Organ Mountain figwort	*Scrophularia laevis*	SOC	-
Plank's campion	*Silene plankii*	SOC, S	SOC
Thurber's campion	*Silene thurberi*	SOC	SOC
Wright's campion	*Silene wrightii*	SOC, S	SOC
Pinos Altos flame flower	*Talinum humile*	SOC	-

Source: FAA, 2008a.
C = candidate, DL = delisted, E = endangered, S = sensitive (BLM, Forest Service), SOC = species of concern (USFWS & NM), T = threatened, - = no status.

3.9.3 Historical, Architectural, Archaeological, and Cultural Resources

Surveys at the Spaceport America site have identified many archaeological and historic sites, including the El Camino Real de Tierra Adentro (El Camino Real) and the Aleman Draw Historic District. The El Camino Real (Royal Road of the Interior) was an international road established by the Spanish in the 1500s to link Mexico City with then San Juan Pueblo, the first Spanish Colonial capital in what was to become New Mexico. In addition to being a designated National Historic Trail, in 2007 the National Trust for Historic Preservation designated El Camino Real one of the 11 Most Endangered Sites, and it is being considered for nomination as a UNESCO World Heritage Site. The route in southern New Mexico follows the Rio Grande except near the Caballo Mountains, where the Trail leaves the river because of rough terrain and enters the most dangerous part of El Camino Real, the Jornada del Muerto basin. The route travels for about 80 miles through the basin before rejoining the Rio Grande and is adjacent to the Spaceport America site. This essentially waterless portion of the route is the reason the basin acquired the Spanish name of Jornada del Muerto or "Dead Man's Journey." Although not pristine, the landscape surrounding the road still retains a sense of remoteness, both through the relative lack of major visual intrusions and through the quiet environment. This feeling of remoteness could help visitors appreciate what it was like for travelers going through Jornada del Muerto. For these reasons, the setting is considered an important historic feature of El Camino Real (FAA, 2008a).

Spanish explorers who were following the Rio Grande Valley to northern New Mexico provided the earliest reports of the Apache in south-central New Mexico. Apache raiding proved more limiting to the settlement of the New Mexico territory than lack of water. Travelers along El Camino Real through the Jornada del Muerto to Santa Fe, New Mexico, suffered continual attacks by the Apache. At present it is not known whether there are Apache sites or materials from this period within the Spaceport America Project area, although it is likely. There are sites with unknown affiliation that might be attributed to Apache use upon further archaeological and ethnohistoric investigation.

The Aleman Draw Historic District has also been determined eligible for listing on the *National Register of Historic Places*, and includes the Aleman Ranch and a segment of El Camino Real that contains physical traces of the road and associated artifacts. In addition, it contains two scatters of prehistoric artifacts associated with the both the Spanish Colonial use of El Camino Real and the historic railroad siding at Aleman. The boundary of Spaceport America intersects a part of the Historic District.

A Programmatic Agreement was developed between the New Mexico Spaceport Authority and Section 106 consulting parties that outlines the processes to develop plans to minimize or mitigation adverse affects (FAA, 2008a).

3.9.4 Floodplains

There are portions of a 100-year floodplain at Spaceport America. According to the National Oceanic and Atmospheric Administration, the statistical 100-year storm event for Truth or Consequences is 3.4 to 3.5 inches of rainfall for a 24-hour period or 2.6 inches of rainfall for a 6-hour period (NOAA, 1973).

The floodplain at Spaceport America represents an area where storm water runoff exits from relatively narrow and deep arroyos and spreads out over the ground under sheet flow conditions. Any runoff in the floodplain would likely dissipate within 2 to 4 days.

3.9.5 Hazardous Materials, Pollution Prevention, and Solid Waste

Local governments or private enterprises manage solid waste in the area of Spaceport America. The region encompasses several municipal landfills. The projected disposal capacity of existing and planned facilities is estimated to be adequate for the next 50 years for Otero County and more than 80 years for Doña Ana County (FAA, 2008a).

Commercial hazardous waste facilities are available in the region. The nearest hazardous waste disposal facility is in Andrews, Texas, approximately 280 miles from the Spaceport America site. The permitted disposal capacity of the facility is more than 5 million cubic yards (FAA, 2008a).

At present, no hazardous materials are handled and no hazardous wastes are produced within the Spaceport America site, except for very small quantities associated with ranching machinery maintenance and operations at the two ranches currently operational in the area. These operations include use of herbicides to control unwanted vegetation and pesticides to control insects on and near cattle. No past activities have resulted in National Priorities List sites (Superfund sites) at the Spaceport America site.

3.9.6 Health and Safety

The immediate area surrounding the Spaceport America site is nearly vacant of human population for a radius of 17 miles. In the event of an emergency, White Sands Missile Range emergency response personnel would assist county responders, if called upon to do so. Residents in the area are also served by eight hospitals/health centers. Spaceport America will adhere to all FAA-required safety considerations in the Launch Site Operator License. In addition, the New Mexico Spaceport Authority is developing a Memorandum of Understanding with BLM to determine appropriate procedures for ensuring public safety during launches and during the recovery of launch vehicles or payloads that inadvertently land on BLM-administered lands.

3.9.7 Land Use (including Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)

Spaceport America will cover approximately 26 square miles of land within the high desert of Sierra County. Infrastructure and utilities are limited. The launch site is entirely on New Mexico State Trust Land, except for the private properties of two landowners needed for access roads and utility corridors to the launch facilities. The western Missile Range boundary lies 11 miles east of Spaceport America and is largely open space that provides a buffer for military testing.

Two current special land use designations relevant to the Spaceport America site are the El Camino Real de Tierra Adentro National Historic Trail, which passes through the western portion of the site, and the Jornada del Muerto Wildlife Habitat Management Area, which includes BLM lands adjacent to the site.

There are no commercial farms and no prime or unique farmland within the Spaceport America site, nor are there any wild and scenic rivers or coastal resources in the vicinity. There are also no Section 4(f) resources, such as publicly owned parks, recreational areas, or wildlife or waterfowl refuges within the site boundaries.

3.9.8 Light Emissions and Visual Resources

Most of the Spaceport America area is characterized as having low visual sensitivity. One exception is El Camino Real, which has high visual sensitivity from the general area of Upham, New Mexico, to Aleman Draw, but Spaceport America infrastructure would be mostly blocked from view by terrain from all but a small portion of the trail. Yost Escarpment is also characterized as having high visual sensitivity, and line-of-sight analysis and direct observation indicate that Spaceport America infrastructure would be visible from that location.

The overall aesthetic character of the area that includes Spaceport America is neither unique nor uncommon for southern New Mexico. The area is, for the most part, indistinctive in scenic quality.

3.9.9 Natural Resources and Energy Supply

Three scenarios for supplying water to Spaceport America are proposed for operations. Scenario 1 would include three water supply wells with associated pump stations, a storage tank, a booster station, and collection and distribution pipelines. The three wells (Well Sites 1, 2, and 3) would be west and south of the runway, adjacent to the perimeter fence. Well sites would include a pump station and water would be pumped through buried collection pipelines in the utility corridor to a 1.3-million-gallon storage tank west of the horizontal development area. This storage site would also include a booster station to pump water to users in the horizontal and vertical launch areas.

Scenario 2 would be the same as Scenario 1, except the three wells (Well Sites 4, 5, and 7c) would be along Yost Draw and Aleman Draw. Water would still be pumped through buried collection pipelines to the storage tank west of the horizontal development area. From there, water would be pumped by booster station through buried distribution pipelines in the same corridors as Scenario 1 to the horizontal and vertical launch areas.

Under Scenario 3, all water would come to the site via truck from an off-site supplier. Water would be stored in a tank in the same location west of the horizontal development area. From there, water would be pumped by booster station through buried distribution pipelines in the same corridors as Scenarios 1 and 2 to the horizontal and vertical launch areas.

Electrical power would be supplied from an existing 115 kilovolt transmission line approximately 6 miles west of the intersection of County Road A013 and the Spaceport entrance road.

3.9.10 Noise and Compatible Land Use

The Spaceport America site is in a remote area with few noise sources. Sources of noise near the site are vehicular traffic on the network of unsurfaced roads, trains on the Burlington Northern and Santa Fe Railroad railway tracks west of the site, noise from passing heavy and light aircraft, occasional military training flights in the area, and constant noise emanating from high voltage electrical distribution lines that pass through the site.

The three largest anthropogenic contributors to noise at the site of Spaceport America are vehicular traffic, railroad traffic, and passing aircraft. However, this traffic is very light. The DNL sound level in the vicinity of the Spaceport America site has been recorded at 31 to 41 dBA (FAA, 2008a). Therefore, effects of noise sources can be characterized in the context of a quiet rural area. However, it should be noted that this noise level was recorded before construction of Spaceport America.

3.9.11 Socioeconomic Resources, Environmental Justice, and Children's Environmental Health and Safety

3.9.11.1 Population

Census 2000 reported a total population of 250,250 for the three-county area around Spaceport America. The population in Doña Ana, Otero, and Sierra Counties represented 14 percent of New Mexico's population in 2000.

3.9.11.2 Employment and Income

In February 2007, the unemployment rate for Dona Ana, Otero, and Sierra Counties was 4.5 percent, 3.8 percent, and 4.5 percent, respectively. These rates are higher than the rate for New Mexico (3.7 percent), but lower than the national rate (4.9 percent).

According to the U.S. Census Bureau (2008e), the area around Spaceport America has a lower median household income and a lower per capita income than the United States or New Mexico. In addition, the area has a higher percentage of its population living in poverty than the United States as a whole. Poverty rates in Doña Ana and Sierra County exceed poverty rates in New Mexico, while the poverty rate in Otero County is lower than the state's poverty rate. All three counties have poverty rates greater than the Nation's poverty rate. Per capita income and median household income are lower in each county than those in New Mexico or the Nation.

3.9.11.3 Environmental Justice

The FAA used demographic information from the 2000 Census to identify minority populations in the three-county area around Spaceport America and in the three Census tracts, which are a part of two of these counties, surrounding Spaceport America. Persons of a minority race or ethnicity were approximately 68 percent of the population in Doña Ana County in 2000. Otero County had an aggregate minority population of 44 percent, which is less than the New Mexico aggregate minority population of 55 percent. Sierra County had an aggregate minority population of 29.5 percent.

Approximately 21, 25, and 19 percent of individuals residing in Sierra, Doña Ana, and Otero Counties, respectively, are living below the poverty level.

3.9.11.4 Children's Environmental Health and Safety

The nearest public school to the Spaceport America site is Truth or Consequences Elementary in the City of Truth or Consequences, which is approximately 18 miles northeast of the proposed Spaceport America site.

3.9.12 Water Quality

3.9.12.1 Surface Water

There is no perennial surface water in the Jornada del Muerto Basin in the vicinity of Spaceport America. Therefore, the surface water resources considered in this analysis are those related to ephemeral surface waters (such as arroyos, draws, and other drainages that contain water only during and after precipitation events). The primary surface drainage at the site is Jornada Draw, which flows south from the northeast to southeast corners of the site. Aleman and Yost Draws, which run across the central and southern parts the site, are tributary drainages to Jornada Draw. Each of these three draws receives storm water runoff from the Caballo Mountains and the San Andres Mountains. Jornada Draw continues to flow south from the site until it drains into Flat Lake.

3.9.12.2 Groundwater

Water quality in the vicinity of the proposed Spaceport America is generally best near the arroyos and in zones of recharge. Water quality decreases with depth and also near the Jornada Draw Fault Zone, where deeper saline groundwater can migrate upward.

3.9.13 Wetlands

There are no wetlands in the Jornada del Muerto Basin in the vicinity of Spaceport America. Therefore, no further consideration of wetland management is required.

4. ENVIRONMENTAL CONSEQUENCES

This chapter describes the potential environmental consequences of the Federal Aviation Administration (FAA) Proposed Action and No Action Alternative, as described in Section 2.1 and 2.2 of this Programmatic Environmental Impact Statement (PEIS). Section 4.1 describes general impacts applicable to all potential launch sites and identifies which environmental resources would not be significantly affected and which environmental resources would require a site-specific analysis to fully assess impacts and their significance. Sections 4.2 through 4.9 describe potential site-specific impacts for the eight launch and landing locations identified and described in Sections 2.1.2 and 3.2 through 3.9. Section 4.10 describes potential programmatic and site-specific cumulative impacts that would result from the incremental impact of the Proposed Action. The Executive Summary summarizes the potential impacts reported in this chapter.

The FAA evaluated the potential environmental consequences of the Proposed Action and the No Action Alternative in accordance with all relevant legal requirements, including 40 CFR 1502.16 and FAA Policies and Procedures (FAA Order 1050.1E, Change 1) for complying with the National Environmental Policy Act (NEPA), which specify significance thresholds by resource. Although detailed aspects of the full scope of activities that might occur under the Experimental Permit Program are not known, the activities described in Section 2.1.1 provide a basis to broadly estimate the nature of the potential environmental impacts under the Proposed Action.

This chapter does not contain separate sections to address construction impacts or secondary (induced) impacts (impact categories listed in FAA Order 1050.1E, Change 1) because the Proposed Action and No Action Alternative do not involve construction activities, and secondary (indirect) impacts are considered with the direct impacts for each impact category. Potential impacts associated with accidents or suborbital rocket failures are not specifically addressed for each site, but are addressed in the general impacts section. The FAA acknowledges that there could be accidents or failures; however, the likelihood of such events is small because the safety review process, including suborbital rocket inspections, is designed to reduce the risk of an accident or failure and ensure that such an event would be contained within the designated operating area.

Under both the Proposed Action and the No Action Alternative, this NEPA analysis could be part of a decision to deny or not issue a requested permit. In the case of a permit denial, the potentially affected area would not experience changes as a result of the proposal. With the exception of socioeconomics, there would be no negative impacts as a result of a permit denial. In the case of socioeconomics, denying a permit would eliminate any additional local employment and services needed to implement the requested activities. However, based on the small size of the staff working at a launch or reentry site and the short duration of these events, the negative impacts to socioeconomics due to a permit denial would be minor and should not result in any notable change in the health of the local economy. At the national level, the positive socioeconomic impacts of the Experimental Permit Program, such as those related to the desired increase in research and funding for the commercial space industry and increased employment opportunities for skilled and professional workers, would not be negatively affected because any possible denials would most likely be widely geographically dispersed and intermittent.

4.1 Impacts to Environmental Resources

4.1.1 Air Quality

4.1.1.1 Proposed Action

This section addresses atmospheric impacts, beginning at ground level and continuing through each atmospheric level. The composition of exhaust emissions from the reusable suborbital rocket varies depending on the type of propellant and the type of propulsion systems used (*i.e.*, jet engine and/or rocket motors), as described in Sections 2.1.1.1 and 2.1.1.2. Exhibit 4-1 lists the major exhaust products from propulsion systems that are currently used by reusable suborbital rockets or are in development. The types of exhaust products from jet engines are fairly consistent across jet fuel types, and most of the jet fuel expected to be used in reusable suborbital rocket launches is commercial kerosene-type fuel (*e.g.*, Jet-A) rather than military naphtha-type jet fuels. The exhaust products from rocket motors, however, vary based on the propellant type (fuel and oxidizer) and are listed separately in Exhibit 4-1. Exhibit 2-4 lists the types of propellants that reusable suborbital rockets can use.

Of the chemical species generated by emissions from reusable suborbital rockets, the emissions of concern are hydrogen chloride (HCl), chlorine (Cl), particulate matter (PM), nitrogen oxides (NO_X), sulfur oxides (SO_X), carbon monoxide (CO), carbon dioxide (CO_2), water (H_2O) (in the stratosphere), hydrogen ions (H^+) (in the ionosphere), and volatile organic compounds (VOCs). As indicated in Exhibit 4-1, not all of these substances are produced by all of the various propulsion systems. The sections below describe potential impacts of emissions of these pollutants in the different atmospheric layers. Emissions of the other main exhaust products would be either insignificant or would not have an adverse impact on any layer of the atmosphere.

Exhibit 4-1. Main Exhaust Products from Reusable Suborbital Rocket Propulsion Systems

Jet Engine	Rocket Motor by Propellant System Type		
	Solid	Liquid	Hybrid
CO CO_2 H_2O NO_X PM Sulfur oxides (SO_X) VOC	Chlorine ions (Cl^-) CO CO_2 HCl H_2O Molecular nitrogen (N_2) NO_X PM	CO CO_2 Hydrogen ions (H^+) Molecular hydrogen (H_2) H_2O NO_X Hydroxyl radicals (OH^-)	CO CO_2 H_2 H_2O OH^- NO_X PM

Source: Adapted from FAA, 2005 (Exhibit 4-1) and FAA, 2004.

Appendix D describes how the FAA calculated the emissions for each vehicle and atmospheric layer. This PEIS considers reusable suborbital rocket launches and powered landings in the analysis of the Proposed Action. Section 4.10, Cumulative Impacts, considers ground testing of rocket motors, but such testing is not part of the Proposed Action. Emissions associated with launch site operations other than reusable suborbital rocket launches, powered landings, and ground testing of reusable suborbital rocket motors – including trucks and other vehicle traffic, generators, fueling activities, boilers, or other activities that would result in emissions – are not included in the scope of this PEIS and were not included in this analysis.

The FAA considered specific reusable suborbital rocket configurations and flight profiles in its analysis of the Proposed Action and the No Action Alternative. Exhibit 2-6 summarizes the reusable suborbital rocket configurations, the maximum annual number of launch and reentry events at each site, and the associated flight profile used in the analysis. Appendix D provides additional information regarding emissions associated with launch activities. The information given in Exhibit 2-6 and Appendix D applies to all Proposed Action launch sites except Spaceport America. The FAA took the data for Spaceport America launches from the Spaceport America Final Environmental Impact Statement (FEIS) (FAA, 2008a [SA FEIS, 2008]). The FAA assumed the annual number of launches at Spaceport America (882) forecast in the Spaceport America FEIS for the full build-out of the facility (2013) in this PEIS. The total launches projected for Spaceport America would likely include licensed launches in addition to launches under experimental permits. However, for this PEIS, the FAA analyzed all launches at Spaceport America as if they would be conducted under experimental permits as part of the Proposed Action. This assumption results in an analysis that is conservative (tending to overestimate impacts). The actual number of launches at Spaceport America under experimental permits would likely be lower than the FAA assumed.

In addition, the sizes of the conceptual launch vehicles analyzed for operations under experimental permits at the other seven launch sites are different from those analyzed in the Spaceport America FEIS. For example, the analysis of the Proposed Action at the other seven launch sites considered vertical lift vehicles that ranged from 6 to 33 feet long with unfueled weight of up to 5,500 pounds. The Spaceport America FEIS considered vertical lift vehicles ranging from 15 to 100 feet long with unfueled weight of up to 22,000 pounds. Thus, propellant volumes and the resulting emissions per vertical launch at Spaceport America would be much greater than at the other seven launch sites. In actuality, the larger vehicles at Spaceport America would likely operate under a license rather than an experimental permit, and therefore would not be included in the Proposed Action. As noted above, the FAA included these vehicles at Spaceport America in the Proposed Action, and this assumption tends to overestimate emissions, which increases the conservatism of the analysis.

Troposphere

Under the Proposed Action, impacts to the troposphere would result from jet engine emissions, carrier aircraft jet engine emissions, and rocket motor emissions in the troposphere. Other potential impacts to the troposphere could result from accidents on the launch pad or during flight. Sections 4.2 through 4.9 provide details on the estimated site-specific air quality impacts.

For purposes of assessing compliance with ambient air quality standards and emissions regulations, emissions associated with the Proposed Action were inventoried for the lower troposphere extending from ground level to a nominal altitude of 3,000 feet. The Federal Government uses the level of 3,000 feet and below to assess contributions of emissions to ambient air quality and for the *de minimis* emissions calculations to determine the applicability of the General Conformity Rule (40 CFR 51 Subpart W) under the Clean Air Act.

The FAA estimated emissions below 3,000 feet per launch or flight for each flight profile (horizontal, vertical, and hover), as described in Section 2.1.1.4. To derive the emissions values, the FAA projected a conservative number of annual launch events over a 6-year period (2009 to 2014) (see Exhibit 2-6). Because the emissions from rocket motors vary with propellant type, the FAA also projected the most likely propellant systems that would be used (kerosene/liquid hydrogen [LOX], solid rocket propellant, and ethanol/LOX rocket propellants and Jet-A aircraft fuel) to provide a reasonable estimate of emissions. Appendix D presents the emissions associated with the annual number of launches and reentries of reusable suborbital rockets for each propellant system.

Exhibit 4-2 lists the estimated emissions per launch event for each type and configuration of reusable suborbital rocket. The FAA calculated the total annual emissions by estimating the emissions per launch for each vehicle type (Exhibit 4-2), multiplying these per launch emissions by the number of estimated annual launches for each vehicle type (Exhibit 2-6), and then summing across all vehicle types. The pollutants of greatest concern related to ground-level concentrations and General Conformity are VOCs and NO_X. Exhibit 4-3 lists the annual emissions that would occur in the lower troposphere based on the assumptions described in Section 2.1 and listed in Exhibit 4-2. The emissions levels listed in Exhibit 4-3 are insignificant in the context of the total regional emissions for the areas in which the launch sites are located. The subsections below discuss the potential impacts of these emissions with respect to the General Conformity requirements and the ambient pollutant concentrations that could result from the emissions. Sections 4.2 through 4.9 discuss the potential air quality impacts at each launch site individually.

Exhibit 4-2. Estimated Emissions below 3,000 Feet per Reusable Suborbital Rocket Launch Event[a,b] (pounds per launch)

Reusable Suborbital Rocket	Cl	CO	CO_2	HCl	H_2O	NO_X	PM	SO_X	VOCs
Horizontal 1	0.00	41	1,017	0.00	0.00	0.57	0.02	0.42	4.35
Horizontal 2	0.00	263	643	0.00	394	0.00	0.00	0.00	0.00
Horizontal 3	0.00	67	1,840	0.00	0.00	1.66	0.03	0.76	6.21
Vertical 1	0.00	184	450	0.00	276	0.00	0.00	0.00	0.00
Vertical 2 (hover)	0.00	1,058	66	0.00	1,080	0.00	0.00	0.00	0.00

[a] Applies to all launch sites except Spaceport America. Emissions data for Spaceport America are from FAA, 2008a.
[b] Values of less than 0.005 pound are shown as 0.00.

Criteria Pollutant Emissions and General Conformity

As discussed in Section 3.1.12, the U.S. Environmental Protection Agency (EPA) has set national air quality standards for certain common pollutants, referred to as "criteria" pollutants, including CO, NO_2, particulate matter with an aerodynamic diameter of less than 2.5 microns ($PM_{2.5}$) and 10 microns (PM_{10}), SO_2, and lead (Pb). Depending on the vehicle and propellant type, reusable suborbital rocket emissions can contain any of these pollutants with the exception of Pb. Jet and rocket propellants do not contain Pb. A General Conformity analysis would be required if a reusable suborbital rocket launch occurred in a region that was in Federal nonattainment for any criteria pollutant. Under the General Conformity Rule, a formal conformity determination for the Proposed Action is not required if the conformity analysis shows that (1) the activities would not produce emissions above the *de minimis* levels specified in the rule; and (2) the Federal action would not be regionally significant as defined in the rule. A Federal action is considered regionally significant when the total increase in emissions due to the action would equal or exceed 10 percent of the nonattainment area's emissions inventory for any criteria pollutant. This PEIS compares annual emissions from the Proposed Action to the *de minimis* levels and evaluates regional significance for those sites that are located in federally designated nonattainment areas.

Exhibit 4-4 lists the launch sites described in Section 2.1.2 and Sections 3.2 through 3.9, the counties in which they are located, and the attainment status of that county or area. As shown in Exhibit 4-4, the Mojave Air and Space Port is the only site in a federally designated nonattainment area. Thus, of the sites listed in Exhibit 4-4, only operations at the Mojave Air and Space Port would be subject to the EPA General Conformity requirements. Section 4.6.1 addresses General Conformity for reusable suborbital rocket operations at the Mojave Air and Space Port.

Exhibit 4-3. Estimated Annual Emissions below 3,000 Feet for the Proposed Action[a] (5,682 Launches, All Sites) (tons per year)

Reusable Suborbital Rocket	Cl	CO	CO_2	HCl	H_2O	NO_X	PM	SO_X	VOCs
Horizontal 1 except Spaceport America	0.00	9.22	228.90	0.00	0.00	0.13	0.00	0.09	0.98
Horizontal 2 except Spaceport America	0.00	70.88	173.64	0.00	106.31	0.00	0.00	0.00	0.00
Horizontal 3 except Spaceport America	0.00	7.07	193.22	0.00	0.00	0.17	0.00	0.08	0.65
All Horizontal Launches at Spaceport America[b]	0.05	13.48	2,945.55	0.00	0.00	13.85	1.53	1.37	2.10
Vertical 1 at all sites[c]	0.05	137.79	437.88	3.97	206.68	5.10	7.18	0.00	0.00
Vertical 2 (hover) at all sites[d]	0.00	1,111.32	114.15	0.00	1,111.32	0.00	0.00	0.00	0.00
Totals	**0.05**	**1,349.76**	**4,093.34**	**3.97**	**1,424.32**	**19.25**	**8.72**	**1.55**	**3.73**

[a] Values of less than 0.005 ton are shown as 0.00.
[b] The Spaceport America FEIS did not report emissions by individual horizontal rocket types.
[c] Includes vehicle types designated V-1 and V-2 in Spaceport America FEIS, which are equivalent to Vertical 1.
[d] Includes vehicle type designated V-3 in Spaceport America FEIS, which is equivalent to Vertical 2.

Exhibit 4-4. Location and Attainment Status of Launch Sites

Site Name	Site Location	Attainment Status
California Spaceport	Santa Barbara County, California	NAAQS: Attainment CAAQS: Nonattainment for 8-hour ozone (O_3) and PM_{10}
John F. Kennedy Space Center	Brevard and Volusia Counties, Florida	Attainment
Kodiak Launch Complex	Kodiak Island Borough, Alaska	Attainment
Mid-Atlantic Regional Spaceport	Accomack County, Virginia	Attainment
Mojave Air and Space Port	Kern County (eastern), California	NAAQS: Nonattainment for 8-hour O_3 CAAQS: Nonattainment for O_3 and PM_{10}
Oklahoma Spaceport	Washita County, Oklahoma	Attainment
Space Florida Launch Complex 46	Brevard County, Florida	Attainment
Spaceport America	Sierra County, New Mexico	Attainment

Note: NAAQS = National Ambient Air Quality Standards; CAAQS = California Ambient Air Quality Standards.

Ambient Concentrations of Criteria Pollutants

Takeoffs of jet-powered reusable suborbital rockets would affect local ambient air quality to an extent similar to operations of conventional aircraft at an airport. Rocket-powered reusable launch vehicles would take off immediately upon ignition and reach 3,000 feet altitude within about 15 seconds. Reusable hover launch vehicles would be expected to take off vertically, maneuver at altitudes below 3,000 feet for up to 3 minutes, and land near the takeoff point. Furthermore, the emissions from reusable suborbital rockets below 3,000 feet would be of short duration and would rapidly disperse due to the mechanical and thermal turbulence of the exhaust gases and the movement of the vehicle. Under the Proposed Action, ambient pollutant concentrations at locations accessible to the public would be expected to be low and would not result in violations of National Ambient Air Quality Standards (NAAQS) or state standards.

The Mojave Air and Space Port is in a federally designated nonattainment area for the 8-hour ozone NAAQS. Thus, emissions of the ozone precursors NO_X and VOC are subject to the EPA General Conformity requirements. Emissions of CO and the other criteria pollutants are not subject to General Conformity because the area is in attainment of the respective NAAQS for those pollutants. Section 4.6.1 provides the conformity analysis for reusable suborbital rocket operations at the Mojave Air and Space Port.

Air Toxics

Two hazardous air pollutants (HCl and Cl), also called air toxics, are sometimes components of solid propellant rocket engine emissions, depending on propellant composition. At all launch sites except Spaceport America, none of the proposed reusable suborbital rockets would use solid rocket motors at altitudes of less than 3,000 feet. Only horizontal reusable suborbital rockets would be expected to use solid propellant, and they would use solid rocket motors only at higher altitudes. Therefore, no HCl or Cl would be emitted to the lower troposphere except possibly at Spaceport America.

The Spaceport America FEIS considers the use of solid propellant for vertical launches. Vertical launch vehicles that use solid propellant likely would be expendable launch vehicles or would operate under launch licenses rather than experimental permits. For this reason, it is unlikely that solid propellants would be used at Spaceport America as part of the Proposed Action, and therefore unlikely that HCl or Cl would be emitted to the lower troposphere under the Proposed Action. The proportion of experimental permit launches to licensed launches at Spaceport America is not known at this time. As noted above, to be conservative and to remain consistent with the Spaceport America FEIS, the Proposed Action in this PEIS includes all launches at Spaceport America in the calculation of emissions. As a result, as shown in Exhibit 4-3, emissions to the lower troposphere associated with the Proposed Action include minor amounts of HCl and Cl.

In addition, none of the proposed reusable suborbital rockets with powered landings would use propellants that result in HCl or Cl emissions. Accordingly, except as noted above, no hazardous air pollutants would be emitted in the lower troposphere under the Proposed Action.

Regional Haze

The regional haze rule (40 CFR 51 Sections 308 and 309, promulgated at 64 *FR* 35714 July 1, 1999) requires states to develop State Implementation Plans to address visibility at designated mandatory Class I areas, including 156 designated national parks, wilderness areas, and wildlife refuges. General features of the regional haze rule are that all states are required to prepare an emissions inventory of all haze-related pollutants (*i.e.*, VOCs, NO_X, SO_2, PM_{10}, $PM_{2.5}$, and ammonia [NH_3]) from all sources in all constituent counties. Most states will develop their regional haze State Implementation Plans in conjunction with their $PM_{2.5}$ State Implementation Plan over the next several years.

The Western Region Air Partnership was established to address regional visibility issues in the West, with member states Arizona, New Mexico, Wyoming, Utah, and Oregon. The Partnership has elected to submit regional haze State Implementation Plans under the provisions of Section 309 of the regional haze rule, which includes a clean air corridor that extends from Nevada and Utah to Oregon and Idaho. Those preliminary regional haze State Implementation Plans were submitted to the EPA in December 2003. The Partnership policy on clean air corridors, completed on November 13, 2002, concluded that a 25-percent increase in weighted emissions would have only a minimal impact on visibility at Class I areas on the Colorado Plateau (WRAP, 2002). The minimal emissions of the haze-related pollutants associated with the Proposed Action would have a negligible impact on the visibility at the designated Class I areas.

Stratosphere

Under the Proposed Action, potential impacts to the stratosphere from reusable suborbital rocket emissions include global climate change from contributions of greenhouse gases and depletion of the stratospheric ozone layer. The FAA calculated emissions to the stratosphere by estimating the emissions per flight in the stratosphere layer for each vehicle type, multiplying these estimates by the estimated annual launches for each vehicle type, and then summing across all vehicle types. Exhibit 4-5 lists emissions to the stratospheric per flight by vehicle type; Appendix D describes these emissions in detail. Exhibit 4-6 lists estimated annual emissions to the stratosphere (across all vehicle types from all identified sites and assuming a total of 5,682 launches).

Exhibit 4-5. Estimated Emissions in Stratosphere per Reusable Suborbital Rocket Launch Event[a,b] (pounds per launch)

Reusable Suborbital Rocket	Cl	CO	CO_2	HCl	H_2O	NO_X	PM	SO_X	VOCs
Horizontal 1	0.00	1,429	3,502	0.00	2,144	0.00	0.00	0.00	0.00
Horizontal 2	0.00	1,138	2,787	0.00	1,706	0.00	0.00	0.00	0.00
Horizontal 3	5.04	34	101	705.10	739	0.00	0.00	0.00	0.00
Vertical 1	0.00	735	1,800	0.00	1,102	0.00	0.00	0.00	0.00
Vertical 2 (hover)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

[a] Applies to all launch sites except Spaceport America. Emissions data for Spaceport America are from FAA, 2008a.
[b] Values of less than 0.005 pound are shown as 0.00.

Under the Proposed Action, the potential reusable suborbital rocket emissions that could affect climate change directly as greenhouse gases include CO_2 and H_2O. The FAA approximated the potential for these reusable suborbital rocket emissions to affect climate change by comparing the estimated annual reusable suborbital rocket emissions of each pollutant to the stratosphere (see Exhibit 4-6) to the annual emissions from all U.S. sources for these pollutants. The estimated reusable suborbital rocket emissions of CO_2 to the stratosphere would be about 3,623 tons annually. In comparison, total annual CO_2 emissions from all U.S. sources for 2006 were 6.59 billion tons[1] (EPA, 2008b). The incremental contribution of reusable suborbital rocket emissions would be an extremely small fraction of this amount, which would result in a negligible impact on global climate change. Reusable suborbital rocket emissions of H_2O also would have an insignificant effect on climate change due to the preponderance of other natural and human-made

[1] Converted from 5.98 billion metric tons (EPA, 2008b).

Exhibit 4-6. Estimated Annual Emissions to the Stratosphere from Reusable Suborbital Rocket Flights under the Proposed Action[a] (5,682 Launches, All Sites) (tons per year)

Reusable Suborbital Rocket	Cl	CO	CO_2	HCl	H_2O	NO_X	PM	SO_X	VOCs
Horizontal 1 except Spaceport America	0.00	321.62	787.96	0.00	482.43	0.00	0.00	0.00	0.00
Horizontal 2 except Spaceport America	0.00	307.13	752.46	0.00	460.69	0.00	0.00	0.00	0.00
Horizontal 3 except Spaceport America	0.53	3.53	10.58	74.04	77.56	0.00	0.00	0.00	0.00
All Horizontal Launches at Spaceport America[b]	0.05	122.00	294.00	7.30	0.00	0.11	13.10	0.00	0.00
Vertical 1 at all sites[c]	0.02	551.16	1,678.90	1.32	826.73	1.70	2.39	0.00	0.00
Vertical 2 (hover) at all sites[d]	0.00	0.00	98.69	0.00	0.00	0.00	0.00	0.00	0.00
Totals	**0.60**	**1,305.42**	**3,622.59**	**82.66**	**1,847.41**	**1.81**	**15.49**	**0.00**	**0.00**

[a] Values of less than 0.005 ton are shown as 0.00.
[b] The Spaceport America FEIS did not report emissions by individual horizontal rocket types.
[c] Includes vehicle types designated V-1 and V-2 in Spaceport America FEIS, which are equivalent to Vertical 1.
[d] Includes vehicle type designated V-3 in Spaceport America FEIS, which is equivalent to Vertical 2.

sources of H_2O. Reusable suborbital rockets also would emit CO and NO_X, two photochemical pollutants that can influence the creation and destruction of greenhouse gases. The estimated reusable suborbital rocket emissions of CO and NO_X annually to the stratosphere would be about 1,305 tons and 1.8 tons, respectively. However, contributions of these pollutants to the atmospheric burden from reusable suborbital rocket emissions would be extremely small in relation to U.S. annual emissions (more than 89 million tons and 19 million tons of CO and NO_X, respectively) for 2005 (EPA, 2006). Thus, the presence of these chemicals in reusable suborbital rocket emissions would have a negligible impact on global climate change.

The primary chemicals of concern for potential ozone depletion due to reusable suborbital rockets are HCl and Cl. To assess the potential impact of emissions to the stratosphere associated with the Proposed Action, the FAA reviewed several studies on the contribution of reusable suborbital rocket emissions on ozone depletion. The field study on Rocket Impact on Stratospheric Ozone confirmed that ozone depletion related to launch emissions is a temporary and limited phenomenon. In general, findings from this study indicate that the potential for ozone depletion associated with reusable suborbital rocket exhaust to cause an increase in the intensity of solar ultraviolet (UV) rays near launch sites is extremely limited (Ross, 1996). A study by the World Meteorological Organization considered the effects of Cl releases from launches of the Space Shuttle, Titan IV, and Ariane 5, which were estimated to release a total of 1,570 tons of Cl per year to the stratosphere. This release amount was reported to be an extremely small fraction (less than 0.07 percent) of the 1994 total stratospheric burden of Cl from industrial sources (World Meteorological Organization, 1995). This amount is, in turn, substantially larger than the total HCl and Cl (about 83 tons) that would be released by reusable suborbital rocket emissions under the Proposed Action (see Exhibit 4-6), indicating that the impacts of reusable suborbital rocket emissions on ozone depletion would be insignificant.

PM also would be emitted to the stratosphere by some of the reusable suborbital rockets considered in this PEIS. PM could affect stratospheric ozone, possibly by acting as a catalytic site for ozone destruction;

however, the exact impact of PM on ozone depletion is unclear. A 1999 study prepared for the U.S. Air Force on the stratospheric impact of solid rocket motor launch emissions concluded that the global impacts of PM from such emissions on ozone depletion are very small (Ko *et al.*, 1999). The estimated total emissions of aluminum oxide (Al_2O_3) (*i.e.*, PM) to the stratosphere used in calculations for that study were approximately 1,120 tons per year. This amount is much larger than the amount that would be emitted under the Proposed Action; therefore, the impacts of PM emissions associated with the Proposed Action on stratospheric ozone depletion would be negligible.

Releases of NO_X also can result from reusable suborbital rocket emissions, and NO_X is a chemical of concern for ozone depletion. However, emissions of NO_X from reusable suborbital rockets would be extremely small in relation to total U.S. emissions of NO_X. About 19 million tons were released in the U.S. in 2005 alone (EPA, 2006).

Mesosphere

Under the Proposed Action, there would be negligible impacts to the mesosphere during reusable suborbital rocket launches. The mesosphere is a relatively narrow band of the atmosphere through which rockets tend to pass fairly quickly. For launches under the Proposed Action, the amount of rocket emissions in this layer would be extremely small. Furthermore, there are no known impacts to the mesosphere associated with the compounds emitted by reusable suborbital rockets.

Ionosphere

Under the Proposed Action, some exhaust products from reusable suborbital rockets during launch from Earth to space would have a temporary effect on electron concentrations in the ionosphere's highest region, the F layer. Such a temporary effect would result in a negligible impact on the ionosphere. The specific exhaust products include CO_2, H_2O, and H. These compounds can react with ambient electrons and ions in the F layer of the ionosphere to effectively form a "hole" in this region by reducing the concentration of electrons and ions in the path of the vehicle.

This effect in the F layer is caused by a rapid charge-exchange reaction between the reusable suborbital rocket exhaust products and the ambient atomic oxygen ions (O^+) in the F layer. Ambient O^+s are the dominant ion in the F layer. At lower altitudes of the ionosphere (*i.e.*, below 87 miles), this reaction is not effective because the dominant positive ions are NO^+ and O_2^+, not O^+. For example, the reaction between H_2O and O^+ is $H_2O + O^+ \rightarrow H_2O^+ + O$ followed by the rapid recombination $H_2O^+ + e^- \rightarrow OH^- + H$. Similar reactions also occur with CO_2 and H. These reactions result in a net decrease in electron concentration in the F layer, potentially affecting radio communication, such as short-wave broadcasts, which interact with the ionosphere (U.S. DOT, 1992).

Records of test firing of the propulsion unit used by the Space Shuttle provide some data on the rapidity with which a "hole" in the F layer might disappear (FAA, 2005). The propellants used in this test firing were monomethyl hydrazine (MMH) and nitrogen tetroxide (N_2O_4), similar to the propellants used for routine launches of some reusable suborbital rockets. The test involved consuming 640 pounds total mass of MMH and N_2O_4. Exhaust products from this experimental test firing consisted of approximately 260 pounds (40.6 percent) N, 203 pounds (31.9 percent) CO_2, 166 pounds (26.1 percent) H_2O, and 9 pounds (1.4 percent) H_2. The percentages represent percent by mass, and complete combustion was assumed. Thus, about 344 pounds of potential electron-depleting substances (CO_2, H_2O, and H_2) were emitted. The associated "ion/electron hole" disappeared into the lower F layer within 5 minutes.

Exhibit 4-7 lists the estimated amounts of electron-depleting substances that would be released per reusable suborbital rocket launch.

Exhibit 4-7. Estimated Emissions of Electron-Depleting Substances Released Into the Ionosphere[a,b] (pounds per launch)

Reusable Suborbital Rocket	H_2	H_2O	CO_2	Total Electron Depleting Substances
Horizontal 1	0.00	0.00	0.00	0.00
Horizontal 2	0.00	0.00	0.00	0.00
Horizontal 3	0.00	0.00	0.00	0.00
Vertical 1	2.57	183.72	300.07	486.36
Vertical 2 (hover)	0.00	0.00	0.00	0.00

[a] Applies to all launch sites except Spaceport America.
[b] Values of less than 0.005 pound are shown as 0.00.

The greatest amount of electron-depleting substances per launch under the Proposed Action would be approximately 486 pounds. This is almost one and one-half times the amount of exhaust products released during the 1985 test of the Space Shuttle maneuvering propulsion unit. There are no data available to estimate the differences in the size of the ion/electron hole that might be created with larger vehicles and the amount of time it would take for these holes to dissipate. However, other studies of the Saturn V launch of Skylab that measured the size of the ionospheric hole created by that launch suggest that in the worst case, the ionospheric hole appears to dissipate in a matter of minutes (Mendillo and Hawkins, 1975). In addition, because the vehicles considered in this PEIS are suborbital, any effect on the ionosphere would be only short-term. Therefore, the effects of this phenomenon are unlikely to accumulate to any degree and affect a particular location, unless there were launches through the same region of the atmosphere every few minutes (which is highly unlikely). The overall impact of emissions of electron-depleting substances from reusable suborbital rockets in the ionosphere would be negligible.

4.1.1.2 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of air quality impacts and addition or removal of emissions to the troposphere, stratosphere, mesosphere, or ionosphere associated with the No Action Alternative would fall within the envelope of air quality impacts discussed under the Proposed Action. However, if the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate the potential air quality impacts, and would not use the information and analyses provided in this PEIS. This could result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.1.2 Biological Resources (Fish, Wildlife, and Plants)

4.1.2.1 Proposed Action

Terrestrial and Aquatic Vegetation

The Proposed Action could cause local adverse impacts to vegetation from rocket emissions and exhaust heat. Such impacts would result from the deposition of rocket engine emissions (*e.g.*, various metals, and other substances based on the propellant type and characteristics), which would decrease the fitness of an affected local plant population, but would not likely result in the permanent removal or loss of a particular vegetation community. Impacts to freshwater or marine systems associated with rocket engine emissions are further discussed in Section 4.1.12.1, Surface Waters. See Section 4.1.1, Air Quality, for additional information on rocket engine emissions. The localized foliar scorching and spotting from other rocket launches has been shown to be temporary and not of sufficient intensity to cause long-term damage to vegetation (USAF, 2006). In addition, the deposition of reusable suborbital rocket components or the landing of a suborbital rocket in vegetated areas would result in an adverse impact on the localized vegetation community. Vegetated areas that would be affected by the Proposed Action would generally be managed vegetative areas associated with a launch or reentry site that would facilitate access to the suborbital rocket during pre- and post-launch activities and to any reusable suborbital rocket component or stage deposition area. Some launch areas at non-licensed sites could consist of unmanaged vegetative areas. Typically, the Proposed Action would result in minor direct, but short-term, adverse impacts to terrestrial or aquatic vegetation. Sections 4.2 through 4.9 further define the site-specific intensity of potential impacts to terrestrial and aquatic vegetation.

Terrestrial and Aquatic Wildlife

The Proposed Action could cause local adverse impacts to wildlife. Such impacts would result from the deposition of rocket engine emissions (*e.g.*, various metals, and other substances based on the propellant type and characteristics), which could be absorbed, inhaled, or ingested by local wildlife. HCl deposition from the burning of solid propellants could create short-term acidification impacts, including fish kills. However, at all launch sites except Spaceport America, none of the proposed reusable suborbital rockets would use solid rocket motors at altitudes of less than 3,000 feet. See Section 4.1.1 for additional information on rocket engine emissions. Additionally, the temporary removal of a vegetation community or the decrease in its fitness could reduce the size of the wildlife population that such an area would be able to support, increase competition among wildlife species for the reduced resources, and decrease the fitness of the local wildlife populations, resulting in an adverse impact to wildlife.

The noise associated with the launch of a launch vehicle or the reentry and landing of a reentry vehicle could startle wildlife and temporarily disrupt their activities (*e.g.*, feeding/foraging, breeding, migration, or resting). However, while launch and landing activities could startle wildlife, animals generally adapt, behaviorally and physiologically, to overflight activities (USAF, 1998). Such impacts could result in minor direct, but short-term, adverse impacts to terrestrial or aquatic wildlife. Sections 4.2 through 4.9 describe further describe site-specific impacts to terrestrial and aquatic wildlife.

Protected Species and Habitat

The Proposed Action could result in location- and species-specific adverse impacts to state or federally protected species, and essential fish habitat. Activities could affect a species' habitat, reproductive fitness, population size, distribution, or other species-specific activities (*e.g.*, feeding/foraging, breeding, migration, or resting). The data available about site-specific launch activities under an experimental permit are not detailed enough at this time to fully evaluate the potential impacts to protected species. Therefore, should the FAA receive an application for an experimental permit, it would coordinate with the appropriate parties in determining if there is a need to consult with the U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration (NOAA) Marine Fisheries Service to fully evaluate the presence of any potential impacts to protected species, including migratory birds. The FAA would similarly coordinate with the appropriate parties regarding any need to further consult with a State agency regarding any applicable requirements for State listed protected species and habitat. If potential impacts are identified, the FAA would consult with the appropriate agencies to develop any mitigation measures that may be warranted, as described in Chapter 5 of this PEIS. Sections 4.2 through 4.9 further describe site-specific impacts to protected species.

4.1.2.2 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of impacts to biological resources associated with the No Action Alternative would fall within the envelope of impacts to biological resources discussed under the Proposed Action. If the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate potential impacts to biological resources. This could result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.1.3 Historical, Architectural, Archaeological, and Cultural Resources

4.1.3.1 Proposed Action

Operating reusable suborbital rockets under the Proposed Action likely would not be expected to have a significant impact on cultural resources. Such activities would not result in ground-disturbing activities that would directly affect the integrity of below-ground (archaeological) resources eligible or listed on the *National Register of Historic Places*. However, operating reusable suborbital rockets in an area where such activities or other aircraft have not previously or routinely been operated could affect the character or setting of historic properties, including historic structures and districts and traditional cultural properties that are listed or eligible for listing on the National Register. There could be impacts from the visual affect of the reusable suborbital rocket, the noise associated with the rocket or jet engine, or the vibrations associated with the noise. If the FAA received an application for an experimental permit from an unlicensed or non-Federal site, the FAA would consult with the appropriate State Historic Preservation Officer, as appropriate, to determine potential impacts to historic, architectural, archaeological, and cultural resources. Sections 4.2 through 4.9 further define the context and site-specific intensity of the potential impacts to specific cultural resources.

4.1.3.2 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of impacts to historical, architectural, archaeological, and cultural resources associated with the No Action Alternative would fall within the envelope of impacts to historical, architectural, archaeological, and cultural resources discussed under the Proposed Action. If the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate potential impacts to historical, architectural, archaeological, and cultural resources. This could result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.1.4 Floodplains

4.1.4.1 Proposed Action

Reusable suborbital rocket activities under the Proposed Action would not affect floodplains. No new permanent infrastructure would be constructed under the Proposed Action, and all temporary structures (*e.g.*, a launch stand or reentry pad) would be removed after a launch or reentry event.

4.1.4.2 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of impacts to floodplains associated with the No Action Alternative would fall within the envelope of impacts to floodplains discussed under the Proposed Action. However, if the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate the potential floodplain impacts. This could result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.1.5 Hazardous Materials, Pollution Prevention, and Solid Waste

4.1.5.1 Proposed Action

Propellants would be the primary hazardous materials used under the Proposed Action. All propellants would be stored and used in compliance with Federal regulations 14 CFR 420.65 and 420.67 for solid and liquid propellants, respectively. Other hazardous materials, including various composites, synthetics, and metals, could be used for rocket operations.

Most propellants would be burned in the event of an explosion; however, propellants could be released into the environment through a variety of sources. There could be a release from a leaking storage or fuel tank, faulty fuel injection lines, or after a reusable suborbital rocket sustained damage (*e.g.*, in a failed launch or landing, or in a collision with another object). All activities associated with underground storage tanks, above-ground storage tanks, and propellant-loading activities would comply with relevant and applicable Federal, state, and local regulations. Releases would be reported to the appropriate local, state, and Federal authorities and would be cleaned up as necessary. Most, if not all, pieces of unburned solid propellant falling on land following an accident would be collected and disposed of as hazardous waste. Similarly, large, unburned pieces falling in shallow fresh water areas would be collected and disposed of as hazardous waste.

In addition, materials used during a launch event could produce hazardous or solid wastes. Hazardous wastes might consist of waste oils, hydraulic fluids, fire suppressants, antifreeze, cleaning fluids, and cutting fluids. Used petroleum, oil, and lubricants would be generated in small amounts that are not normally considered hazardous waste (designation varies by state). The minimal quantities of hazardous waste that could be generated would be disposed of in accordance with appropriate waste-disposal regulations. Accidental releases of hazardous materials or waste would be reported to the appropriate local, state, and Federal authorities and would be cleaned up as necessary. All non-hazardous solid waste would be disposed of in accordance with local, state, and Federal requirements.

All temporary storage tanks and other facilities for the storage of hazardous materials associated with a launch or reentry event would be in protected and controlled areas designed to comply with Spill Prevention and Control Countermeasures rules as outlined in 40 CFR 112. All accidental releases of hazardous materials under the Proposed Action would be subject to reporting requirements. Under 40 CFR 302, which governs the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 United States Code [U.S.C.] 9601 through 9675), a release of hazardous materials must be reported to the National Response Center if the quantity exceeds its reportable quantity as noted in CERCLA §103(a). Reportable quantities for hazardous substances are listed in 40 CFR 302.4 and 355. Launch operators would also comply with Section 304(a) of the Emergency Planning and Community Right to Know Act, promulgated by 40 CFR 355.40, to report accidental releases of hazardous materials greater than the reportable quantity to the appropriate State Emergency Response Commission and local emergency planning committees.

Because activities associated with the Proposed Action would comply with all relevant and applicable Federal, state, and local regulations related to hazardous materials and hazardous waste, there would be no significant impacts. Sections 4.2 through 4.9 further define site-specific hazardous waste, hazardous material, and solid waste issues.

4.1.5.2 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of impacts related to hazardous materials, pollution prevention, and solid waste associated with the No Action Alternative would fall within the envelope of impacts related to hazardous materials, pollution prevention, and solid waste discussed under the Proposed Action. However, if the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate potential impacts related to hazardous materials, pollution prevention, and solid waste, and would not use the information and analyses provided in this PEIS. This could result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.1.6 Health and Safety

4.1.6.1 Proposed Action

The FAA would review all permit applications to ensure that the operation of the reusable suborbital rocket would comply with FAA requirements (14 CFR 437) for obtaining an experimental permit. To obtain an experimental permit, an applicant must provide a program description, a flight test plan, and operational safety documentation. The flight test plan must identify and describe the geographic coordinates of the boundary of each operating area where the flight is planned. The applicant must also prepare a hazard analysis that identifies and characterizes the hazards and assesses the risk to public health and safety and property from each permitted flight. The FAA safety review assesses the possible hazards associated with proposed ground, flight, and landing operations and ensures that the operating area would be large enough to contain each planned trajectory and all expected vehicle dispersions. In addition, the operating area must contain enough unpopulated or sparsely populated area to perform key flight-safety tasks. The operating area cannot contain or be adjacent to a densely populated area or large concentrations of members of the public. The FAA review process would ensure the selection of an operating area that would minimize the risk to public health, safety, and property. Therefore, the operation of a reusable suborbital rocket under the Proposed Action would not be expected to result in significant impacts to public health and safety.

The establishment of defined operating areas for launches under an experimental permit, in addition to disseminating Notices to Mariners and Notices to Airmen in accordance with standard operating procedures, serves to protect the public health and safety. In support of each launch, the FAA would review and verify the hazard analysis to evaluate potential hazards and reduce the associated risks to an acceptable level. The review and verification would be coordinated with the appropriate Range Safety Officer.

To minimize the risk of fire or explosion, all propellants would be stored and used in accordance with Federal and state regulations, and site-specific standard operating procedures. In addition, all site personnel, contractors, and applicants who perform propellant loading operations would be properly trained to safely use and store propellants. Therefore, propellant-loading activities associated with a reusable suborbital rocket would not be anticipated to affect the health and safety of site personnel or the surrounding public. Sections 4.2 through 4.9 further define site-specific health and safety issues.

4.1.6.2 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of impacts to health and safety associated with the No Action Alternative would fall within the envelope of impacts to health and safety discussed under the Proposed Action. However, if the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate potential impacts to health and safety and not use the information and analyses provided in this PEIS. This could result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.1.7 Land Use (including Department of Transportation 4(f) Resources, Farmlands, Wild and Scenic Rivers, and Coastal Resources)

4.1.7.1 Proposed Action

Activities under the Proposed Action, which would conform to local, state, and Federal land-use and land-management practices, would not have a significant impact on land use. Activities that would conflict with or preclude established land-management practices could adversely affect land use. Because no construction activities would be associated with the Proposed Action, and all key flight safety events would occur over unpopulated or sparsely populated areas, the potential for adverse impacts to land use would be remote. In addition, because no permanent facilities or infrastructure would be developed under the Proposed Action, no prime farmlands would be lost. Accordingly, there would be no impact to farmlands protected under the Farmland Protection Policy Act. There would likely be no impacts to wild and scenic rivers or coastal resources. However, if the FAA received an application for an experimental permit to launch from an unlicensed site or non-Federal site, the FAA would determine the potential impacts to wild and scenic rivers and coastal resources using site-specific information.

Because no permanent facilities or infrastructure would be developed, there would be no physical taking or use of lands protected under Section 4(f), including public parks, recreation areas, or wildlife and waterfowl refuges of national, state, or local significance, or land from an historic site of national, state, or local significance. If there is a potential for indirect impacts (constructive use) on lands protected under Section 4(f), the FAA must determine if the impacts would substantially impair the Section 4(f) resource. Substantial impairment occurs when the action substantially diminishes the activities, features, or attributes of a Section 4(f) resource. Section 4.1.10 describes noise-related impacts to land use. Sections 4.2 through 4.9 provide additional information on site-specific impacts to land use.

4.1.7.2 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of impacts to land use associated with the No Action Alternative would fall within the envelope of impacts to land use discussed under the Proposed Action. If the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate potential impacts to land use. This could result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.1.8 Light Emissions and Visual Resources

4.1.8.1 Proposed Action

Operating reusable suborbital rockets under an experimental permit would not be likely to have a significant impact on aesthetics and visual resources. The FAA would review experimental permit applications as they are received to determine the impacts of launches and reentries based on site-specific information. This review would determine whether proposed launches would conform to the visual resource management policies and statutes of local, state, and Federal agencies and American Indian tribes for both designated and undesignated areas of great natural beauty and scenic diversity, such as national forests; national monuments; national, state, or county parks; national wildlife refuges; wilderness areas; scenic byways; national trails; and historic places and districts.

4.1.8.2 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of impacts to light emissions and visual resources associated with the No Action Alternative would fall within the envelope of impacts to light emissions and visual resources discussed under the Proposed Action. If the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate potential impacts to light emissions and visual resources. This could result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.1.9 Natural Resources and Energy Supply

4.1.9.1 Proposed Action

The Proposed Action would not result in the development of new facilities or result in notable changes in local energy demands or consumption of other natural resources. Reusable suborbital rocket launch or reentry events would be short in duration and could involve up to 30 launch personnel, which would not result in any notable changes to local energy demands or consumption of other natural resources (*e.g.*, water or wastewater disposal). Reusable suborbital rockets would use solid or liquid propellants and other consumable fluids that would be expended during operation. Support aircraft would use jet fuel. Because of the relatively small scale of activity under the Experimental Permit Program, the use of rocket propellants and jet fuel would not notably alter their supply or demand, and would result in only minor impacts to natural resources and energy supplies.

4.1.9.2 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of impacts to natural resources and energy supply associated with the No Action Alternative would fall within the envelope of impacts to natural resources and energy supply discussed under the Proposed Action. However, if the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate potential impacts to natural resources and energy supply, and would not use the information and analyses provided in this PEIS. This could result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.1.10 Noise and Compatible Land Use

4.1.10.1 Proposed Action

Activities associated with the Proposed Action that would affect ambient noise levels include noise generated from a rocket engine or from a jet engine during launch and landing, or from a sonic boom generated from the reusable suborbital rocket exceeding the sound barrier. The noise from such activities could result in an increase in the ambient noise levels or affect particular noise-sensitive receptors (*e.g.*, humans, wildlife, or a structure). The following paragraphs describe the noise associated with jet and rocket engines during launch and landing and sonic booms and their associated impacts. Sections 4.2 through 4.9 describe the context and site-specific intensity of the potential impacts.

Engine Noise

Under the Proposed Action, ground-level noise emissions would result from either jet-powered or rocket-powered launch and flight. Previous noise studies of large jet-powered aircraft (C-5 and C-17 military transport planes), with noise recorded both parallel and perpendicular to the runway and associated landing and take-off flight paths, have documented maximum sound levels between 86 A-weighted decibels (dBA) and 122 dBA between 0.8 mile and 1.8 miles from the runway (USAF, 2002). Rocket-powered launches would generate noise levels that would range from 76 to 86 dBA at 1,000 feet from the source (FAA, 2006d). The ignition of a rocket engine at or above 20,000 feet above the ground surface would not adversely affect noise-sensitive receptors on the surface of Earth. The noise generated at such altitudes would dissipate because of distance attenuation and atmospheric absorption by the time the sound wave impinged on the surface of Earth.

Vertical Launches

Assuming 2,000 pounds of thrust and a simple rocket noise model, estimated launch noise levels from a vertical launch vehicle operating under an experimental permit would be expected to range from 76 dBA to 86 dBA at 1,000 feet from the launch location. Conservatively assuming those noise levels for 179 seconds, no nighttime launches, and up to 300 launches per year, the 65 day-night average sound level (DNL) noise contour would lie approximately 450 feet from the launch pad. Noise-sensitive receptors beyond 450 feet from the launch pad would not be significantly affected because they would not experience an increase in noise of 1.5 dBA or more at or above DNL 65 (see FAA Order 1050.1E, Section 14, Noise).

Horizontal Launches

Horizontal launches would consist of rocket only, turbojet/rocket powered (a single vehicle), and turbojet assisted (two vehicles) (see Exhibit 2-6). Thrusts for rocket only would be relatively small (1,800 pounds) compared with turbojet thrusts (60,000 pounds). Consequently, the upper-bound noise levels generated by horizontal launches would be similar to existing jet aircraft activity at the launch facilities. Existing jet aircraft operations are relatively high at many of the launch facilities. Therefore, up to 400 horizontal launches per year would be expected to result in an insignificant increase in noise. For permit applications to operate at sites without existing jet aircraft operations, the FAA would perform site-specific noise analyses to determine impact levels.

Hovering Vehicles

A representative hovering vehicle would be similar to Armadillo Aerospace's Lunar Lander Analog QUAD test vehicle. Based on recent noise measurements at the X Prize event in Las Cruces, New

Mexico, the Armadillo Aerospace vehicle produced noise levels of 82 dBA at 4,500 feet from the launch pad (FAA, 2007b). Assuming 300 launches per year and 180 seconds of firing, the 65 DNL contour would be approximately 1,300 feet from the launch pad. Noise-sensitive receptors beyond 1,300 feet from the launch pad would not be significantly affected because they would not experience an increase in noise of 1.5 dBA or more at or above DNL 65 (see FAA Order 1050.1E, Section 14, Noise).

Landing Activities

There would be engine noise associated with powered landings, but none associated with unpowered landings. Powered landings would use either jet engines or retrothrust rocket engines. Hovering vehicles would use retrothrust rocket engines to maintain altitude and control direction and orientation. The use of jet engines or retrothrust rocket engines would be expected to produce the same or less noise than the noise generated during launch.

Sonic Boom Noise

Except for those designed to hover, reusable suborbital rockets would be capable of reaching supersonic speeds during some portion of their flight and would produce sonic booms. Reusable suborbital rockets would produce a sonic boom during their vertical ascent, while reusable suborbital rockets reentering Earth's atmosphere would produce a sonic boom in the upper levels of the atmosphere and would be traveling at subsonic speeds in the lower portions of the atmosphere.

The magnitude of a sonic boom is measured as overpressure in pounds per square foot. The likely overpressure generated by the vehicles associated with the Proposed Action would be up to 2 pounds per square foot measured on the surface of Earth (FAA, 2006d). The relatively low pounds per square foot of the sonic boom associated with reusable suborbital rockets considered under the Proposed Action is based on the relatively small size of the rocket (the smaller size, the smaller the pressure wave), the launch and reentry trajectories (the more perpendicular to the surface of Earth, the less area affected by the pressure wave), and the altitudes at which such vehicles would exceed the speed of sound (the higher the elevation the less effect at ground level). In addition, because the operating area of key flight-safety events and the reusable suborbital rocket would be in unpopulated or sparsely populated areas, sonic booms would have minimal noise impacts.

4.1.10.2 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of impacts related to increased noise associated with the No Action Alternative would fall within the envelope of impacts related to increased noise discussed under the Proposed Action. However, if the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate potential impacts related to increased noise and not use the information and analyses provided in this PEIS. This could result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.1.11 Socioeconomic Impacts, Environmental Justice, and Children's Environmental Health and Safety Risks (including Secondary [Induced] Impacts)

4.1.11.1 Proposed Action

Socioeconomic Impacts

Under the Proposed Action, the FAA would issue permits for launches of reusable suborbital rockets, resulting in minor, short-term impacts to local socioeconomics. Such impacts would result from the launch and reentry support staff working at the launch or reentry site for the duration of the event. Because of the relatively small number of support staff and short duration of the event, demands on the local infrastructure (*e.g.*, power, water, disposal, transportation system) would not result in a noticeable change over the current conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. The potential national socioeconomic effect would be an increase in the employment of skilled and professional workers. This would result in an economically beneficial impact.

Jobs associated with the commercial launch industry are generally technology based and require employees with specialized skills and higher levels of education. The creation of jobs in the commercial launch industry would have secondary economic effects on local communities due to increased personal income and the associated tax base. Furthermore, the new or additional workers could increase the size of the surrounding community and create a need for more local services, which in turn would create additional jobs within that community.

Environmental Justice and Children's Environmental Health and Safety

In assessing potential environmental justice impacts, the FAA reviewed the impacts of the Proposed Action to identify any large and adverse human health or environmental effects that would disproportionately affect minority and/or low-income populations. The impacts analysis in this PEIS does not identify any large and adverse human health or environmental effects associated with the Proposed Action. Therefore, no minority or low-income populations would be disproportionately affected.

In assessing environmental health risks and safety risks that might disproportionately affect children, the FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. In addition, the operating area of the reusable suborbital rocket may not contain or be adjacent to a densely populated area or large concentrations of members of the public. Considering these factors, the FAA determined that the Proposed Action would not be likely to adversely affect children's environmental health and safety.

4.1.11.2 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of impacts to socioeconomics, environmental justice, and children's environmental health and safety associated with the No Action Alternative would fall within the envelope of impacts to socioeconomics, environmental justice, and children's environmental health and safety discussed under the Proposed Action. However, if the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate potential impacts to socioeconomics, environmental justice, and children's environmental health and safety, and would not use the information and analyses provided in this PEIS.

This could result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.1.12 Water Quality

4.1.12.1 Proposed Action

Surface Water

Under the Proposed Action, there could be local adverse impacts to freshwater or marine systems. Such impacts would result from the deposition of materials associated with rocket engine emissions on a particular body of water or in its associated watershed. Section 4.1.1, Air Quality, discusses the potential rocket emissions under the Proposed Action. Most of the reusable suborbital rockets would use propellants that emit H_2O, CO_2, NO_x, PM, SO_x, VOCs, and CO. NO_x and SO_x together are the major precursors to acidic deposition (acid rain), which is associated with the acidification of water bodies. While emissions from launch vehicles could affect the water quality of a specific body of water, because of the low levels of emissions, it is not expected that any impact would be significant. Monitoring of the water chemistry in local streams around active launch pads from which rockets have been launched has shown that emissions from rocket engines have not had a long-term effect on basic water chemistry (USAF, 2006). At all launch sites except Spaceport America, none of the proposed reusable suborbital rockets would use solid rocket motors at altitudes of less than 3,000 feet. Therefore, no HCl or Cl would be emitted to the lower troposphere except possibly at Spaceport America. HCl deposition from the burning of solid propellants below 3,000 feet could create short-term acidification impacts. Furthermore, the Proposed Action would be expected to have a minor short-term affect on local surface water quality, but would not be expected to affect the designated use as defined under Section 303 of the Clean Water Act.

Groundwater

The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater (see Section 4.1.14 for additional information). However, impacts would be expected to be minimized through adherence to all site-specific spill prevention and control requirements at each site. Additionally, no impacts to groundwater supply would be anticipated because demand on groundwater to support the Proposed Action would be negligible.

4.1.12.2 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of impacts to water quality associated with the No Action Alternative would fall within the envelope of impacts to water quality discussed under the Proposed Action. However, if the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate potential impacts to water quality, and would not use the information and analyses provided in this PEIS. This could result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.1.13 Wetlands

4.1.13.1 Proposed Action

The Proposed Action could result in local adverse impacts to wetland vegetation and wildlife from deposition of rocket engine emissions, but such impacts would not be significant (see Section 4.1.2). Depending on the propellant type and characteristics, rocket engine emissions could decrease the fitness of an affected local plant or wildlife population but would not be likely to result in the permanent removal or loss of a particular community. The Proposed Action would not result in filling or draining of wetlands, because no new permanent infrastructure would be constructed and all temporary structures (*e.g.*, a launch stand or reentry pad) would be expected to be located beyond wetland areas and would be removed after a launch or reentry event. See Section 4.1.12, Water Quality, for additional information on rocket engine emission impacts to surface waters.

4.1.13.2 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of impacts to wetlands associated with the No Action Alternative would fall within the envelope of impacts to wetlands discussed under the Proposed Action. However, if the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate potential impacts to wetlands and not use the information and analyses provided in this PEIS. This could result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.1.14 Accidents

4.1.14.1 Proposed Action

In the event of an accident during launch activities, the point in the launch sequence when failure occurred would determine the impact on the environment. An accident on or near the launch pad could produce air emissions, spills of propellant, and potential health and safety impacts from any blast, flying debris, fire, and inhalation of toxic combustion products. Emissions from a launch vehicle accident would not be expected to produce long-term environmental impacts, but localized impacts similar to those produced under normal launch conditions.

Any burning of solid propellant at the launch pad during an accident could cause localized health risks and damage to nearby biota due to the emission of HCl. The total amount of toxic material released from burning propellant following a launch accident would essentially be the same as that released during a normal launch, except that the exhaust cloud would be concentrated in the area of the launch instead of being dispersed over the flight trajectory. At all launch sites except Spaceport America, none of the reusable suborbital rockets proposed under the Experimental Permits Program would use solid fuel rocket motors below altitudes of 3,000 feet under normal operating conditions; therefore, they would not normally emit HCl below 3,000 feet.

In the event of an accident on the launch pad, nearby vegetation could be damaged by heat, fire, flying debris, and HCl deposition. However, no long-term effects would be expected. The types of impacts to vegetation expected during an accident would be similar to those during a normal launch.

Surface waters near the launch pad could be affected during an accident if spills of liquid propellants entered the water. In addition, any HCl deposition from the burning of solid propellants could create short-term acidification impacts, including fish kills. Most, if not all, unburned solid propellant pieces falling into surface water bodies or adjacent land areas would be collected and disposed of as hazardous waste according to relevant Federal, state, and local regulations.

4.1.14.2 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of impacts related to accidents associated with the No Action Alternative would fall within the envelope of impacts related to accidents discussed under the Proposed Action. However, if the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate potential impacts related to accidents, and would not use the information and analyses provided in this PEIS. This could result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.2 California Spaceport

4.2.1 Air Quality

The California Spaceport is in an area that is in attainment for all NAAQS, but has been designated nonattainment for the more stringent California standards for PM_{10} and ozone. As shown in Exhibit 4-8, annual emissions from ground-level to 3,000 feet, based on the assumption of 600 yearly launch and reentry events, would be about 186 tons CO, 77 tons CO_2, and 203 tons H_2O. There would be no emissions of hazardous air pollutants (Cl and HCl) from the launch of reusable suborbital rockets at the California Spaceport. Emissions from the launch and reentry of reusable suborbital rockets would be of very short duration and would be rapidly dispersed due to the mechanical and thermal turbulence of the exhaust gases and the movement of the vehicle. Emissions of PM_{10} and the ozone precursors VOC and NO_x, for which the region is designated nonattainment for the California standards, would be less than 0.005 ton of each, as shown in Exhibit 4-8. These minimal emissions would not have a measurable effect on ambient concentrations of PM_{10} or ozone. Therefore, the launch of reusable suborbital rockets at the California Spaceport would not significantly affect air quality.

The California Global Warming Solutions Act of 2006 (AB 32) mandates that California reduce its greenhouse gas emissions to 1990 levels by 2020. This represents a roughly 25 percent reduction in greenhouse gas emissions under business as usual estimates. The California Environmental Protection Agency's Air Resources Board has estimated the 1990 level of CO_2 emissions at 470.1 million tons[2] (CARB, 2007). As shown in Exhibit 4-8, annual emissions of CO_2 from 600 yearly launch and reentry events would be about 77 tons.

[2] Converted from 420 million metric tons (CARB, 2007).

Exhibit 4-8. Estimated Annual Emissions Below 3,000 Feet per Site (600 Launches) under the Proposed Action (tons)

Reusable Suborbital Rocket	Cl	CO	CO_2	HCl	H_2O	NO_X	PM	SO_X	VOCs
Horizontal 1	-	-	-	-	-	-	-	-	-
Horizontal 2	-	-	-	-	-	-	-	-	-
Horizontal 3	-	-	-	-	-	-	-	-	-
Vertical 1	0.00	27.56	67.52	0.00	41.34	0.00	0.00	0.00	0.00
Vertical 2 (hover)	0.00	158.73	9.92	0.00	162.04	0.00	0.00	0.00	0.00
Totals	**0.00**	**186.29**	**77.44**	**0.00**	**203.38**	**0.00**	**0.00**	**0.00**	**0.00**

Note: Values of less than 0.005 ton are shown as 0.00.

4.2.2 Biological Resources (Fish, Wildlife, and Plants)

4.2.2.1 Terrestrial Plants and Animals

The exhaust heat and atmospheric deposition of emissions associated with the launch and reentry of a reusable suborbital rocket has the potential to harm nearby vegetation. The vegetation in the area near the active launch site consists of bladed road shoulders, mowed grasses and forbs, or weedy parking areas. This vegetation does not include any sensitive plant communities (USAF, 1998). The Proposed Action would create minimal disturbance to vegetation near the launch site.

There could be impacts to terrestrial wildlife at Vandenberg Air Force Base from visual and noise disturbances during reusable suborbital rocket launch and flight activities. Noise and light generated during launch activities have the potential to disturb birds, including migratory species, resulting in potential loss of bird eggs and abandonment of resting, breeding, or feeding areas. Launch noise could elicit a startle response from terrestrial mammals and birds, including migratory species, in the immediate area of the launch. However, these effects would be temporary and would not be expected to have a notable effect (decrease or increase) on local wildlife populations. In addition, because the launches would represent brief events, no significant impacts to terrestrial wildlife species present on the Base would be expected as a result of reusable suborbital rocket launch and flight noise. This finding is supported by other reviews of previous launch vehicles operating from Vandenberg Air Force Base that found no significant impacts (USAF, 2006).

Any sonic booms associated with the Proposed Action would result in minor impacts to the terrestrial wildlife species at Vandenberg Air Force Base. Studies of sonic booms from other rocket launches found that, depending on the strength of the acoustic overpressures generated, sonic boom impulses would affect wildlife in a similar manner as launch noise. Monitoring of pinnipeds on the offshore islands downrange from the Base has shown that sonic booms between 1 and 2 pounds per square foot usually elicit a “heads up” response or slow movement toward and entering the water, particularly for pups (USAF, 2006).

4.2.2.2 Aquatic Plants and Animals

Most reusable suborbital rockets would use propellants that emit H_2O, CO_2, and CO. Surface-water monitoring for larger launch systems on South Vandenberg has shown emissions have not had an effect on basic water chemistry. Therefore, the impacts of atmospheric deposition from launch emissions on aquatic vegetation would be negligible (USAF, 2006).

There could be impacts to aquatic wildlife at Vandenberg Air Force Base from visual and noise disturbances during reusable suborbital rocket launch and flight activities. These activities have the potential to disturb marine mammals, resulting in potential separation of pinniped mothers and offspring, and abandonment of resting, breeding, or feeding areas. The main pinniped haul-out area at Vandenberg Air Force Base is located about 2 miles south of SLC-8 at Rocky Point. Pinnipeds that haul-out at Vandenberg Air Force Base include the Pacific harbor seal, California sea lion, and northern elephant seal. Studies at the Base have shown that launch noise at levels as low as 80 dBA caused a short-term (30-minute) abandonment of a pinniped haul-out area at Rocky Point (Tetra Tech, 1997). However, short-term haul-out area abandonment has not caused noticeable impacts to the pinniped populations at Rocky Point (USAF, 2006). Research conducted at Vandenberg Air Force Base since 1997 under scientific research permits issued by the National Marine Fisheries Service pursuant to Section 104 of the Marine Mammal Protection Act, have shown that the population dynamics of harbor seals have not been negatively impacted as a result of launches and other military activity. With the exception of El Niño events, the population of harbor seals has increased at a steady rate at Vandenberg Air Force Base (NMFS, 2009a).

For even the largest launch vehicles, such as the Delta IV, the launch noise and sonic booms can be expected to cause no more than a startle response and flight to water for those harbor seals, California sea lions, and other pinnipeds that are hauled out on the coastline of Vandenberg Air Force Base. The noise may cause temporary but not permanent hearing sensitivity in individuals (NMFS, 2009a).

Among other pinniped monitoring requirements, harbor seals on Vandenberg Air Force base must be monitored at the nearest occupied haul-out at least 72 hours prior to planned launches and 48 hours after the launch in the pupping season, which extends from March 1- June 30(NMFS, 2009b). Results must be reported to the National Marine Fisheries Service.

The risk of operations at the California Spaceport affecting or taking a marine mammal is extremely low. A take would only occur if a reusable suborbital rocket failed or a projectile fell on a marine mammal, or in the event that the startle response was so great that adults trampled juveniles in an attempt to get to the water. Such events would be very unlikely. In addition, no notable adverse impacts to fish or essential fish habitat surrounding California Spaceport would be expected because ocean currents would rapidly dilute any emission deposition that entered the water.

Stellar sea lions and Guadalupe fur seals are sometimes sighted on the Northern Channel Islands southwest of California Spaceport, but are not likely to be affected by launches of space vehicles (NMFS, 2009a).

Therefore, the effects from reusable suborbital rocket launches and flight under the Proposed Action would be expected to be minor, and would not significantly affect aquatic wildlife populations or behavior.

4.2.2.3 Protected Species and Habitat

Of the species listed in Exhibit 3-8, two protected plant species, six protected animal species, and two protected fish species have the potential to be affected by the Experimental Permit Program. Although launches under the Proposed Action could cause short-term effects on these species, the launches would be unlikely to adversely affect the long-term wellbeing, reproduction rates, or survival of any of these species. Based on the location of the launch area, the other species listed in Exhibit 3-8 would not be expected to be affected by the Proposed Action. Should the FAA receive an application for an experimental permit that proposes to launch from the California Spaceport, the FAA would coordinate with the USAF in determining if there is a need to further consult with either the Fish and Wildlife

Service and/or the National Marine Fisheries Service based on any new activities proposed by the applicant. The FAA would similarly coordinate with the USAF regarding any need to further consult with the appropriate State agency regarding any applicable requirements for State listed protected species and habitat. If potential impacts are identified, the FAA would consult with the appropriate agencies to develop any mitigation measures that may be warranted, as described in Chapter 5 of this PEIS.

Plant Species

There are two protected plant species in the immediate vicinity of the California Spaceport: the federally listed endangered Gaviota tarplant, found within 1 mile of the launch site, and the state designated threatened surf thistle, found within 0.8 mile of the site. Due to their distance from the launch site, the relatively small number of suborbital rockets that would use solid propellant, and emission dispersion and dilution that would occur, these plant species would not be expected to be affected by suborbital rocket launches.

Animal Species

There are six threatened or endangered animals known to be present near the launch site: the California red-legged frog, the California brown pelican, and the southern sea otter, the western snowy plover, the California least tern, and the El Segundo blue butterfly.

The California red-legged frog is known to inhabit evaporation ponds near the launch site. Earlier U.S. Fish and Wildlife Service biological opinions (USFWS, 1996, 1998, 1999b) authorized the incidental harassment of the frog from launch activities. However, more recent monitoring of nearby frog populations during launch activities determined a negligible impact on the frog's activities and on the water quality of their habitat (USAF, 2006).

Endangered California brown pelicans roost at several shoreline locations near the California Spaceport. In the vicinity of the Spaceport, they roost at or near Point Sal, Purisma Point, and Point Arguello, with fewer occurrences at the mouths of Shuman Creek, San Antonio Creek, and the Santa Ynez River. In a 1995 biological opinion, the U.S. Fish and Wildlife Service authorized the incidental harassment of an unspecified number of seabirds during launch activities (Roest, 1995). However, monitoring studies conducted for a 2001 Atlas IIAS launch showed no evidence of injury, mortality, or abnormal behavior in the pelicans (USAF, 2006).

Southern sea otter colonies are found in the offshore waters along the South Vandenberg coastline, less than 2 miles from the launch site. In earlier biological opinions, the U.S. Fish and Wildlife Service authorized the incidental harassment of sea otters during rocket launches because of the potential for launches to cause a startle response in the animals (USFWS, 1996, 1998). However, monitoring of sea otters during a more recent Delta II launch showed no evidence of injury, mortality, mother-pup separation, or other abnormal behavior (USAF, 2006).

Western snowy plovers nest on all sandy beaches with suitable habitat in the vicinity of the California Spaceport, and winter on all of Vandenberg Air Force Base's sandy beaches. The California least tern has been known to nest near the mouth of the San Antonio Creek, Purisima Point, and the Santa Ynez River (USAF, 1995). Mitigation measures have been developed at Vandenberg Air Force Base through past analysis of launch noise impacts for the dune area adjacent to SLC-2 and consultation with USFWS. Formal consultations with the USFWS resulted in a no jeopardy opinion, stating that the Taurus launch vehicle is allowed to launch from SLC-6 once during the combined nesting period of the snowy plover and least tern, subject to compliance with certain mitigation requirements (NASA, 2002b).

The federally listed El Segundo blue butterfly relies on some species of buckwheat as host plants. The butterfly lays its eggs within the flowerhead of the buckwheat plant and the larvae feed on the flower heads of the host plant before they molt to their pupal stage. The seacliff buckwheat, a host plant for the El Segundo blue butterfly, occurs in the vicinity of SLC-8. As no infrastructure development, and consequently no vegetation removal, is planned as a part of the Proposed Action, no impacts to the seacliff buckwheat would be expected.

Whale species would not likely be affected by the Proposed Action because the animals would not be exposed to significant launch noise under the water. Specifically, it would be unlikely that the noise would be at levels that would affect behavior or cause injury. Additionally, the animals would likely be in water far enough off the coast of Vandenberg Air Force Base that they would not hear the launches. No significant impacts to whale species would be expected as a result of the proposed launches.

Fish Species

Two federally listed endangered fish species, the tidewater goby and unarmored threespine stickleback, have been known to occur in South Vandenberg, particularly in the waters near Point Pedernales and in Honda Creek. Both sites are more than 5 miles north and northeast, respectively, from the launch site. Because of this distance and prevailing winds that would generally push deposition of exhaust products away from potential habitat, these species would not be expected to be affected by the Proposed Action. Additionally, previous studies for large-rocket launch operations from the California Spaceport found that the tidewater goby and unarmored threespine stickleback would not be affected (USAF, 1998).

The Proposed Action would not impact the essential fish habitat along the shoreline of South Vandenberg, which includes coastal pelagic schooling squids and fishes (*e.g.*, Pacific sardine and mackerel, northern anchovy, and jack mackerel), groundfish (*e.g.*, rockfish, shark, and cod), and large, highly migratory pelagic fishes (tuna, marlin, and swordfish). Rocket engine emissions would be dispersed and diluted in the seawater and would not alter its characteristics.

4.2.3 Historical, Architectural, Archaeological, and Cultural Resources

As discussed in Section 3.2.3, there are several historic and archaeological resources in the vicinity of the launch site, several of which have been recommended for inclusion on the *National Register of Historic Places*. Activities associated with the Proposed Action would not result in any new ground disturbances and would not represent a new type of activity in the area that would affect the character or setting of cultural resources. Therefore, there would be no impact on cultural resources.

As discussed in Section 3.2.3, two areas in the vicinity of the California Spaceport could contain traditional resources and could be considered a traditional cultural property. However, because previous and ongoing launch activities have not affected the character or setting of these potential traditional cultural properties, activities under the Proposed Action would not be expected to have an effect on the character or setting of these properties.

4.2.4 Floodplains

South Vandenberg Air Force Base is not in a floodplain. Therefore, there would be no adverse impacts to floodplains as a result of the Proposed Action.

4.2.5 Hazardous Materials, Pollution Prevention, and Solid Waste

Under the Proposed Action, the amount of hazardous material, hazardous waste, and solid waste generated at the California Spaceport would increase. The California Spaceport has the mechanisms in place to store and manage the increased quantity of hazardous materials, including liquid propellant. All activities would be conducted in accordance with applicable regulations for the use and storage of hazardous materials. Therefore, no adverse effects regarding the additional hazardous waste generated under the Proposed Action would be expected.

Pre-launch activities, including vehicle integration and inspection, and fueling operations are all routine activities at the California Spaceport. During pre-flight preparations and post-launch refurbishment and blast residue removal, all hazardous materials and associated wastes would be responsibly managed in accordance with applicable Federal, State of California, local, U.S. Department of Defense, and Air Force regulations, and the established policies and procedures identified in Section 3.2.5. The handling of any hazardous spills would be conducted in accordance with the Vandenberg Air Force Base Spill Prevention, Control, and Countermeasures Plan and Hazardous Materials Emergency Response Plan.

Hazardous material and waste-handling capacities would not be exceeded, and management programs would not have to change. Therefore, no adverse impacts from the management of hazardous materials and waste would be expected.

4.2.6 Health and Safety

The handling of large rocket motors, liquid propellants, and other vehicle ordnance is a hazardous operation that requires special care and personnel training. All transportation and handling requirements for the rocket motors and other ordnance would be accomplished in accordance with U.S. Department of Defense, Air Force, and U.S. Department of Transportation policies and regulations to safeguard the materials from fire or other mishap. By adhering to the established and proven safety standards and procedures identified in Section 3.2.6, risks to military personnel, contractors, and the general public would be minimal. Safety programs under the Proposed Action would be the same as safety programs for the current launch operations. Based on the health and safety measures described above and in Section 4.1.6, there would be no significant impacts to health and safety.

4.2.7 Land Use (including Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)

The Proposed Action would not result in new types of activities or coastal development at Vandenberg Air Force Base. Therefore, the actions would be consistent with the Local Coastal Program of the South Central Coast Area of the California Coastal Commission. Vandenberg Air Force Base flight safety measures would require no overflight of civilian property on the coastline, and no overflight of any of the Channel Islands, except San Miguel Island (USAF, 1998). The potential need to close recreational areas, such as Jalama Beach and Ocean Beach county parks, during periods of activity under an experimental permit is not known at this time and would be based on an applicant’s proposed rocket type and size, and defined operating area. Impacts associated with such closures would be addressed in separate NEPA documentation, as appropriate.

4.2.8 Light Emissions and Visual Resources

Launch vehicles would leave visible contrails, but they would be similar in visual impact to contrails from existing operations. Because this area is already used for aircraft takeoffs and landings, the visual sensitivity is low. Launch operations would not substantially degrade the existing visual character or quality of the site and its surroundings. Visual impacts from launch operations, including impacts on Jalama Beach, would be infrequent, temporary, and minor.

4.2.9 Natural Resources and Energy Supply

Activities that would be permitted under the Proposed Action would not result in the development of new facilities at the California Spaceport or result in notable changes in local energy demands or consumption of other natural resources. Reusable suborbital rocket launch or reentry events would be short in duration and could involve up to 30 launch personnel, which would not result in any notable changes to local energy demands or consumption of other natural resources (*e.g.*, water or wastewater disposal). Reusable suborbital rockets would use liquid propellants and other consumable fluids that would be expended during operations. Because of the relatively small scale of activity at the California Spaceport under the Experimental Permit Program, the use of rocket propellants would not notably alter their supply or demand, and would result in only minor impacts to natural resources and energy supplies.

4.2.10 Noise and Compatible Land Use

Noise levels generated by each launch or reentry under an experimental permit would vary, depending on the rocket configuration, flight path, and weather conditions. The issuance of experimental permits would result in an increase in the potential number and frequency of launches at Vandenberg Air Force Base. However, the experimental vehicles would be expected to be smaller and produce lower noise levels than the class of vehicles currently operating at the Base. The nearest residential area is Lompoc, approximately 8 miles from the California Spaceport. Based on the discussion in Section 4.1.10, activities associated with the Proposed Action would generate DNL 65 contours within the area of the Spaceport. Therefore, there would be no significant noise impact in Lompoc.

Any sonic booms generated by reusable suborbital rockets would reach Earth's surface at a distance downrange of Vandenberg Air Force Base over the ocean. Sonic booms would not affect coastal land areas (USAF, 2006).

4.2.11 Socioeconomics Resources, Environmental Justice, and Children's Environmental Health and Safety

4.2.11.1 Socioeconomic Impacts

Under the Proposed Action, the FAA would issue permits for launches of reusable suborbital rockets at the California Spaceport, which would result in minor short-term impacts to local socioeconomics. Such impacts would result from the launch and reentry support staff working at the launch or reentry site for the duration of the event. Because of the relatively small number of support staff and short duration of each event, demands on the local infrastructure (*e.g.*, power, water, disposal, transportation system) would not result in a noticeable change in existing conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. The potential national socioeconomic effect would be a small increase in the employment of skilled and professional workers. This would result in an economically beneficial impact.

Jobs associated with the commercial launch industry are generally technology based and require employees with specialized skills and higher levels of education. The creation of jobs in the commercial launch industry would have secondary economic effects on local communities due to increased personal income and the associated tax base. Furthermore, the new or additional workers could increase the size of the community around the California Spaceport and create a need for more local services, which in turn would create additional jobs within that community.

4.2.11.2 Environmental Justice and Children's Environmental Health and Safety

In assessing potential environmental justice impacts, the FAA reviewed the impacts of the Proposed Action to identify any large and adverse human health or environmental effects that would disproportionately affect minority or low-income populations. The impacts analysis in this PEIS does not identify any large and adverse human health or environmental effects associated with the Proposed Action at the California Spaceport. Therefore, no minority or low-income populations would be disproportionately affected.

In assessing environmental health risks and safety risks that might disproportionately affect children, the FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. In addition, the operating area of the reusable suborbital rocket may not contain or be adjacent to a densely populated area or large concentrations of members of the public. Considering these factors, the FAA determined that the Proposed Action at the California Spaceport would not be likely to adversely affect children's environmental health and safety.

4.2.12 Water Quality

4.2.12.1 Surface Water

Under the Proposed Action, there could be adverse impacts to freshwater systems. Such impacts would result from the deposition of materials associated with rocket engine emissions into the surface waters described in Section 3.2.12. Impacts to surface waters associated with rocket engine emissions are further discussed in Section 4.1.12.1. Most of the reusable suborbital rockets launched at the California Spaceport would use propellants that emit H_2O, CO_2, and CO. See Section 4.1.1, Air Quality, for additional information on rocket engine emissions. Monitoring of the water chemistry in local streams around active launch pads from which rockets have been launched has shown that emissions from rocket engines have not had a long-term effect on basic water chemistry (USAF, 2006). Launch vehicles operating under experimental permits at the California Spaceport would not be expected to use solid propellants. Therefore, there would be no impacts to water quality from Cl and HCl. Furthermore, the Proposed Action would be expected to have a minor short-term affect on local surface water quality, but would not be expected to affect the designated use as defined under Section 303 of the Clean Water Act.

4.2.12.2 Groundwater

The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater (see Section 4.1.14 for additional information). However, impacts would be expected to be minimized through adherence to all site-specific spill prevention and control requirements at each site. Additionally, no impacts to groundwater supply would be anticipated because demand on groundwater to support the Proposed Action at the California Spaceport would be negligible.

4.2.13 Wetlands

Launch activities would be expected to be conducted from SLC-8, which is already developed and contains no wetlands. Any temporary launch structures would be located at the existing developed site. Therefore, there would be no adverse impacts to wetlands as a result of the Proposed Action.

4.2.14 Accidents

Section 4.1.14 describes potential impacts from accidents at any of the sites evaluated in this PEIS. In the unlikely event of an accident, potential impacts at the California Spaceport would be the same as those described in Section 4.1.14.

4.3 John F. Kennedy Space Center, Shuttle Landing Facility

4.3.1 Air Quality

The John F. Kennedy Space Center (KSC) is in an area (Brevard and Volusia Counties, Florida) that is in attainment for all Federal and State of Florida air quality standards for criteria pollutants. As shown in Exhibit 4-9, annual emissions from ground level to 3,000 feet, based on the assumption of 700 yearly launch and reentry events, would be about 188 tons CO, 209 tons CO_2, 197 tons H_2O, 0.10 ton NO_X, 0.0024 ton PM, 0.06 ton SO_X, and 0.54 ton VOCs. There would be no lower tropospheric emissions of hazardous air pollutants (Cl and HCl) from the launch of reusable suborbital rockets at KSC because propellants that contain chlorine would be burned only at higher altitudes and not below 3,000 feet. Emissions from the launch and reentry of reusable suborbital rockets would be of very short duration and would be rapidly dispersed due to the mechanical and thermal turbulence of the exhaust gases and the movement of the vehicle. Therefore, the launch of reusable suborbital rockets at KSC would not significantly affect air quality.

Exhibit 4-9. Estimated Annual Emissions Below 3,000 feet Per Site (700 Launches) under the Proposed Action (tons)

Reusable Suborbital Rocket	Cl	CO	CO_2	HCl	H_2O	NO_X	PM	SO_X	VOCs
Horizontal 1	0.00	3.07	76.30	0.00	0.00	0.04	0.00	0.03	0.33
Horizontal 2	0.00	23.63	57.88	0.00	35.44	0.00	0.00	0.00	0.00
Horizontal 3	0.00	2.36	64.41	0.00	0.00	0.06	0.00	0.03	0.22
Vertical 2 (hover)	0.00	158.73	9.92	0.00	162.04	0.00	0.00	0.00	0.00
Totals	**0.00**	**187.79**	**208.51**	**0.00**	**197.48**	**0.10**	**0.00**	**0.06**	**0.54**

Note: Values of less than 0.005 ton are shown as 0.00.

4.3.2 Biological Resources (Fish, Wildlife, and Plants)

4.3.2.1 Terrestrial Plants and Animals

The exhaust heat and atmospheric deposition of emissions associated with the launch and operation of a reusable suborbital rocket has the potential to harm nearby vegetation. Vegetation around launch areas is regularly mowed, and although heat and emissions could result in localized vegetation scorching and spotting, similar effects from other rocket launches have been shown to be temporary and not of sufficient intensity to cause long-term damage to the vegetation (USAF, 1998, 2006; NASA, 2004a). There could be some temporary distress to nearby vegetation from launch emissions, resulting in a minor short-term impact, but no long-term adverse effects would be expected.

The greatest effects on terrestrial wildlife occur from collisions with aircraft and from visual and noise disturbances during launch activities. Although the KSC is considered a low-volume airfield, supporting less than 10,000 aircraft operations annually, its location within the Merritt Island National Wildlife Refuge and its proximity to a variety of upland and wetland habitats poses the potential for a bird strike hazard. However, because the Proposed Action would not vastly increase the number of launches at KSC, an adverse impact on wildlife from potential collisions would not be expected.

During launch activities, birds in the immediate area could be startled and flee the site for a short time; however, the continued presence of sea and shore birds at KSC demonstrates that launches have had little lasting effects on these species. In addition, terrestrial animals might suffer startle responses and be subject to temporary displacement during launch activities. While initially startling to wildlife, animals generally adapt to over-flight activities by changing their behavior and responses, and the overall effects appear to be negligible (USAF, 1998). Furthermore, launch activities would not be expected to significantly affect local wildlife populations.

4.3.2.2 Aquatic Plants and Animals

Most suborbital rockets would use propellants that emit H_2O, CO_2, and CO. Surface-water monitoring conducted for large launch systems at KSC and other launch facilities has shown that the emissions from rocket engines have not had a long-term effect on basic water chemistry or resulted in alterations of the aquatic vegetation (NASA, 2004a; USAF, 2006). The continued classification of the Indiana River Lagoon system as one of the richest and most productive estuarine faunas in the continental United States demonstrates that launches from KSC have had little lasting effects on aquatic plants and wildlife. Acidification and impacts to marine aquatic wildlife would not be expected in the nearby Atlantic Ocean because emissions and fluids would be neutralized by sea salt and quickly diluted in the open ocean (NASA, 2004a; USAF, 1998). Therefore, the impacts of atmospheric deposition from launch emissions on aquatic vegetation and wildlife would be expected to be negligible.

The risk of operations at KSC affecting or taking a marine mammal would be extremely low. A take would only occur if a reusable suborbital rocket failed or a projectile fell on a marine mammal. Such events would be very unlikely. In addition, no notable adverse impacts to fish or essential fish habitat surrounding KSC would be expected, because ocean currents would rapidly dilute any emission deposition that entered the water.

4.3.2.3 Protected Species and Habitat

Of the species listed in Exhibit 3-10, two protected bird species, five protected reptiles or amphibians, and two protected mammals have the potential to be affected by the Experimental Permit Program. Although launches under the Proposed Action could cause short-term effects on these species, the launches would not be likely to adversely affect the long-term well-being, reproduction rates, or survival of any of these species. Based on the location of the launch area, the other species listed in Exhibit 3-12 would not be expected to be affected by the Proposed Action. Should the FAA receive an application for an experimental permit that proposes to launch from the Shuttle Landing Facility at John F. Kennedy Space Center, the FAA would coordinate with NASA in determining if there is a need to further consult with either the Fish and Wildlife Service and/or the National Marine Fisheries Service based on any new activities proposed by the applicant. The FAA would similarly coordinate with NASA regarding any need to further consult with the appropriate State agency regarding any applicable requirements for State listed protected species and habitat. If potential impacts are identified, the FAA would consult with the appropriate agencies to develop any mitigation measures that may be warranted, as described in Chapter 5 of this PEIS.

Bird Species

Essential feeding and nesting habitat for the federally listed threatened Florida scrub jay is widespread in the region. A noise survey in 1990 assessed the noise levels in Florida scrub jay habitat during a Titan 34D launch at Cape Canaveral Air Force Station (CCAFS). Although no conclusions were drawn from the field data, ongoing observations of the scrub jay have not indicated any adverse impact. In addition, there have been studies of reproductive success and survival of Florida scrub jays in the area surrounding the CCAFS former Titan launch pads. The studies did not identify acute or obvious direct impacts to the scrub jay from the Titan launches (KSC, 2003).

The state listed least tern has also been known to nest near launch pads at KSC. Individual launches may disturb or startle a few individual terns due to noise and vibration levels associated with the Proposed Action. These impacts would be temporary and would be limited to individual birds close to the launch site during launch activities. Impacts on least terns would be expected to be similar to that of scrub jays (FAA, 2008b).

Essential feeding and nesting habitat for the federally listed endangered wood stork is widespread in the region. Impacts to the wood stork during Space Shuttle launches were examined in 2003 and while a startle response was noted during the launch, within 10 minutes the colony appeared to be functioning normally and no young were observed to be injured or killed from startle effects. Site visits made before and after the launches did not indicate any obvious adverse effects (KSC, 2003). Wood stork colonies could be susceptible to detrimental effects if the flight path of a rocket strayed within 500 feet of the colony. However, the flight path of reusable suborbital rocket launches from the Shuttle Landing Facility would not be expected to stray within 500 feet of a colony.

Mammal Species

The southeastern beach mouse, a State of Florida species of special concern, mainly lives along the primary coastal dunes of the Merritt Island National Wildlife Refuge, Canaveral National Seashore, and CCAFS (USFWS, 1999a). Activities associated with the Proposed Action would occur inland on KSC, away from coastal dunes. Therefore, the Proposed Action would not be expected to affect the southeastern beach mouse.

Amphibian and Reptile Species

The federally listed threatened Atlantic salt marsh snake and eastern indigo snake are present at KSC and the Merritt Island National Wildlife Refuge. The Atlantic salt marsh snake inhabits coastal salt marshes and mangrove swamps, while the eastern indigo snake prefers open undeveloped habitat (USFWS, 1999a). Because the Proposed Action would primarily occur on developed inland areas of KSC, launches would not be expected to affect the Atlantic salt marsh snake, which would not likely be found around operational areas. Since the eastern indigo snake utilizes a wider range of habitat types than the Atlantic salt marsh snake, it is possible that this species could be present around operational areas at KSC.

The federally listed threatened Atlantic loggerhead sea turtle, and the federally listed endangered Atlantic green sea turtle and leatherback sea turtle are found along KSC beaches. Sea turtle activities, including nesting, along KSC, Merritt Island National Wildlife Refuge, and Canaveral National Seashore beaches would not be expected to be affected by daytime activities under an experimental permit. Facility lighting associated with nighttime launches could disorient sea turtles and hatchlings, and cause them to move in the wrong direction, away from the ocean. Such occurrences could be prevented by implementing a light management plan, as appropriate (USAF, 1998, 2006; NASA, 2004a).

4.3.3 Historical, Architectural, Archaeological, and Cultural Resources

An increase in the number of launches associated with the Proposed Action would not affect the registered or eligible cultural resources at KSC or alter their character or setting. Activities associated with the Proposed Action would not result in any new ground disturbances and would not represent a new type of activity in the area that would affect the character or setting of a cultural resource. Therefore, there would be no impact on cultural resources.

4.3.4 Floodplains

Most of KSC is within the 100-year floodplain and the areas adjacent to Launch Complex (LC)-39 Pads A and B and the Industrial Area are within the 500-year floodplain (NASA 2008a). However, no new permanent infrastructure would be constructed under the Proposed Action, and all temporary structures (*e.g.*, a launch stand or reentry pad) would be removed after a launch or reentry event. Therefore, there would be no adverse impacts to floodplains as a result of the Proposed Action.

4.3.5 Hazardous Materials, Pollution Prevention, and Solid Waste

Under the Proposed Action, the amount of hazardous material, hazardous waste, and solid waste generated at KSC would increase. The types of hazardous materials used for reusable suborbital rockets would be similar to those already used at KSC for its launch programs. KSC has mechanisms in place to store and manage the increased quantity of hazardous materials through the KSC Storage Tank Systems Management Program. All hazardous and non-hazardous wastes would be properly disposed of in accordance with applicable Federal, State of Florida, and local regulations. Reusable suborbital rockets operating under an experimental permit would be much smaller than vehicles currently launched from KSC and would not be expected to generate more hazardous materials than can be safely handled. Hazardous waste management plans would not be expected to change (NASA, 2004a).

Similarly, solid waste is expected to increase with the increase of launches, and the amount of waste generated could be handled under existing collection and disposal operations at the KSC/Schwartz landfill.

KSC is required to reach pollution prevention goals, such as reducing hazardous waste disposal. An increased volume of hazardous materials generated and used by reusable suborbital rockets could affect KSC's ability to meet these goals. Activities associated with reusable suborbital rockets would be coordinated with KSC's pollution prevention plans and goals to reduce the impact of increased hazardous waste.

4.3.6 Health and Safety

Access to launch and support areas would be limited to essential KSC and launch personnel. Based on the health and safety measures discussed in Section 4.1.6, there would be no significant impacts to health and safety.

4.3.7 Land Use (including Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)

Activities associated with reusable suborbital rockets would be compatible with existing launch activities and land uses; therefore, there would be no incompatible land uses from implementation of the Proposed Action. There are no prime or unique farmlands or wild and scenic rivers in the vicinity of the launch areas. Because there would be no construction activities under the Proposed Action, no significant impact on coastal resources would be expected. The potential need to close recreational areas (Merritt Island National Wildlife Refuge and Canaveral National Seashore) or other Section 4(f) resources during periods of activity under an experimental permit is not known at this time and would be based on an applicant's proposed rocket type and size, and defined operating area. Impacts associated with such closures would be addressed in separate NEPA documentation, as appropriate.

4.3.8 Light Emissions and Visual Resources

Launch vehicles would leave visible contrails, but they would be similar in visual impact to contrails from existing operations. Because this area is already used for aircraft takeoffs and landings, the visual sensitivity is low. Launch operations would not substantially degrade the existing visual character or quality of the site and its surroundings. Visual impacts from launch operations would be infrequent, temporary, and minor.

4.3.9 Natural Resources and Energy Supply

Activities that would be permitted under the Proposed Action would not result in the development of new facilities at KSC or result in notable changes in local energy demands or consumption of other natural resources. Reusable suborbital rocket launch or reentry events would be short in duration and could involve up to 30 launch personnel, which would not result in any notable changes to local energy demands or consumption of other natural resources (*e.g.*, water or wastewater disposal). Reusable suborbital rockets would use solid or liquid propellants and other consumable fluids that would be expended during operations. Support aircraft would use jet fuel. Because of the relatively small scale of activity at KSC under the Experimental Permit Program, the use of rocket propellants and jet fuel would not notably alter their supply or demand, and would result in only minor impacts to natural resources and energy supplies.

4.3.10 Noise and Compatible Land Use

Noise levels generated by each launch under an experimental permit would vary, depending on the rocket configuration, flight path, and weather conditions. The issuance of experimental permits would result in an increase in the potential number and frequency of launches at KSC. However, the experimental vehicles would be expected to be smaller and produce lower noise levels than the class of vehicles historically launched KSC.

The nearest residential areas are the Cities of Titusville and Cape Canaveral, both within 14 miles of KSC. Because of the relatively small number of jet-assisted launches, the jet noise DNL 65 contour would not impact these residential areas. Furthermore, because the Proposed Action would not generate DNL 65 contours in residential areas, there would be no significant noise impact in Titusville and Cape Canaveral.

Any sonic booms generated by reusable suborbital rockets would reach Earth's surface at a distance downrange of KSC over the ocean. The flight paths would not overfly populated areas. Therefore, the sonic booms would not affect populated coastal land areas (USAF, 2006).

4.3.11 Socioeconomic Resources, Environmental Justice, and Children's Environmental Health and Safety

4.3.11.1 Socioeconomic Impacts

Under the Proposed Action, the FAA would issue permits for launches of reusable suborbital rockets from KSC, which would result in minor short-term impacts to local socioeconomics. Such impacts would result from the launch and reentry support staff working at the launch or reentry site for the duration of the event. Because of the relatively small number of support staff and short duration of each event, demands on the local infrastructure (*e.g.*, power, water, disposal, transportation system) would not result in a noticeable change in existing conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. The potential national socioeconomic effect would be a small increase in the employment of skilled and professional workers. This would result in an economically beneficial impact.

Jobs associated with the commercial launch industry are generally technology based and require employees with specialized skills and higher levels of education. The creation of jobs in the commercial launch industry would have secondary economic effects on local communities due to increased personal income and the associated tax base. Furthermore, the new or additional workers could increase the size of the community around KSC and create a need for more local services, which in turn would create additional jobs within that community.

4.3.11.2 Environmental Justice and Children's Environmental Health and Safety

In assessing potential environmental justice impacts, the FAA reviewed the impacts of the Proposed Action to identify any large and adverse human health or environmental effects that would disproportionately affect minority or low-income populations. The impacts analysis in this PEIS does not identify any large and adverse human health or environmental effects associated with the Proposed Action at KSC. Therefore, no minority or low-income populations would be disproportionately affected.

In assessing environmental health risks and safety risks that might disproportionately affect children, the FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. In addition, the operating area of the reusable suborbital rocket may not contain or be adjacent to a densely populated area or large concentrations of members of the public. Considering these factors, the FAA determined that the Proposed Action would not be likely to adversely affect children's environmental health and safety.

4.3.12 Water Quality

4.3.12.1 Surface Water

Under the Proposed Action, there could be adverse impacts to freshwater systems. Such impacts would result from the deposition of materials associated with rocket engine emissions into the surface waters discussed in Section 3.3.12. Impacts to surface waters associated with rocket engine emissions are further discussed in Section 4.1.12.1. Most reusable suborbital rockets launched at KSC would use propellants that emit H_2O, CO_2, and CO. See Section 4.1.1, Air Quality, for additional information on rocket engine emissions. Monitoring of the water chemistry in local streams around active launch pads from which rockets have been launched has shown that emissions from rocket engines have not had a long-term effect on basic water chemistry (USAF, 2006). Launch vehicles operating under experimental permits at KSC would not be expected to use solid propellants at altitudes of less than 3,000 feet. Therefore, no impacts to water quality from Cl and HCl would be expected. Furthermore, the Proposed Action would be expected to have a minor short-term affect on local surface water quality, but would not be expected to affect the designated use as defined under Section 303 of the Clean Water Act.

4.3.12.2 Groundwater

The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater (see Section 4.1.14 for additional information). However, impacts would be expected to be minimized through adherence to all site-specific spill prevention and control requirements at each site. Additionally, no impacts to groundwater supply would be anticipated because demand on groundwater to support the Proposed Action at KSC would be negligible.

4.3.13 Wetlands

The Proposed Action could result in local adverse impacts to wetland vegetation and wildlife from deposition of rocket engine emissions, but such impacts would not be significant (see Section 4.1.2). Depending on the propellant type and characteristics, rocket engine emissions could decrease the fitness of an affected local plant or wildlife population but would not be likely to result in the permanent removal or loss of a particular community. The Proposed Action would not result in filling or draining of wetlands, because no new permanent infrastructure would be constructed at KSC and all temporary structures (*e.g.*, a launch stand or reentry pad) would be expected to be located beyond wetland areas and would be removed after a launch or reentry event. See Section 4.1.12, Water Quality, for additional information on rocket engine emission impacts to surface waters.

4.3.14 Accidents

Section 4.1.14 describes potential impacts from accidents at any of the sites evaluated in this PEIS. In the unlikely event of an accident, potential impacts at KSC would be the same as those described in Section 4.1.14.

4.4 Kodiak Launch Complex

4.4.1 Air Quality

The Kodiak Launch Complex (KLC) is in an area that is in attainment for all Federal and State of Alaska air quality standards for criteria pollutants. As listed in Exhibit 4-8, annual emissions from ground level to 3,000 feet, based on the assumption of 600 yearly launch and reentry events, would be about 186 tons CO, 77 tons CO_2, and 203 tons H_2O. There would be no lower tropospheric emissions of hazardous air pollutants (Cl and HCl) from the launch of reusable suborbital rockets at KLC. Emissions from the launch and reentry of reusable suborbital rockets would be of very short duration and would be rapidly dispersed due to the mechanical and thermal turbulence of the exhaust gases and the movement of the vehicle. Therefore, the launch of reusable suborbital rockets from KLC would not significantly affect air quality.

4.4.2 Biological Resources (Fish, Wildlife, and Plants)

4.4.2.1 Terrestrial Plants and Animals

The exhaust heat and atmospheric deposition of emissions associated with reusable suborbital rockets under an experimental permit has the potential to harm nearby vegetation. Localized vegetation scorching and spotting from other rocket launches at KLC has caused temporary impacts, but not of sufficient intensity to cause long-term damage to vegetation (USAF, 2006). The proposed reusable suborbital rockets would be much smaller than many of the launch vehicle and missile configurations previously launched from KLC. There could be some temporary distress to nearby vegetation from launch emissions, resulting in a minor short-term impact, but no long-term adverse effects would be expected.

A monitoring study of 37 bird species, including migratory species, at KLC determined that rocket launches were not notably affecting local bird populations (ENRI, 2002). The launch of a reusable suborbital rocket could cause bird species to be startled and temporarily leave the immediate area, which could disrupt feeding and nesting activities. For vertical vehicles that hover, the hovering action could lead to increased impacts to nearby wildlife because vehicles would be visible for a longer period. However, while the visual stimuli could initially startle wildlife, animals generally adapt to overflight activities by changing their behavior and responses (USAF, 1998). Therefore, the potential reusable suborbital rocket operations at KLC would be expected to have a minor affect on terrestrial plants and animals.

4.4.2.2 Aquatic Plants and Animals

Most of the reusable suborbital rockets would use propellants that emit H_2O, CO_2, and CO. Monitoring of the water chemistry in local streams has shown that prior launches have not had measurable impacts on basic water chemistry (ENRI, 2002; AADC, 2006; AADC, 2009). Based on the findings of the monitoring studies and the relatively small size of the reusable suborbital rockets, no significant impacts to aquatic plants and animals would be expected. Furthermore, the waters south of Kodiak Island, including the essential fish habitat in the Narrow Cape vicinity, would not be expected to be affected by the Proposed Action.

The risk of operations at KLC affecting or taking a marine mammal would be extremely low. A take would only occur if a reusable suborbital rocket failed or a projectile fell on a marine mammal. Such events would be very unlikely. Although launch noises would have the potential to produce startle responses in marine mammals and could disrupt normal activities (resting, feeding, grooming) for short periods, serious injuries and long-term changes in behavior patterns would not be expected (FAA, 1996). In addition, no notable adverse impacts to fish or essential fish habitat surrounding KLC would be expected, because ocean currents would rapidly dilute any emission deposition that entered the water.

4.4.2.3 Protected Species and Habitat

The launch or reentry of reusable suborbital rockets could affect protected species that might be present in the vicinity of KLC, including the federally protected Steller sea lion, northern sea otter, Steller's eider, short-tail albatross, and species of whales. Although launches under the Proposed Action could cause short-term effects on these species, the launches would not be likely to adversely affect the long-term well being, reproduction rates, or survival of any of these species. Should the FAA receive an application for an experimental permit that proposes to launch from the KLC, the FAA would coordinate with the Alaska Aerospace Corporation in determining if there is a need to further consult with either the Fish and Wildlife Service and/or the National Marine Fisheries Service based on any new activities proposed by the applicant. The FAA would similarly coordinate with the Alaska Aerospace Corporation regarding any need to further consult with the appropriate State agency regarding any applicable requirements for State listed protected species and habitat. If potential impacts are identified, the FAA would consult with the appropriate agencies to develop any mitigation measures that may be warranted, as described in Chapter 5 of this PEIS.

Steller Sea Lions

The nearest critical habitat for Steller sea lions is on Ugak Island, approximately 3.5 miles from the proposed launch site. According to a 2003 U.S. Fish and Wildlife Service Biological Opinion, noise and visual stimuli from launch activities could impact Steller sea lions (USFWS, 2003). The visual stimuli caused by a reusable suborbital rocket could cause Steller sea lions to move toward the water. These impacts would be expected to be temporary. In addition, biological monitoring determined that KLC launches could occasionally induce a startle response in Steller sea lions (ENRI, 2002). No noise impacts due to sonic booms would be expected, because sonic booms would occur downrange from the site of critical habitat.

On February 27, 2006, the NOAA Marine Fisheries Service published regulations governing the taking of Stellar sea lions and Pacific harbor seals incidental to rocket launches from KLC (71 *FR* 4297). These regulations will remain in effect until February 28, 2011. On March 19, 2007, the Marine Fisheries Service sent a letter to the Alaska Aerospace Corporation authorizing the incidental take of Stellar sea lions and Pacific harbor seals for to up to nine rocket launches from KLC (72 *FR* 12773). The authorization was effective until March 11, 2009. It was determined that up to nine rocket launches (with Castor 120 motors) would have a negligible impact on marine mammal stocks, and would not have unmitigable adverse impacts to the availability of the affected marine mammal stocks for subsistence use.

Northern Sea Otters

Exposure to short-term noise from launches could cause startle effects in northern sea otters at Narrow Cape. Studies of the southern sea otter, a cousin of the northern sea otter, do not provide any evidence of mother-pup separation following rocket launches. KLC previously consulted with the U.S. Fish and Wildlife and, based on the infrequency of launch activities at KLC (0 to 8 launches a year) and the temporary nature of the disturbance, KLC and the U.S. Fish and Wildlife Service found that the rocket launches would likely have no effect on the northern sea otter (AADC, 2006, 2007).

Steller's Eider

Launches from KLC have not had a significant effect on habitat-use patterns of birds within the Narrow Cape area. The U.S. Fish and Wildlife Service recently ended its formal agreement with the Alaska Aerospace Corporation to perform surveys, because previous monitoring results showed no adverse effects on the Stellar's eiders (AADC, 2006, 2007).

Short-Tail Albatross

No short-tail albatrosses were sighted during biological monitoring for the first five launches from KLC from 1998 to 2001 (USAF, 2006). Because the short-tailed albatross has not been recorded in the vicinity of KLC and the noise associated with a reusable suborbital rocket launch would be expected to attenuate to levels below 80 dBA, the launches and reentries under an experimental permit would not be expected to have an effect on the short-tailed albatross.

Whales

The humpback whale is not likely to be affected by the Proposed Action because the animals would not be exposed to significant launch noise under the water. According to a 2003 U.S. Fish and Wildlife Service biological opinion for KLC, whales would only hear the launch if it flew directly overhead, and it would be unlikely that the noise would be at levels that would affect behavior or cause injury (USFWS, 2003). Additionally, other state and federally protected whale species would likely be in water far enough off the coast of Kodiak Island that they would not hear the launches. No significant impacts to whale species would be expected as a result of the proposed launches.

4.4.3 Historical, Architectural, Archaeological, and Cultural Resources

As indicated in Section 3.4.3, prior archaeological surveys found no historic resources in and around KLC, although paleontological resources are generally found in the Narrow Cape formation. Because there are no historic resources in and around KLC, the proposed reusable suborbital rocket operations would not affect the character or setting of any historic resources. In addition, because there would be no new construction under the Proposed Action, there would be no impact to paleontological resources. Therefore, there would be no impact on cultural or paleontological resources.

4.4.4 Floodplains

KLC is not in a floodplain (FAA, 1996). Therefore, there would be no adverse impacts to floodplains as a result of the Proposed Action.

4.4.5 Hazardous Materials, Pollution Prevention, and Solid Waste

Under the Proposed Action, the amount of hazardous material, hazardous waste, and solid waste generated at KLC would increase. All hazardous material, hazardous waste, and solid waste would be managed in accordance with the policies and procedures identified in Section 3.4.5. All hazardous and non-hazardous wastes would be properly disposed of in accordance with applicable Federal, State of Alaska, and local regulations. Under the Proposed Action, KLC's production limit of 2,200 pounds of hazardous waste per month would not be exceeded and management programs would not have to change. Therefore, no adverse impacts from the use, generation, or management of hazardous material, hazardous waste, and solid waste would be expected.

4.4.6 Health and Safety

In addition to the safety measures described in Section 4.1.6, access to launch and support areas would be limited to essential KLC and launch personnel. The area of Kodiak Borough in the vicinity of KLC is sparsely populated and the typical trajectory from KLC would be directed over the ocean. Therefore, there would be no significant impacts to health and safety.

4.4.7 Land Use (including Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)

Activities associated with the Proposed Action would be consistent with existing launch activities and land uses at KLC. In addition, the Proposed Action would not add any new types of activities or coastal development to Kodiak Island; therefore, the actions would be consistent with the Alaskan Coastal Zone Management Program and the Kodiak Island Borough Coastal Management Program. The potential need to close recreational areas (*e.g.*, Fossil Beach and East Twin Lake) or other Section 4(f) resources during periods of activity under an experimental permit is not known at this time and would be based on an applicant's proposed rocket type and size, and defined operating area. Impacts associated with such closures would be addressed in separate NEPA documentation, as appropriate.

4.4.8 Light Emissions and Visual Resources

Launch vehicles would leave visible contrails, but they would be similar in visual impact to contrails from existing operations. Due to the isolation of KLC and the consequent lack of permanent viewers, launch operations would result in minimal impacts to visual resources. Visual impacts from launch operations, including impacts to Narrow Cape, would be infrequent, temporary, and minor.

4.4.9 Natural Resources and Energy Supply

Activities that would be permitted under the Proposed Action would not result in the development of new facilities at KLC or result in notable changes in local energy demands or consumption of other natural resources. Reusable suborbital rocket launch or reentry events would be short in duration and could involve up to 30 launch personnel, which would not result in any notable changes to local energy demands or consumption of other natural resources (*e.g.*, water or wastewater disposal). Reusable suborbital rockets would use liquid propellants and other consumable fluids that would be expended during operations. Because of the relatively small scale of activity at KLC under the Experimental Permit Program, the use of rocket propellants would not notably alter their supply or demand, and would result in only minor impacts to natural resources and energy supplies.

4.4.10 Noise and Compatible Land Use

Noise levels generated by each launch or reentry under an experimental permit would vary, depending on the rocket configuration, flight path, and weather conditions. The issuance of experimental permits would result in an increase in the potential number and frequency of launches at KLC. However, the experimental vehicles would be expected to be smaller and produce lower noise levels than the class of vehicles currently operating at KLC.

The nearest residential area is a ranch 3.8 miles from the launch site. This area is well beyond the DNL 65 contour line associated with the Proposed Action, and there would be no significant impacts because this receptor would not experience an increase in noise of 1.5 dBA or more at or above DNL 65 (see FAA Order 1050.1E, Change 1, Section 14, Noise).

Any sonic booms generated by reusable suborbital rockets would reach Earth's surface at a distance downrange of KLC over the ocean. The sonic booms would not be expected to affect populated coastal land areas or other islands.

4.4.11 Socioeconomic Resources, Environmental Justice, and Children's Environmental Health and Safety

4.4.11.1 Socioeconomic Impacts

Under the Proposed Action, the FAA would issue permits for launches of reusable suborbital rockets at KLC, which would result in minor short-term impacts to local socioeconomics. Such impacts would result from the launch and reentry support staff working at the launch or reentry site for the duration of the event. Because of the relatively small number of support staff and short duration of each event, demands on the local infrastructure (*e.g.*, power, water, disposal, transportation system) would not result in a noticeable change in existing conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. The potential national socioeconomic effect would be a small increase in the employment of skilled and professional workers. This would result in an economically beneficial impact.

Jobs associated with the commercial launch industry are generally technology based and require employees with specialized skills and higher levels of education. The creation of jobs in the commercial launch industry would have secondary economic effects on local communities due to increased personal income and the associated tax base. Furthermore, the new or additional workers could increase the size of the community around KLC and create a need for more local services, which in turn would create additional jobs within that community.

4.4.11.2 Environmental Justice and Children's Environmental Health and Safety

In assessing potential environmental justice impacts, the FAA reviewed the impacts of the Proposed Action to identify any large and adverse human health or environmental effects that would disproportionately affect minority or low-income populations. The impacts analysis in this PEIS does not identify any large and adverse human health or environmental effects associated with the Proposed Action. Therefore, no minority or low-income populations would be disproportionately affected.

In assessing environmental health risks and safety risks that might disproportionately affect children, the FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. In addition, the operating area of the reusable suborbital rocket may not contain or be adjacent to a densely populated area or large concentrations of members of the public. Considering these factors, the FAA determined that the Proposed Action would not be likely to adversely affect children's environmental health and safety.

4.4.12 Water Quality

4.4.12.1 Surface Water

Under the Proposed Action, there could be adverse impacts to freshwater systems. Such impacts would result from the deposition of materials associated with rocket engine emissions into the surface waters discussed in Section 3.4.12. Impacts to surface waters associated with rocket engine emissions are further discussed in Section 4.1.12.1.1, Surface Waters. Most reusable suborbital rockets launched at KLC would use propellants that emit H_2O, CO_2, and CO. See Section 4.1.1, Air Quality, for additional information on rocket engine emissions. Monitoring of the water chemistry in local streams around active launch pads from which rockets have been launched has shown that emissions from rocket engines have not had a measurable impact on basic water chemistry (USAF, 2006; AADC, 2009). Launch vehicles operating under experimental permits at KLC would not be expected to use solid propellants. Therefore, there would be no impacts to water quality from Cl and HCl. Furthermore, the Proposed Action could have a minor short-term affect on local surface water quality, but would not be expected to affect the designated use as defined under Section 303 of the Clean Water Act.

4.4.12.2 Groundwater

The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater (see Section 4.1.14 for additional information). However, impacts would be expected to be minimized through adherence to all site-specific spill prevention and control requirements at each site. Additionally, no impacts to groundwater supply would be anticipated because demand on groundwater to support the Proposed Action at KLC would be negligible.

4.4.13 Wetlands

The Proposed Action could result in local adverse impacts to wetland vegetation and wildlife from deposition of rocket engine emissions, but such impacts would not be significant (see Section 4.1.2). Depending on the propellant type and characteristics, rocket engine emissions could decrease the fitness of an affected local plant or wildlife population but would not be likely to result in the permanent removal or loss of a particular community. The Proposed Action would not result in filling or draining of wetlands, because no new permanent infrastructure would be constructed at KLC and all temporary structures (*e.g.*, a launch stand or reentry pad) would be expected to be located beyond wetland areas and would be removed after a launch or reentry event. See Section 4.1.12, Water Quality, for additional information on rocket engine emissions impacts to surface waters.

4.4.14 Accidents

Section 4.1.14 describes potential impacts from accidents at any of the sites evaluated in this PEIS. In the unlikely event of an accident, potential impacts at KLC would be the same as those described in Section 4.1.14.

4.5 Mid-Atlantic Regional Spaceport

4.5.1 Air Quality

The Mid-Atlantic Regional Spaceport (MARS) is in an area that is in attainment for all Federal and Commonwealth of Virginia air quality standards for criteria pollutants. As listed in Exhibit 4-8, annual emissions from ground level to 3,000 feet, based on the assumption of 600 yearly launch and reentry events, would be about 186 tons CO, 77 tons CO_2, and 203 tons H_2O. There would be no lower tropospheric emissions of hazardous air pollutants (Cl and HCl) from the launch of reusable suborbital rockets at MARS. Emissions from the launch and reentry of reusable suborbital rockets would be of very short duration and would be rapidly dispersed due to the mechanical and thermal turbulence of the exhaust gases and the movement of the vehicle. Therefore, the launch of reusable suborbital rockets from MARS would not significantly affect air quality.

4.5.2 Biological Resources (Fish, Wildlife, and Plants)

4.5.2.1 Terrestrial Plants and Animals

The vegetation immediately around the launch pads is managed to minimize the risk of brush fires. For vertical launches and hovering launches, Launch Complex 0, which includes Launch Pads 0-A and 0-B, would be used. Launch Pad 0-B contains a flame trench that would direct the principal exhaust and flames toward the beach and over the open ocean. The flame trench directs the principal impacts away from the undisturbed marshes and piping plover habitat west and south of Launch Complex 0-B (NASA, 2005). Launches of reusable suborbital rockets could cause temporary distress to nearby vegetation from deposition of rocket engine emissions. This would result in minor short-term impacts, but no long-term adverse affects would be expected.

Any terrestrial mammals close to a launch on Wallops Island might have startle responses. However, these effects would be temporary and would not have a significant effect on local populations. Amphibian and reptile species, including snapping turtles, northern fence lizards, and Fowler's toads, in the immediate area of a launch might also be startled, but no long-term impacts would be expected (USAF, 2006).

Wallops Island is along the Atlantic Flyway Route and is an important stop for migratory birds. It is possible that birds in the immediate area of a reusable suborbital rocket launch would be startled and flee the site for some period. However, on Wallops Island, the continued presence and breeding of sea and shore birds demonstrates that rocket launches over the years have had little effect on these species (USAF, 2006).

4.5.2.2 Aquatic Plants and Animals

Most reusable suborbital rockets would use propellants that emit H_2O, CO_2, and CO. Surface-water monitoring conducted for large launch systems at other launch facilities has shown that the emissions from rocket engines have not had a long-term effect on basic water chemistry or resulted in alterations to the aquatic vegetation (NASA, 2004a; USAF, 2006).

The risk of operations at Wallops Island affecting or taking a marine mammal would be extremely low. A take would only occur if a reusable suborbital rocket failed or a projectile fell on a marine mammal. Such events would be very unlikely. Additionally, during the preparation of the 2005 Site-Wide Environmental Assessment for the Wallops Flight Facility, it was determined that the information in the Wallops Flight Facility Memorandum for the Record dated July 5, 2000, *Taking of Marine Mammals Incidental to Rocket Launches from NASA Space Flight Center's Wallops Flight Facility* was still applicable and that no significant impacts to marine mammals or other marine life would be expected.

No notable adverse impacts to fish or essential fish habitat surrounding Wallops Flight Facility would be expected, because ocean currents would rapidly dilute any emission deposition that entered the water. Other studies at Wallops Flight Facility have found that metal ions or other chemical constituents released by failed launch vehicles would not result in a significant adverse effect on fish or essential fish habitat (NASA, 2005).

4.5.2.3 Protected Species and Habitat

The sights and sounds of reusable suborbital rocket launches at Wallops Island have the potential to adversely affect the following state or federally protected bird species: piping plovers, Wilson's plovers, peregrine falcons, gulled-billed terns, and upland sandpipers. The launches could cause these species to temporarily abandon nearby areas during migration and/or the breeding season. Although launches under the Proposed Action could cause short-term effects on these species, the launches would not be likely to adversely affect the long-term well-being, reproduction rates, or survival of any of these species. Should the FAA receive an application for an experimental permit that proposes to launch from the Wallops Flight Facility, the FAA would coordinate with NASA in determining if there is a need to further consult with either the Fish and Wildlife Service and/or the National Marine Fisheries Service based on any new activities proposed by the applicant. The FAA would similarly coordinate with NASA regarding any need to further consult with the appropriate State agency regarding any applicable requirements for State listed protected species and habitat. If potential impacts are identified, the FAA would consult with the appropriate agencies to develop any mitigation measures that may be warranted, as described in Chapter 5 of this PEIS.

Piping Plover and Wilson's Plover

There are piping plover and Wilson's plover nesting areas on both the northern and southern ends of Wallops Island. At the request of U.S. Fish and Wildlife Service, these areas are closed to vehicle and human traffic during the nesting season, from mid-March through mid-September. Launch threats for piping plovers and Wilson's plovers are primarily from exhaust products, such as gases, fire, and noise. Previous studies have shown that impacts can be expected within a 3,000-foot radius of the launch pad, with a principal impact radius of approximately 660 to 980 feet, and the impacts could last from 2 to 10 minutes. The closest piping plover and Wilson's plover critical habitat to Launch Pads 0-A and 0-B is approximately 4,000 feet to the southeast. This distance is well outside the DNL 65 contour line associated with hovering and vertical launch vehicles. At this distance, the habitat area would be subject to a brief increase in noise, but otherwise would not be adversely affected by launch operations.

The infrequent and brief noise generated during a launch could startle and cause piping plovers and Wilson's plovers to flee their nesting sites for a short period during and after a launch. However, monitoring and the continued presence and breeding of piping plovers and Wilson's plover on Wallops Island demonstrates that years of rocket launches on the island have had a limited impact on the species (USAF, 2006; NASA, 2005).

Peregrine Falcon

The state listed threatened peregrine falcon has been observed occasionally near the south end of Wallops Island in the vicinity of the launch pads. In addition, a peregrine falcon nest has been recorded on the northwest side of Wallops Island, a few miles from Launch Pads 0-A and 0-B. The infrequent and brief noise generated during a launch could startle peregrine falcons for a short period during a launch.

Upland Sandpiper

During the migratory season, the upland sandpiper could inhabit large grassy areas at Wallops Flight Facility. The infrequent and brief noise generated during a launch could startle upland sandpipers for a short period.

Gulled-Billed Tern

The gulled-billed tern can be found nesting on the beaches or mud flats on Wallops Island. However, because they would not be anticipated to be found near the launch area, no impacts to the gulled-billed tern would be expected.

Bald Eagle

Bald eagles can often be seen flying over Wallops Flight Facility, although they are not known to nest on Wallops Island. There is an active bald eagle nest just north of the Wallops Flight Facility's Main Base. This nest is located more than 8 miles away from Wallops Island. Because of the limited nesting activity of bald eagles in the Wallops Island area, and because noise levels associated with a launch would be less than those already occurring, launches and reentries under an experimental permit would likely have no affect on bald eagles.

Leatherback Sea Turtle, Hawksbill Sea Turtle, Kemp's Ridley Sea Turtle, Loggerhead Sea Turtle, and Atlantic Green Sea Turtle

These sea turtle species have known migration paths along the east coast of the United States, including the nearshore waters of Wallops Island. Sea turtle crawl tracks, a sign of nesting activity, have infrequently been found on Wallops Island beaches. A loggerhead sea turtle nest was established in 2008 on Wallops Island, approximately 16,600 feet and 17,900 feet northeast of Launch Pads 0-A and 0-B, respectively. Launch threats for sea turtles are primarily from exhaust products, such as gases, fire, and noise. Additionally, offshore sonic booms associated with launches could range as high as 117 to 176 dB. However, the NOAA Marine Fisheries Service has defined 218 dB as a safe outer limit for recoverable auditory trauma for marine mammals. Because of the limited activity of sea turtles in the Wallops Island area, and because noise levels associated with a launch would be less than those already occurring, launches and reentries under an experimental permit would likely have no affect on leatherback, hawksbill, Kemp's ridley, loggerhead, and Atlantic green sea turtles.

Marine Mammals

Whale species and manatees present in the waters near Wallops Flight Facility would not likely be affected by the Proposed Action because the animals would not be exposed to significant launch noise under the water. Specifically, it would be unlikely that the noise would be at levels that would affect behavior or cause injury. Additionally, the animals would likely be in water far enough off the coast of Wallops Flight Facility that they would not hear the launches. It is also very unlikely that a rocket or debris would strike or otherwise jeopardize a marine mammal, given the relatively low density of species within the surface waters of these open ocean areas (NASA, 2009). No significant impacts to whale species would be expected as a result of the proposed launches.

4.5.3 Historical, Architectural, Archaeological, and Cultural Resources

As indicated in Section 3.5.3, surveys of Wallops Flight Facility have identified three prehistoric sites on the Main Base, one prehistoric site on Wallops Mainland, and two historic structures on Wallops Island (the Wallops Beach Lifeboat Station and its associated Coast Guard Observation Tower). Activities associated with the Proposed Action would not result in any new ground disturbances and would not represent a new type of activity in the area that would affect the character or setting of the historic sites or archeological sites. Therefore, there would be no impact on cultural resources.

4.5.4 Floodplains

Reusable suborbital rocket activities at MARS under the Proposed Action would not affect floodplains. No new permanent infrastructure would be constructed at MARS under the Proposed Action, and all temporary structures (*e.g.*, a launch stand or reentry pad) would be removed after a launch or reentry event.

4.5.5 Hazardous Materials, Pollution Prevention, and Solid Waste

Under the Proposed Action, the amount of hazardous materials, hazardous waste, and solid waste generated at Wallops Island would increase. All hazardous materials and associated wastes would be managed in accordance with the policies and procedures identified in Section 3.5.5. All hazardous and non-hazardous wastes would be properly disposed of, in accordance with applicable Federal, Commonwealth of Virginia, and local regulations. Activities under the Proposed Action would comply with the pollution prevention requirements and procedures in place at the Facility. In addition, operations would be consistent with the current Wallops Flight Facility Administrative Agreement on Consent, under Section 7003 of RCRA. Hazardous material- and waste-handling capacities would not be exceeded and management programs would not change. Therefore, no adverse impacts from the use, generation, or management of hazardous material, hazardous waste, and solid waste would be expected.

4.5.6 Health and Safety

The establishment of ground and flight safety guidelines is the responsibility of NASA. The Wallops Flight Facility Range Safety Branch is responsible for implementing these safety guidelines. To ensure the safety of personnel, property, and the public, Wallops Flight Facility requires all range users to submit formal documentation pertaining to their proposed operations for safety review. The Range Safety Branch is responsible for coordinating review of the proposed operations with all applicable organizations. Risks to human health and safety would be completely addressed and managed by these plans (NASA, 2009). Strict compliance with the Integrated Contingency Plan would minimize the risk of accidental releases of propellants that could impact soil and water and would minimize its impact should an accidental release occur. Based on the health and safety measures described above and in Section 4.1.6, there would be no significant impacts to health and safety.

4.5.7 Land Use (including Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)

In the past, rocket launches at MARS have precluded staff at Chincoteague National Wildlife Refuge (CNWR) from accessing Assawoman Island for the purposes of monitoring beach nesting birds, including piping plovers. Although the Proposed Action would not result in any immediate increase in experimental permit launches at the MARS site, should the FAA receive any future permit applications at MARS, the FAA would coordinate with NASA in order to determine (1) the current status of any consultations with the U.S. Fish and Wildlife Service and CNWR staff concerning both impacts to nesting birds as well as the monitoring program, and (2) the need for any further mitigation measures as a result of any proposed new experimental launches. The results of this coordination would be reflected in the FAA's NEPA document for the permit application(s).

4.5.8 Light Emissions and Visual Resources

The Proposed Action would not preclude any other land uses in and around Wallops Flight Facility. The Chincoteague National Wildlife Refuge is well beyond the DNL 65 contour line associated with the Proposed Action. There would be no significant noise impacts or access restrictions to nearby recreational areas or other Section 4(f) resources. Additionally, the Proposed Action would not add any new activities or coastal development to Wallops Flight Facility. Therefore, the actions would be consistent with the Virginia Coastal Resources Management Program. Based on the measures the FAA would implement regarding consultation with CNWR staff, and the land-use impacts described in Section 4.1.7, no significant impacts to land use would be expected.

Launch vehicles would leave visible contrails, but they would be similar in visual impact to contrails from existing operations. Because this area is already used for aircraft takeoffs and landings, the visual sensitivity is low. Launch operations would not substantially degrade the existing visual character or quality of the site and its surroundings. Visual impacts from launch operations would be infrequent, temporary, and minor.

4.5.9 Natural Resources and Energy Supply

Activities that would be permitted under the Proposed Action would not result in the development of new facilities or result in notable changes in local energy demands or consumption of other natural resources. Reusable suborbital rocket launch or reentry events would be short in duration and could involve up to 30 launch personnel, which would not result in any notable changes to local energy demands or consumption of other natural resources (*e.g.*, water or wastewater disposal). Reusable suborbital rockets would use liquid propellants and other consumable fluids that would be expended during operations. Because of the relatively small scale of activity at MARS under the Experimental Permit Program, the use of rocket propellants would not notably alter their supply or demand, and would result in only minor impacts to natural resources and energy supplies.

4.5.10 Noise and Compatible Land Use

Noise levels generated by each launch or reentry under an experimental permit would vary, depending on the rocket configuration, flight path, and weather conditions. The issuance of experimental permits would result in an increase in the potential number and frequency of launches at MARS. However, the experimental vehicles would be expected to be smaller and produce lower noise levels than the class of vehicles historically launched from Wallops Island.

The launch areas on Wallops Island are approximately 2.5 miles from the mainland. The marshland and water surrounding the island would act as a buffer zone for noise generated during reusable suborbital rocket launches. The towns of Atlantic and Chincoteague, and private farms, are within 7.5 miles of the launch pads. These areas are well beyond the DNL 65 contour line associated with the Proposed Action. Therefore, there would be no significant noise impacts, because no receptors would experience an increase in noise of 1.5 dBA or more at or above DNL 65 (see FAA Order 1050.1E, Section 14, Noise).

Sonic booms would be possible from the launch of suborbital rockets. Sonic booms would occur over the ocean downrange of the Wallops Flight Facility launch site. The sonic booms would not be an issue affecting populated coastal land areas or other islands (USAF, 2006).

4.5.11 Socioeconomic Resources, Environmental Justice, and Children's Environmental Health and Safety

4.5.11.1 Socioeconomic Impacts

Under the Proposed Action, the FAA would issue permits for launches of reusable suborbital rockets at MARS, resulting in minor short-term impacts to local socioeconomics. Such impacts would result from launch and reentry support staff working at the launch or reentry site for the duration of each event. Because of the relatively small number of support staff and short duration of each event, demands on the local infrastructure (*e.g.*, power, water, disposal, transportation system) would not result in a noticeable change in existing conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. The potential national socioeconomic effect would be a small increase in the employment of skilled and professional workers. This would result in an economically beneficial impact.

Jobs associated with the commercial launch industry are generally technology based and require employees with specialized skills and higher levels of education. The creation of jobs in the commercial launch industry would have secondary economic effects on local communities due to increased personal income and the associated tax base. Furthermore, the new or additional workers could increase the size of the community around MARS and create a need for more local services, which in turn would create additional jobs within that community.

4.5.11.2 Environmental Justice and Children's Environmental Health and Safety

In assessing potential environmental justice impacts, the FAA reviewed the impacts of the Proposed Action to identify any large and adverse human health or environmental effects that would disproportionately affect minority or low-income populations. The impacts analysis in this PEIS does not identify any large and adverse human health or environmental effects associated with the Proposed Action at MARS. Therefore, no minority or low-income populations would be disproportionately affected.

In assessing environmental health risks and safety risks that might disproportionately affect children, the FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. In addition, the operating area of the reusable suborbital rocket may not contain or be adjacent to a densely populated area or large concentrations of members of the public. Considering these factors, the FAA determined that the Proposed Action would not be likely to adversely affect children's environmental health and safety.

4.5.12 Water Quality

4.5.12.1 Surface Water

Under the Proposed Action, there could be adverse impacts to freshwater systems. Such impacts would result from the deposition of materials associated with rocket engine emissions into the surface waters discussed in Section 3.5.12. Impacts to surface waters associated with rocket engine emissions are further discussed in Section 4.1.12.1. Most of the reusable suborbital rockets launched at MARS would use propellants that emit H_2O, CO_2, and CO. See Section 4.1.1, Air Quality, for additional information on rocket engine emissions. Monitoring of the water chemistry in local streams around active launch pads from which rockets have been launched has shown that emissions from rocket engines have not had a long-term effect on basic water chemistry (USAF, 2006). Launch vehicles operating under experimental permits at MARS would not be expected to use solid propellants. Therefore, there would be no impacts to water quality from Cl and HCl. Furthermore, the Proposed Action would be expected to have a minor short-term affect on local surface water quality, but would not be expected to affect the designated use as defined under Section 303 of the Clean Water Act.

Wallops Flight Facility has developed and implemented an Integrated Contingency Plan to minimize hazards to human health and the environment that could occur as the result of an accidental release of hazardous materials. The Integrated Contingency Plan identifies the locations of hazardous material storage areas and outlines spill prevention, control, response, and remediation procedures, and training protocols for personnel who work with hazardous materials (NASA, 2008d). Strict compliance with the Integrated Contingency Plan should minimize the risk of accidental releases of hazardous materials that could impact surface waters and would minimize impacts to surface waters should an accidental release occur.

4.5.12.2 Groundwater

The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater (see Section 4.1.14 for additional information). Strict compliance with the Integrated Contingency Plan should minimize the risk of accidental releases of hazardous materials that could impact groundwater and would minimize impacts to groundwater should an accidental release occur. Additionally, no impacts to groundwater supply would be anticipated because demand on groundwater to support the Proposed Action would be negligible.

4.5.13 Wetlands

The Proposed Action could result in local adverse impacts to wetland vegetation and wildlife from deposition of rocket engine emissions, but such impacts would not be significant (see Section 4.1.2). Depending on the propellant type and characteristics, rocket engine emissions could decrease the fitness of an affected local plant or wildlife population but would not be likely to result in the permanent removal or loss of a particular community. The Proposed Action would not result in filling or draining of wetlands, because no new permanent infrastructure would be constructed at MARS and all temporary structures (*e.g.*, a launch stand or reentry pad) would be expected to be located beyond wetland areas and would be removed after a launch or reentry event. See Section 4.1.12, Water Quality, for additional information on rocket engine emission impacts to surface waters.

4.5.14 Accidents

Section 4.1.14 describes potential impacts from accidents at any of the sites evaluated in this PEIS. In the unlikely event of an accident, potential impacts at MARS would be the same as those described in Section 4.1.14.

4.6 Mojave Air and Space Port

4.6.1 Air Quality

The Mojave Air and Space Port is in the Eastern Kern County nonattainment area (Mojave Desert Air Basin), which is classified as nonattainment for the 8-hour ozone NAAQS. Accordingly, the conformity requirements apply to emissions of NO_X and VOCs. The general conformity *de minimis* thresholds for this area are 100 tons per year of NO_X and 100 tons per year of VOCs. As listed in Exhibit 4-9, annual emissions from ground level to 3,000 feet, based on the assumption of 700 yearly launch and reentry events, would be 188 tons CO, 209 tons CO_2, 197 tons H_2O, 0.10 ton NO_X, 0.0024 ton PM, 0.058 ton SO_X, and 0.54 ton VOCs. Both the total annual NO_X and VOC emissions would be substantially below the *de minimis* levels (100 tons of NO_X or VOC) for this area. There would be no lower tropospheric emissions of hazardous air pollutants (Cl and HCl) from the launch of reusable suborbital rockets at the Mojave Air and Space Port because propellants that contain chlorine would be burned only at higher altitudes and not below 3,000 feet.

A Federal action is considered regionally significant for purposes of conformity when the total increase in emissions due to the action would equal or exceed 10 percent of the nonattainment area's emissions inventory for any criteria pollutant. The total emissions in the Eastern Kern County nonattainment area for 2005 were 13,469 tons of NO_X and 4,625 tons of VOCs (CARB, 2006). The 10-percent thresholds for regional significance would be 1,347 tons of NO_X and 463 tons of VOC. The total annual emissions under the Proposed Action would be well below these levels.

The total increases in emissions due to the Proposed Action would be less than *de minimis* levels and are less than the 10-percent threshold for regional significance. Thus, the Proposed Action would not require a General Conformity determination for launch events at the Mojave Air and Space Port.

4.6.2 Biological Resources (Fish, Wildlife, and Plants)

4.6.2.1 Terrestrial Plants and Animals

The exhaust heat and atmospheric deposition of emissions associated with reusable suborbital rockets could harm nearby vegetation. Localized vegetation scorching and spotting from other rocket launches has been shown to be temporary and not of sufficient intensity to cause long-term damage to vegetation (USAF, 1998, 2006; NASA, 2004a). In addition, the Mojave Specific Plan designates Mojave Air and Space Port as an "urbanized, non-sensitive" area. Therefore, while there could be some temporary distress to nearby vegetation from launch emissions, this would be a minor short-term impact, with no long-term adverse effects. No Joshua trees or creosote scrub would be expected to be affected by the Proposed Action.

The greatest effects on terrestrial wildlife occur from visual and noise disturbances during overflight activities. The noise associated with the launch and operation of reusable suborbital rockets would be similar to the noise generated from the current daily aircraft takeoffs and landings. Terrestrial species in the immediate area of a launch might have startle responses; however, animals generally adapt, behaviorally and physiologically, to overflight activities (USAF, 1998). These effects would be temporary and no long-term impacts to local populations of terrestrial wildlife would be expected.

4.6.2.2 Aquatic Plants and Animals

As stated in Section 3.6.2, there are no aquatic plants or animals at the Mojave Air and Space Port. Therefore, there would be no impacts.

4.6.2.3 Protected Species and Habitat

Of the species listed in Exhibit 3-17, only the federally listed threatened desert tortoise and the state listed threatened Mohave ground squirrel have been known to occur at the Mojave Air and Space Port. Because the other species listed in Exhibit 3-17 have only been observed outside of the Mojave Air and Space Port, the launch of reusable suborbital rockets would not be expected to affect these species (FAA, 2004). Should the FAA receive an application for an experimental permit that proposes to launch from the Mojave Air and Space Port, the FAA would coordinate with the East Kern Airport District in determining if there is a need to further consult with either the Fish and Wildlife Service and/or the National Marine Fisheries Service based on any new activities proposed by the applicant. The FAA would similarly coordinate with the East Kern Airport District regarding any need to further consult with the appropriate State agency regarding any applicable requirements for State listed protected species and habitat. If potential impacts are identified, the FAA would consult with the appropriate agencies to develop any mitigation measures that may be warranted, as described in Chapter 5 of this PEIS.

Desert Tortoise

The desert tortoise is an herbivorous reptile that occurs in low densities, primarily within creosote scrub and Joshua tree formations. There is no designated critical habitat for desert tortoises at Mojave Air and Space Port and, based on the species preferred habitat, it is unlikely that a desert tortoise would be found within the launch area. Previous consultation with the U.S. Fish and Wildlife Service resulted in a conclusion that desert tortoises are either absent from or occur in extremely low numbers at the Mojave Airport (USFWS, 2006).

Mohave Ground Squirrel

The Mohave ground squirrel typically occupies underground burrows from July through February and is only found in the Mojave Desert. There is no designated critical habitat for the ground squirrel at the Mojave Air and Space Port (FAA, 2004; EKAD, 2005). The launch of rockets under an experimental permit would not be expected to affect the Mohave ground squirrel.

4.6.3 Historical, Architectural, Archaeological, and Cultural Resources

As discussed in Section 3.6.3, there are no recorded cultural resources in the launch area and no sites at the Mojave Air and Space Port listed on the *National Register of Historic Places*. In addition, there are no designated tribal lands on Mojave Air and Space Port property. Activities associated with the Proposed Action would not result in any new ground disturbances and would not represent a new type of activity in the area that would affect the character or setting of a cultural resource. Therefore, there would be no impact to cultural resources.

4.6.4 Floodplains

The Mojave Air and Space Port is not in a floodplain. Therefore, there would be no adverse impacts to floodplains as a result of the Proposed Action.

4.6.5 Hazardous Materials, Pollution Prevention, and Solid Waste

Under the Proposed Action, the amount of hazardous material, hazardous waste, and solid waste generated at the Mojave Air and Space Port would increase. Hazardous materials that would be used to support the operations associated with the Proposed Action are similar to materials already handled at the Mojave Air and Space Port. In addition, procedures are currently in place to accommodate additional fuel and other launch-related hazardous materials, including paint, oils, lubricants, and solvents. All fuels and other hazardous materials would be stored and used in compliance with the regulations applicable to their storage and use, and already in place at Mojave Air and Space Port. No adverse impacts would be expected from these additional hazardous materials.

4.6.6 Health and Safety

In support of each launch, the FAA would review and verify the hazard analysis to evaluate potential hazards and reduce the associated risks to an acceptable level. The review and verification would be coordinated with Mojave Air and Space Port and with Edwards Air Force Base, which is approximately 30 miles east of Mojave Air and Space Port. In addition, access to launch and support areas would be limited to essential Mojave Air and Space Port and launch personnel. Based on the health and safety measures described above and in Section 4.1.6, there would be no significant impacts to health and safety.

4.6.7 Land Use (including Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)

The Mojave Air and Space Port is a highly developed, urbanized, non-sensitive area, and habitat and nature conservation plans do not apply. As stated in Section 3.6.7, there are no farmlands or wild and scenic rivers on Mojave Air and Space Port property. In addition, no areas outside of the launch site would have to be cleared and no roads would have to be closed for any reusable suborbital rocket launches from the Mojave Air and Space Port. Furthermore, there would be no impacts to land use, Section 4(f) lands, wild and scenic rivers, or coastal resources.

4.6.8 Light Emissions and Visual Resources

Launch vehicles would leave visible contrails, but they would be similar in visual impact to contrails from existing operations. Because this area is already used for aircraft takeoffs and landings, the visual sensitivity is low. Launch operations would not substantially degrade the existing visual character or quality of the site and its surroundings and would have no adverse effect on a scenic vista or scenic resources, because there are none in the area.

4.6.9 Natural Resources and Energy Supply

Activities that would be permitted at the Mojave Air and Space Port under the Proposed Action would not result in the development of new facilities or result in notable changes in local energy demands or consumption of other natural resources. Reusable suborbital rocket launch or reentry events would be short-term and could involve up to 30 launch personnel, which would not result in any notable changes to local energy demands or consumption of other natural resources (*e.g.*, water or wastewater disposal). Reusable suborbital rockets would use solid or liquid propellants and other consumable fluids that would be expended during operations. Support aircraft would use jet fuel. Because of the relatively small scale of activity at the Mojave Air and Space Port under the Experimental Permit Program, the use of rocket propellants and jet fuel would not notably alter their supply or demand, and would result in only minor impacts to natural resources and energy supplies.

4.6.10 Noise and Compatible Land Use

Noise levels generated by each launch under an experimental permit would vary, depending on the rocket configuration, flight path, and weather conditions. Annual jet activity is 1,226 operations (FAA, 2004) per year, as compared to the Proposed Action's maximum of 400 additional jet-assisted launches per year. The DNL associated with this change would increase by less than 1.5 dBA, so noise impacts associated with horizontal launches would not be significant. Hovering vehicles would produce DNL 65 contours within the Mojave Air and Space Port environment and therefore would produce no significant noise impacts.

The Proposed Action would not expose persons to or generate noise levels in excess of standards established by the California State Building Code, the California Land Use Compatibility for Community Noise Environments guidelines, the Kern County General Plan, the Mojave Specific Plan, or the Kern County Airport Land Use Compatibility Plan. The Proposed Action would not result in a substantial permanent or temporary increase in ambient noise levels in the vicinity of the Mojave Air and Space Port.

The Mojave Air and Space Port and surrounding areas currently experience sonic boom noise exposure from supersonic military jets at Edwards Air Force Base. The Mojave community, including sensitive receptors such as schools and residential areas, currently experience high-intensity noise levels above 90 dBA. Assuming that the Proposed Action could cause sonic booms with magnitude as high as 2 pounds per square foot, up to 750 sonic booms per year would need to be generated before reaching a significance threshold of CDNL 61.[3] Under the Proposed Action, there could be 400 additional annual sonic booms associated with experimental permit activity.

4.6.11 Socioeconomic Resources, Environmental Justice, and Children's Environmental Health and safety environmental consequences

4.6.11.1 Socioeconomic Impacts

Under the Proposed Action, the FAA would issue permits for launches of reusable suborbital rockets at the Mojave Air and Space Port, resulting in minor short-term impacts to local socioeconomics. Such impacts would result from launch and reentry support staff working at the launch or reentry site for the duration of the event. Because of the relatively small number of support staff and short duration of the event, demands on the local infrastructure (*e.g.*, power, water, disposal, transportation system) would not result in a noticeable change in existing conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. The potential national socioeconomic effect would be a small increase in the employment of skilled and professional workers. This would result in an economically beneficial impact.

Jobs associated with the commercial launch industry are generally technology based and require employees with specialized skills and higher levels of education. The creation of jobs in the commercial

[3] CDNL is C-weighted DNL. C-weighting is the appropriate weighting network for evaluating low-frequency sonic booms. CDNL 61 is equivalent to DNL 65 (A-weighted).

launch industry would have secondary economic effects on local communities due to increased personal income and the associated tax base. Furthermore, the new or additional workers could increase the size of the community around the Mojave Air and Space Port and create a need for more local services, which in turn would create additional jobs within that community.

4.6.11.2 Environmental Justice and Children's Environmental Health and Safety

In assessing potential environmental justice impacts, the FAA reviewed the impacts of the Proposed Action to identify any large and adverse human health or environmental effects that would disproportionately affect minority or low-income populations. The impacts analysis in this PEIS does not identify any large and adverse human health or environmental effects associated with the Proposed Action. Therefore, no minority or low-income populations would be disproportionately affected.

In assessing environmental health risks and safety risks that might disproportionately affect children, the FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. In addition, the operating area of the reusable suborbital rocket may not contain or be adjacent to a densely populated area or large concentrations of members of the public. Considering these factors, the FAA determined that the Proposed Action would not be likely to adversely affect children's environmental health and safety.

4.6.12 Water Quality

4.6.12.1 Surface Water

As discussed in Section 3.6.12.1, there are no bodies of standing surface water at the Mojave Airport, but there are surface drainage channels to the east and southwest of the runways. The Proposed Action does not involve construction and would not be expected to create discharges to these channels. Therefore, no impacts to surface water quality would be expected.

4.6.12.2 Groundwater

The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater (see Section 4.1.14 for additional information). However, impacts would be expected to be minimized through adherence to all site-specific spill prevention and control requirements at each site. Additionally, no impacts to groundwater supply would be anticipated because demand on groundwater to support the Proposed Action at the Mojave Air and Space Port would be negligible.

4.6.13 Wetlands

Launch activities would be expected to be conducted from the existing infrastructure at the Mojave Air and Space Port. There are no jurisdictional wetlands at the Mojave Air and Space Port and any temporary launch structures would be located beyond the series of drainage channels that are located to the east and southwest of the runway operating area. Thus, there would be no adverse impacts to wetlands as a result of the Proposed Action.

4.6.14 Accidents

Section 4.1.14 describes potential impacts from accidents at any of the sites evaluated in this PEIS. In the unlikely event of an accident, potential impacts at the Mojave Air and Space Port would be the same as those described in Section 4.1.14.

4.7 Oklahoma Spaceport

4.7.1 Air Quality

The Oklahoma Spaceport is in an area that is in attainment for all NAAQS. As listed in Exhibit 4-10, annual emissions from ground level to 3,000 feet, based on the assumption of 1,000 yearly launch and reentry events, would be about 215 tons CO, 276 tons CO_2, 239 tons H_2O, 0.10 ton NO_x, less than 0.005 ton PM, 0.058 ton SO_x, and 0.54 ton VOCs. There would be no lower tropospheric emissions of hazardous air pollutants (Cl and HCl) from the launch of reusable suborbital rockets, because propellants that contain chlorine would be burned only at higher altitudes and not below 3,000 feet. Emissions from the launch and reentry of reusable suborbital rockets would be of very short duration and would be rapidly dispersed due to the mechanical and thermal turbulence of the exhaust gases and the movement of the vehicle. Therefore, the launch of reusable suborbital rockets from Oklahoma Spaceport would not significantly affect air quality and would have a negligible impact on visibility at the designated Class II area.

Exhibit 4-10. Estimated Annual Emissions Below 3,000 feet Per Site (1,000 Launches) under the Proposed Action (tons)

Reusable Suborbital Rocket	Cl	CO	CO_2	HCl	H_2O	NO_X	PM	SO_X	VOCs
Horizontal 1	0.00	3.07	76.30	0.00	0.00	0.04	0.00	0.03	0.33
Horizontal 2	0.00	23.63	57.88	0.00	35.44	0.00	0.00	0.00	0.00
Horizontal 3	0.00	2.36	64.41	0.00	0.00	0.06	0.00	0.03	0.22
Vertical 1	0.00	27.56	67.52	0.00	41.34	0.00	0.00	0.00	0.00
Vertical 2 (hover)	0.00	158.73	9.92	0.00	162.04	0.00	0.00	0.00	0.00
Totals	**0.00**	**215.35**	**276.03**	**0.00**	**238.82**	**0.10**	**0.00**	**0.06**	**0.54**

Note: Values of less than 0.005 ton are shown as 0.00.

4.7.2 Biological Resources (Fish, Wildlife, and Plants)

4.7.2.1 Terrestrial Plants and Animals

The greatest effects on terrestrial wildlife occur from visual and noise disturbances during overflight activities. The noise associated with the launch and operation of reusable suborbital rockets would be less than that associated with the daily military aircraft takeoffs and landings. Terrestrial species, including skunks, rabbits, and coyotes, in the immediate area of a launch might have startle responses. However, animals generally adapt, behaviorally and physiologically, to overflight activities. Overall, the risk to terrestrial species would be negligible (USAF, 1998). Impacts would be temporary and short-term.

4.7.2.2 Aquatic Plants and Animals

Most reusable suborbital rockets would use propellants that emit H_2O, CO_2, and CO, which would not be expected to affect aquatic systems near the Oklahoma Spaceport.

4.7.2.3 Protected Species and Habitat

There are no known federally protected species or designated critical habitats at the Oklahoma Spaceport (USACE, 1999). Of the species listed in Exhibit 3-19, the whooping crane is the most likely endangered species to be found near the Oklahoma Spaceport. Previous studies indicate that the whooping crane might be present in or near the wetlands at the Oklahoma Spaceport during its spring and fall migration (USAF, 2004). However, given the disturbed nature of the site (*i.e.*, adjacent to an active airport) and the frequency and noise levels of aircraft operations, it is unlikely that the wetlands on or near the Oklahoma Spaceport provide suitable stopover habitat for whooping cranes. Therefore, launches and reentries associated with a reusable suborbital rocket would not be expected to affect the whooping crane. It is not likely that the other species listed in Exhibit 3-20 would be present at the Spaceport.

4.7.3 Historical, Architectural, Archaeological, and Cultural Resources

As indicated in Section 3.7.3, no prehistoric or historic sites have been identified within the boundaries of the Clinton-Sherman Industrial Airpark, although prehistoric and historic sites have been identified in the surrounding area. Activities associated with the Proposed Action would not result in any new ground disturbances and would not represent a new type of activity in the area that would affect the character or setting of cultural resources. Therefore, there would be no impact to cultural resources.

4.7.4 Floodplains

Reusable suborbital rocket activities under the Proposed Action at the Oklahoma Spaceport would not affect floodplains. No new permanent infrastructure would be constructed under the Proposed Action, and all temporary structures (*e.g.*, a launch stand or reentry pad) would be removed after a launch or reentry event.

4.7.5 Hazardous Materials, Pollution Prevention, and Solid Waste

Under the Proposed Action, the amount of hazardous material, hazardous waste, and solid waste generated at the Clinton-Sherman Industrial Airpark would increase. All hazardous material, hazardous waste, and solid waste would be managed in accordance with the policies and procedures identified in Section 3.7.5. The Airpark has standard operating procedures in place to minimize the hazards associated with transporting and storing jet fuel and propellants. Emergency response personnel would be on standby during shipments. All liquid fuel and propellants would be shipped to the Airpark in bulk tanker trucks, each with a capacity of approximately 4,000 gallons, which would also serve as temporary storage containers. No propellants would be stored for extended periods; propellant shipments would be brought in to support launches as needed.

Temporary dikes would be provided for containment in the event a spill occurred during fueling operations at existing onsite fuel staging areas. The launch operator would be responsible for any necessary cleanup and remediation actions following a spill. Clinton-Sherman Industrial Airpark maintains a current inventory of all hazardous materials being stored and used within the boundaries of the Airpark by type, quantity, and location. All propellants and other hazardous materials would be handled, stored, and used in compliance with applicable regulations.

Clinton-Sherman Industrial Airpark is not a regulated hazardous waste generator under RCRA, but does comply with all existing requirements for launch facility operation. Under the Proposed Action, the total storage capacity of Jet-A and 100-octane fuel would not be exceeded. All hazardous and non-hazardous wastes would be properly disposed of in accordance with applicable Federal, State of Oklahoma, and local regulations. Therefore, no adverse impacts from the use, generation, or management of hazardous material, hazardous waste, and solid waste would be expected.

4.7.6 Health and Safety

Clinton-Sherman Industrial Airpark implements an integrated program to manage safety and environmental protection objectives for operation of a commercial launch and landing site. This includes implementation of safety plans to protect workers during potentially hazardous activities. Protection of health and safety would be accomplished through land-use planning, range clearing (airspace closures, road closures, public evacuations), and public notifications during launch and landing (FAA, 2006d). The Proposed Action would not impede or adversely affect the existing contamination or clean up activities at the Airpark.

Based on the health- and safety-protection measures described above and in Section 4.1.6, there would be no significant impacts on health and safety.

4.7.7 Land Use (including Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)

The Proposed Action would not preclude or alter any land uses in and around Clinton-Sherman Industrial Airpark. There are no wild and scenic rivers or coastal resources in the vicinity of the Oklahoma Spaceport. The Proposed Action would not affect the Washita National Wildlife Refuge, which is 12 miles north of the Oklahoma Spaceport. Based on the land-use discussion in Section 4.1.7, and the fact that the Proposed Action would not preclude or alter land uses, there would be no impacts to land use.

4.7.8 Light Emissions and Visual Resources

The visual presence of launches would not be new to the area. Most existing aircraft operations at the Clinton-Sherman Industrial Airpark involve jet-powered aircraft. Launch vehicles would leave visible contrails, but they would be similar in visual impact to contrails from existing operations. Because this area is already used for aircraft takeoffs and landings of, the visual sensitivity is low. Launch operations would not substantially degrade the existing visual character or quality of the site and its surroundings. Visual impacts from launch operations would be infrequent, temporary, and minor.

4.7.9 Natural Resources and Energy Supply

Activities that would be permitted under the Proposed Action at the Oklahoma Spaceport would not result in the development of new facilities or result in notable changes in local energy demands or consumption of other natural resources. Reusable suborbital rocket launch or reentry events would be short-term and could involve up to 30 launch personnel, which would not result in any notable changes to local energy demands or consumption of other natural resources (*e.g.*, water or wastewater disposal). Reusable suborbital rockets would use solid or liquid propellants and other consumable fluids that would be expended during operation. Support aircraft would use jet fuel. Because of the relatively small scale of activity at the Oklahoma Spaceport under the Experimental Permit Program, the use of rocket propellants and jet fuel would not notably alter their supply or demand, and would result in only minor impacts to natural resources and energy supplies.

4.7.10 Noise and Compatible Land Use

Noise levels generated by each launch under an experimental permit would vary, depending on the rocket configuration, flight path, and weather conditions. The issuance of experimental permits would result in an increase in the potential number and frequency of launches at the Oklahoma Spaceport. Experimental launches would be short in duration and noise from the launches should not result in a change in noise exposure in excess of the applicable threshold of significance within the DNL 65 contour. Most of this land within this DNL 65 contour is either part of the Clinton-Sherman Industrial Airpark or agricultural land. As discussed in Section 3.7.10, the nearest sensitive receptor is a single-family house approximately 2,000 feet northwest of the end of Runway 17R. The Proposed Action would not result in a significant increase in DNL at the residence. The additional noise sources from proposed reusable suborbital rocket launches would be similar to noise generated by large military aircraft currently using the Airpark, and significant adverse impacts due to noise would not be expected.

FAA estimates of sonic booms found that CDNL values associated with reusable suborbital rockets would likely be lower than CDNL 61 at noise-sensitive receptor locations. The FAA defines a significant noise impact as occurring above DNL 65, which is the equivalent of CDNL 61. Hence, there would be no significant noise impact associated with sonic booms at Clinton-Sherman Industrial Airpark. In addition, the most likely areas where sonic booms would occur are sparsely populated (FAA, 2006d).

4.7.11 Socioeconomic Resources, Environmental Justice, and Children's Environmental Health and Safety

4.7.11.1 Socioeconomic Impacts

Under the Proposed Action, the FAA would issue permits for launches of reusable suborbital rockets at the Oklahoma Spaceport, resulting in minor short-term impacts to local socioeconomics. Such impacts would result from launch and reentry support staff working at the launch or reentry site for the duration of the event. Because of the relatively small number of support staff and short duration of each event, demands on the local infrastructure (*e.g.*, power, water, disposal, transportation system) would not result in a noticeable change in existing conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. The potential national socioeconomic effect would be a small increase in the employment of skilled and professional workers. This would result in an economically beneficial impact.

Jobs associated with the commercial launch industry are generally technology based and require employees with specialized skills and higher levels of education. The creation of jobs in the commercial launch industry would have secondary economic effects on local communities due to increased personal income and the associated tax base. Furthermore, the new or additional workers could increase the size of the community around the Oklahoma Spaceport and create a need for more local services, which in turn would create additional jobs within that community.

4.7.11.2 Environmental Justice and Children's Environmental Health and Safety

In assessing potential environmental justice impacts, the FAA reviewed the impacts of the Proposed Action to identify any large and adverse human health or environmental effects that would disproportionately affect minority or low-income populations. The impacts analysis in this PEIS does not identify any large and adverse human health or environmental effects associated with the Proposed Action. Therefore, no minority or low-income populations would be disproportionately affected.

In assessing environmental health risks and safety risks that might disproportionately affect children, the FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. In addition, the operating area of the reusable suborbital rocket may not contain or be adjacent to a densely populated area or large concentrations of members of the public. Considering these factors, the FAA determined that the Proposed Action would not be likely to adversely affect children's environmental health and safety.

4.7.12 Water Quality

4.7.12.1 Surface Water

Under the Proposed Action, there could be adverse impacts to freshwater systems. Such impacts would result from the deposition of materials associated with rocket engine emissions into the surface waters discussed in Section 3.7.12. Impacts to surface waters associated with rocket engine emissions are further discussed in Section 4.1.12.1. Most of the reusable suborbital rockets would use propellants that emit H_2O, CO_2, and CO. See Section 4.1.1, Air Quality, for additional information on rocket engine emissions. Monitoring of the water chemistry in local streams around active launch pads from which rockets have been launched has shown that emissions from rocket engines have not had a long-term effect on basic water chemistry (USAF, 2006). Launch vehicles operating under experimental permits at the Oklahoma Spaceport would not be expected to use solid propellants at altitudes of less than 3,000 feet. Therefore, no impacts to water quality from Cl and HCl would be expected. Furthermore, the Proposed Action would be expected to have a minor short-term affect on local surface water quality, but would not be expected to affect the designated use as defined under Section 303 of the Clean Water Act.

4.7.12.2 Groundwater

The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater (see Section 4.1.14 for additional information). However, impacts would be expected to be minimized through adherence to all site-specific spill prevention and control requirements at each site. Additionally, no impacts to groundwater supply would be anticipated because demand on groundwater to support the Proposed Action at the Oklahoma Spaceport would be negligible.

4.7.13 Wetlands

The Proposed Action could result in local adverse impacts to wetland vegetation and wildlife from deposition of rocket engine emissions, but such impacts would not be significant (see Section 4.1.2). Depending on the type of propellant type and its characteristics, rocket engine emissions could decrease the fitness of an affected local plant or wildlife population but would not be likely to result in the permanent removal or loss of a particular community. The Proposed Action would not result in filling or draining of wetlands, because no new permanent infrastructure would be constructed at the Oklahoma Spaceport and all temporary structures (*e.g.*, a launch stand or reentry pad) would be expected to be located beyond wetland areas and would be removed after a launch or reentry event. See Section 4.1.12, Water Quality, for additional information on rocket engine emission impacts to surface waters.

4.7.14 Accidents

Section 4.1.14 describes potential impacts from accidents at any of the sites evaluated in this PEIS. In the unlikely event of an accident, potential impacts at the Oklahoma Spaceport would be the same as those described in Section 4.1.14.

4.8 Space Florida

4.8.1 Air Quality

Launch Complex (LC-46) is in an attainment area (Brevard County) for all Federal and State of Florida air quality standards for criteria pollutants. As shown in Exhibit 4-8, annual emissions from ground level to 3,000 feet, based on the assumption of 600 yearly launch and reentry events, would be about 186 tons CO, 77 tons CO_2, and 203 tons H_2O. There would be no emissions of hazardous air pollutants (Cl and HCl) from the launch of reusable suborbital rockets at LC-46. Emissions from launch and reentry of reusable suborbital rockets would be of very short duration and would be rapidly dispersed due to the mechanical and thermal turbulence of the exhaust gases and the movement of the vehicle. As a result, the launch of reusable suborbital rockets at LC-46 would not significantly affect air quality.

4.8.2 Biological Resources (Fish, Wildlife, and Plants)

4.8.2.1 Terrestrial Plants and Animals

The greatest effects on terrestrial wildlife occur from visual and noise disturbances during overflight activities. Birds in the immediate area could be startled and flee the site for a short time. However, the continued presence of sea and shore birds at CCAFS demonstrates that launches have had little lasting effects on the behavior of these species (USAF, 2007b). Terrestrial animals may have startle responses. These effects would be temporary and would not be expected to significantly affect local populations. While initially startling to wildlife, animals generally adapt, behaviorally and physiologically, to overflight activities, and overall effects would be expected to be negligible (USAF, 1998).

4.8.2.2 Aquatic Plants and Animals

Most of the reusable suborbital rockets would use propellants that emit H_2O, CO_2, and CO. Surface-water monitoring conducted for large launch systems at CCAFS and other launch facilities has not shown alterations of the aquatic vegetation (NASA, 2004a; USAF, 2006). The upper Banana River, adjacent to CCAFS, has generally good water quality. Acidification and impacts to marine aquatic wildlife would not be expected in the nearby Atlantic Ocean, because emissions and fluids would be neutralized by sea salt and quickly diluted in the open ocean (USAF, 1998, 2006). Therefore, the impacts of atmospheric deposition from launch emissions on aquatic vegetation and wildlife would be negligible.

4.8.2.3 Protected Species and Habitat

Of the species listed in Exhibit 3-22, four protected bird species, six protected reptiles or amphibians, and two protected mammals could be affected by implementation of the Proposed Action at LC-46. Although launches under the Proposed Action could cause short-term effects on these species, the launches would be unlikely to adversely affect the long-term well being, reproduction rates, or survival of any of these species. Based on the location of the launch area, the other species listed in Exhibit 3-22 would not be expected to be affected by the Proposed Action. Should the FAA receive an application for an experimental permit that proposes to launch from CCAFS, the FAA would coordinate with the USAF in determining if there is a need to further consult with either the Fish and Wildlife Service and/or the National Marine Fisheries Service based on any new activities proposed by the applicant. The FAA would similarly coordinate with the USAF regarding any need to further consult with the appropriate State agency regarding any applicable requirements for State listed protected species and habitat. If potential impacts are identified, the FAA would consult with the appropriate agencies to develop any mitigation measures that may be warranted, as described in Chapter 5 of this PEIS.

Bird Species

Essential feeding and nesting habitat is widespread in the region for several protected bird species, including the Florida scrub jay, piping plover, wood stork, and the peregrine falcon. A noise survey in 1990 assessed the noise levels in Florida scrub jay habitat during a Titan 34D launch at CCAFS. Although no conclusions were drawn from the field data, ongoing observations of the scrub jay have not indicated any adverse impact. In addition, there have been studies of reproductive success and survival of Florida scrub jays in the areas around the CCAFS former Titan launch pads. These studies did not reveal acute or obvious direct impacts to the scrub jay from Titan launches (KSC, 2003).

The state listed least tern has been known to nest near LC-46. Individual launches may disturb or startle a few individual terns due to noise and vibration levels associated with the Proposed Action. These impacts would be temporary and would be limited to individual birds close to the launch site during launch activities. Impacts on least terns would be expected to be similar to that of scrub jays (FAA, 2008b). Impacts to the wood stork at CCAFS were examined in 1998 and 2000 as part of the Evolved Expendable Launch Vehicle Program and as part of the Falcon 1 and Falcon 9 Environmental Assessment. Wood storks were observed feeding in the CCAFS drainage canal system and resting along the canal banks and in adjacent fields (USAF, 2007b). Expendable launches did not jeopardize existing wood stork colonies because disturbances were intermittent and birds were able to habituate to the disturbance or to return to normal behavior after a startle response (USAF, 1998, 2000).

The infrequent and brief noise generated during a launch under an experimental permit could startle and cause piping plovers and peregrine falcons to flee their nesting sites for a short time during and after a launch. However, the continued presence and breeding of piping plovers and peregrine falcons on CCAFS demonstrates that years of rocket launches has had a limited effect on these species. Furthermore, because of the distance between the LC-46 and the plover and falcon nesting areas, and the lower noise levels associated with a reusable suborbital rocket, launches and reentries under an experimental permit would not be expected to have an adverse effect on the long-term well-being, reproduction rates, or survival of theses species.

Amphibian and Reptile Species

The federally listed threatened eastern indigo snake is present at CCAFS. The species prefers open undeveloped habitat, but utilizes a wide range of habitat types. Because the eastern indigo snake can use a wide range of habitat types, it is possible that this species could be present around operational areas at CCAFS (USFWS, 1999a). However, the major sources of eastern indigo snake mortality are from road vehicle strikes and intentional killings, not from rocket launches. Therefore, the Proposed Action would not be expected to affect the local eastern indigo snake population.

The federally listed threatened loggerhead sea turtle, and the federally listed endangered Atlantic green sea turtle, leatherback sea turtle, Hawksbill sea turtle, and Kemp's Ridley sea turtle use beach habitat along the CCAFS coast. Sea turtle nesting habitat along CCAFS and on nearby KSC, Merritt Island National Wildlife Refuge, and Canaveral National Seashore beaches would not be expected to be disturbed by launch operations. However, facility lighting could disorient sea turtles and hatchlings at night, and cause them to move in the wrong direction, away from the ocean. Such occurrences would be prevented by adhering to the existing light management plans for the site (USAF, 1998, 2006).

Mammal Species

The southeastern beach mouse, a state designated species of special concern, primarily lives along the coastal dunes on CCAFS and nearby KSC, Merritt Island National Wildlife Refuge, and Canaveral

National Seashore (USFWS, 1999a). Activities associated with the Proposed Action would occur inland on CCAFS, away from coastal dunes. Therefore, the Proposed Action would not be expected to affect the southeastern beach mouse.

The federally listed endangered West Indian manatee is present in the Banana River to the west of CCAFS. Though the hearing sensitivity of manatees has not been well studied, manatees have been shown to be relatively unresponsive to human-made noise (NASA, 2004b; USAF, 1998). Therefore, launch noise would not be expected to results in an impact on manatees.

4.8.3 Historical, Architectural, Archaeological, and Cultural Resources

Historic and architectural sites listed on the *National Register of Historic Places*, such as historic and architectural buildings associated with the Man in Space Program, could be used in future launch operations similar to their past use. An increase in the number of launches associated with the Proposed Action would not affect the registered or eligible cultural resources at CCAFS or alter their character or setting. Activities associated with the Proposed Action would not result in any new ground disturbances and would not represent a new type of activity in the area that would affect the character or setting of a cultural resource. Therefore, there would be no impact to cultural resources.

4.8.4 Floodplains

Reusable suborbital rocket activities at LC-46 under the Proposed Action would not affect floodplains. No new permanent infrastructure would be constructed under the Proposed Action, and all temporary structures (*e.g.*, a launch stand or reentry pad) would be removed after a launch or reentry event.

4.8.5 Hazardous Materials, Pollution Prevention, and Solid Waste

Under the Proposed Action, the amount of hazardous material, hazardous waste, and solid waste generated at LC-46 would increase. The types of hazardous materials used for reusable suborbital rockets would be similar to those already used at CCAFS for its current launch programs. An increase in the number of launches would increase the amount of hazardous materials on CCAFS, which has mechanisms in place to store and manage the increased quantity of hazardous materials, including liquid propellants. All hazardous and non-hazardous wastes would be properly disposed of in accordance with applicable Federal, state, and local regulations. Reusable suborbital rockets operating under experimental permits would not be expected to generate more hazardous materials than CCAFS could safely handle and hazardous-waste management plans would not be expected to change.

Similarly, solid waste would be expected to increase with the increase of launches and the amount of waste generated would be handled under existing collection and disposal operations.

CCAFS is required to reach pollution prevention goals, such as reducing quantities of hazardous waste. An increased volume of hazardous materials generated and used by reusable suborbital rockets could affect the ability of CCAFS to meet these goals. Activities associated with reusable suborbital rockets would coordinate with CCAFS pollution prevention plans and goals to reduce the impact of increased hazardous waste.

4.8.6 Health and Safety

Based on the health and safety measures described in Section 4.1.6, there would be no significant impacts to health and safety.

4.8.7 Land Use (including Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)

Activities associated with reusable suborbital rockets would be compatible with launch activities and existing land uses at CCAFS; therefore, there would be no incompatible land uses. There are no prime or unique farmlands or wild and scenic rivers in the vicinity of LC-46; thus, no impacts would be expected to these resources. Because there would be no construction activities under the Proposed Action, no significant impact on coastal resources would be expected. The potential need to close recreational areas (*i.e.*, Merritt Island National Wildlife Refuge and Canaveral National Seashore) or other Section 4(f) resources during periods of activity under an experimental permit is not known at this time and would be based on an applicant's proposed rocket type and size, and defined operating area. Impacts associated with such closures would be addressed in separate NEPA documentation, as appropriate.

4.8.8 Light Emissions and Visual Resources

Launch vehicles would leave visible contrails, but they would be similar in visual impact to contrails from existing operations. Because this area is already used for launch activities, the visual sensitivity is low. Launch operations would not substantially degrade the existing visual character or quality of the site and its surroundings. Visual impacts from launch operations would be infrequent, temporary, and minor.

4.8.9 Natural Resources and Energy Supply

Activities that would be permitted at LC-46 under the Proposed Action would not result in the development of new facilities or result in notable changes in local energy demands or consumption of other natural resources. Reusable suborbital rocket launch or reentry events would be short in duration and could involve up to 30 launch personnel, which would not result in any notable changes to local energy demands or consumption of other natural resources (*e.g.*, water or wastewater disposal). Reusable suborbital rockets would use liquid propellants and other consumable fluids that would be expended during operation. Because of the relatively small scale of activity at LC-46 under the Experimental Permit Program, the use of rocket propellants would not notably alter their supply or demand, and would result in only minor impacts to natural resources and energy supplies.

4.8.10 Noise and Compatible Land Use

Noise levels generated by each launch under an experimental permit would vary, depending on the rocket configuration, operating area, and weather conditions. The issuance of experimental permits would result in an increase in the potential number and frequency of launches at LC-46. However, the experimental vehicles would be expected to be smaller and produce lower noise levels than the class of vehicles currently operating from LC-46.

The nearest residences are in Cities of Cape Canaveral, Cocoa, Cocoa Beach, and Rockledge, which are all within 14 miles of CCAFS. On nearby Merritt Island, there is an unincorporated community adjacent to KSC that is predominantly agricultural (USAF, 2006; NASA, 2004b). These areas are well beyond the DNL 65 contour line associated with the Proposed Action. Therefore, there would be no significant noise impacts.

Any sonic booms generated by reusable suborbital rockets would reach Earth's surface at a distance downrange of LC-46 over the ocean. Therefore, no impacts from sonic booms would be expected.

4.8.11 Socioeconomic Resources, Environmental Justice, and Children's Environmental Health and Safety

4.8.11.1 Socioeconomic Impacts

Under the Proposed Action, the FAA would issue permits for launches of reusable suborbital rockets at LC-46, resulting in minor short-term impacts to local socioeconomics. Such impacts would result from launch and reentry support staff working at the launch or reentry site for the duration of the event. Because of the relatively small number of support staff and short duration of each event, demands on the local infrastructure (*e.g.*, power, water, disposal, transportation system) would not result in a noticeable change in existing conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. The potential national socioeconomic effect would be a small increase in the employment of skilled and professional workers. This would result in an economically beneficial impact.

Jobs associated with the commercial launch industry are generally technology based and require employees with specialized skills and higher levels of education. The creation of jobs in the commercial launch industry would have secondary economic effects on local communities due to increased personal income and the associated tax base. Furthermore, the new or additional workers could increase the size of the surrounding community and create a need for more local services, which in turn would create additional jobs within that community.

4.8.11.2 Environmental Justice and Children's Environmental Health and Safety

In assessing potential environmental justice impacts, the FAA reviewed the impacts of the Proposed Action to identify any large and adverse human health or environmental effects that would disproportionately affect minority or low-income populations. The impacts analysis in this PEIS does not identify any large and adverse human health or environmental effects associated with the Proposed Action. Therefore, no minority or low-income populations would be disproportionately affected.

In assessing environmental health risks and safety risks that might disproportionately affect children, the FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. In addition, the operating area of the reusable suborbital rocket may not contain or be adjacent to a densely populated area or large concentrations of members of the public. Considering these factors, the FAA determined that the Proposed Action would not be likely to adversely affect children's environmental health and safety.

4.8.12 Water Quality

4.8.12.1 Surface Water

Under the Proposed Action, there could be adverse impacts to freshwater systems. Such impacts would result from the deposition of materials associated with rocket engine emissions into the surface waters discussed in Section 3.8.12. Impacts to surface waters associated with rocket engine emissions are further discussed in Section 4.1.12.1.1, Surface Waters. Most of the reusable suborbital rockets launched at LC-46 would use propellants that emit H_2O, CO_2, and CO. See Section 4.1.1, Air Quality, for additional information on rocket engine emissions. Monitoring of the water chemistry in local streams around active launch pads from which rockets have been launched has shown that emissions from rocket engines have not had a long-term effect on basic water chemistry (USAF, 2006). Launch vehicles operating under experimental permits at LC-46 would not be expected to use solid propellants. Therefore, no impacts to water quality from Cl and HCl would be expected. Furthermore, the Proposed Action would be expected to have a minor short-term affect on local surface water quality, but would not be expected to affect the designated use as defined under Section 303 of the Clean Water Act.

4.8.12.2 Groundwater

The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater (see Section 4.1.14 for additional information). However, impacts would be expected to be minimized through adherence to all site-specific spill prevention and control requirements at each site. Additionally, no impacts to groundwater supply would be anticipated because demand on groundwater to support the Proposed Action at LC-46 would be negligible.

4.8.13 Wetlands

The Proposed Action could result in local adverse impacts to wetland vegetation and wildlife from deposition of rocket engine emissions, but such impacts would not be significant (see Section 4.1.2). Depending on the type of propellant type and its characteristics, rocket engine emissions could decrease the fitness of an affected local plant and wildlife population but would not be likely to result in the permanent removal or loss of a particular community. The Proposed Action would not result in filling or draining of wetlands, because no new permanent infrastructure would be constructed at LC-46 and all temporary structures (*e.g.*, a launch stand or reentry pad) would be expected to be located beyond wetland areas and would be removed after a launch or reentry event. See Section 4.1.12, Water Quality, for additional information on rocket engine emission impacts to surface waters.

4.8.14 Accidents

Section 4.1.14 describes potential impacts from accidents at any of the sites evaluated in this PEIS. In the unlikely event of an accident, potential impacts at LC-46 would be the same as those described in Section 4.1.14.

4.9 Spaceport America

4.9.1 Air Quality

Spaceport America is in an area that is in attainment for all NAAQS. As listed in Exhibit 4-11, annual emissions from ground level to 3,000 feet, based on the assumption of 882 yearly launch and reentry events, would be about 0.05 ton Cl, 13 tons CO, 3,091 tons CO_2, 4.0 tons HCl, 19 tons NO_x, 8.7 tons PM, 1.4 tons SO_x, and 2.1 tons VOCs (FAA, 2008a). Emissions from the launch and reentry of reusable suborbital rockets would be of very short duration and would be rapidly dispersed due to the mechanical and thermal turbulence of the exhaust gases and the movement of the vehicle. Furthermore, increases in ambient background concentrations resulting from these emissions would be negligible.

Exhibit 4-11. Estimated Annual Emissions Below 3,000 Feet at Spaceport America (882 Launches) under the Proposed Action[a,b] (tons)

Reusable Suborbital Rocket	Cl	CO	CO_2	HCl	H_2O	NO_X	PM	SO_X	VOCs
All Horizontal Launches	0.00	13.48	2,945.55	0.00	n.c.[c]	13.85	1.53	1.37	2.10
Vertical 1	0.05	0.00	100.30	3.97	n.c.	5.10	7.18	0.00	0.00
Vertical 2 (hover)	0.00	0.00	44.69	0.00	n.c.	0.00	0.00	0.00	0.00
Totals	**0.05**	**13.48**	**3,090.54**	**3.97**	**n.c.**	**18.95**	**8.71**	**1.37**	**2.10**

[a] Source: FAA, 2008a.
[b] Values of less than 0.005 ton are shown as 0.00.
[c] n.c. = not calculated in source document.

4.9.2 Biological Resources (Fish, Wildlife, and Plants)

4.9.2.1 Plants

Launch and recovery operations would not affect vegetation because these activities would be conducted over existing concrete pads. High-temperature exhaust would not impact vegetation during either take-offs or landings because they would generally occur over concrete pads where there is no vegetation.

Although chemicals from vehicle launch emissions could impact vegetation, ecologically significant effects would not be expected from reusable suborbital rocket activities. CO_2 is another emission from launch activities. While CO_2 emissions contribute to global warming, Spaceport America emissions would be a minute fraction of the U.S. and worldwide emissions. These emissions would have no effect on local plant communities (FAA, 2008a).

4.9.2.2 Animal Species

Activities associated with Spaceport America's daily operations that could negatively impact wildlife include launch- and recovery-related noise, sonic booms, vehicle launch emissions, and increased human presence onsite and on roads. Noise from launches would temporarily disturb wildlife, but wildlife should return and resume normal activities after the disturbance (launch noise) ceased. No permanent negative impacts related to launches would be expected. Large mammals, including mountain sheep, desert bighorn sheep, mule deer, and pronghorn antelope, have been found to exhibit temporary changes in behavior and heart rate in response to noise from low-level aircraft over-flights. Animal responses to noise decreased with increased exposure, suggesting they become accustomed to the noise over time. No negative impacts related to landings would be expected.

Noise levels greater than 80 dBA could result in startle reactions in birds and mammals, and predicted noise levels from rocket launches suggest levels greater than 80 dBA at locations up to 8 miles from the launch site. Noise from launches would temporarily disturb wildlife, but they would be expected to return and resume normal activities after the disturbance (launch noise) ceases. Any impacts to wildlife from sonic booms would be of short duration and would not result in a significant impact. Thus, no permanent negative impacts related to launches would be expected.

Increased human presence from site personnel could disturb some members of wildlife populations near roads, buildings, and facilities. It would be likely that some wildlife would acclimate to the new conditions, while others would be displaced and would move from the area. Impacts from noise, human activity, and traffic would increase during the X Prize Cup; however, because this event would occur only once a year for up to 7 days, this increase would be temporary.

4.9.2.3 Protected Species and Habitat

The only Federal- or State-listed species documented as observed in the Spaceport America Project area are bald and golden eagles and Bell's vireo. These species are considered transients of the area (*i.e.*, the species do not breed on the site). There is marginal habitat in the Project area for Aplomado falcons, but they have not been observed on the site. Sensitive species and/or species of concern present in the Project area include loggerhead shrikes, Texas horned lizards, and possibly burrowing owls (FAA, 2008a). It is possible that individuals of these species would be temporarily disturbed by launch noise or sonic booms. These disturbances would be brief, and the resultant brief alteration in behavior should not materially affect the local and regional populations of the species, or its ability to survive and reproduce. Should the FAA receive an application for an experimental permit that proposes to launch from Spaceport America, the FAA would coordinate with the New Mexico Spaceport Authority, and the FAA would determine if there is a need to further consult with either the Fish and Wildlife Service and/or the National Marine Fisheries Service based on any new activities proposed by the applicant. The FAA would similarly coordinate with the New Mexico Spaceport Authority regarding any need to further consult with the appropriate State agency regarding any applicable requirements for State listed protected species and habitat. If potential impacts are identified, the FAA would consult with the appropriate agencies to develop any mitigation measures that may be warranted, as described in Chapter 5 of this PEIS.

4.9.3 Historical, Architectural, Archaeological, and Cultural Resources

There would be impacts to historic properties, including physical damage (in the event of a vehicle crash), changes to setting, and visual and auditory effects, as a result of launch activities at Spaceport America. Launching of vehicles at Spaceport America would result in moderate visual and noise effects to the settings of the National Historic Trail properties and Aleman Draw Historic District, but these direct impacts would be short in duration and periodic. During launches, there would be more activity at Spaceport America, resulting in more workers and likely more visitors than at other times. The additional traffic, both on the site and on County Road A013, dust, and activity would result in visual and noise effects to the settings of the Trail properties and Historic District, but these indirect impacts would be minimal.

Potential direct impacts to the settings of the Trail properties and Historic District from the X Prize Cup event would include visual and noise effects from the launches and demonstrations, increased worker traffic on the site, and the large number of people at the facility (up to 20,000 per day). Indirect impacts to the settings would be anticipated from the increased worker traffic and the large number of buses bringing spectators to the event. The resulting indirect impacts to the settings of the Trail properties and Historic District from visual and noise intrusions generated by X Prize Cup could be significant. However, because the event would occur only once a year for up to 7 days, the impacts would be temporary.

A Programmatic Agreement was developed between the New Mexico Spaceport Authority and Section 106 consulting parties that outlines the processes to develop plans to minimize or mitigation adverse affects (FAA, 2008a).

4.9.4 Floodplains

Reusable suborbital rocket activities at Spaceport America under the Proposed Action would not affect floodplains. No new permanent infrastructure would be constructed under the Proposed Action, and all temporary structures (*e.g.*, a launch stand or reentry pad) would be removed after a launch or reentry event.

4.9.5 Hazardous Materials, Pollution Prevention, and Solid Waste

On-site impacts stemming from the management of hazardous materials and hazardous and nonhazardous wastes would not be expected because they would be handled, stored, and used in compliance with all applicable regulations. Hazardous material storage area would be equipped with secondary containment and the appropriate spill control equipment. Procedures would be in place to minimize potential impacts from spills of hazardous materials and hazardous waste. Pollution prevention plans would be implemented to minimize waste through reuse and recycling of materials.

The X Prize Cup would generate an estimated additional solid waste quantity of 45.4 tons per day in the absence of a recycling program. Off-site impacts from disposal of Spaceport-generated waste would be negligible to minimal due to the small quantities of waste in comparison to waste disposal capacity available in the region.

4.9.6 Health and Safety

Operations would result in small quantities of dust and launch exhaust emissions, but these would be expected to result in a negligible decrease in local ambient air quality. Off-site impacts stemming from hazardous materials and waste would not be expected. Visitors would be restricted to areas a safe distance from hazardous materials and waste storage facilities. No visitors would be allowed in areas that could pose a hazard from air emissions during launch accidents. In the event of a catastrophic accidental release of the entire on-site capacity of all propellant components, these fuels would not create a pollution hazard for the underlying aquifer, nor would they create pollution hazards that could migrate to the Rio Grande River through storm water runoff. The cities of Hatch and Truth or Consequences, New Mexico, would be shielded from the launch and test firing sites by the Caballo Mountains and neither would be exposed to peak noise levels from the launches or firings.

The most substantial potential impact to the general public would be falling debris. Falling debris could result from a catastrophic failure after launch or during descent. Spaceport America is in a very sparsely populated area and launches would be directed toward and over White Sands Missile Range. Persons within the Range would be notified of Spaceport America launches and would evacuate the recovery area according to prescribed, standard Range procedures for launches. Based on this protocol, and the health and safety measures described in Section 4.1.6, there would be no significant impacts to health and safety.

4.9.7 Land Use (including Department of Transportation Section 4(f), Farmlands, Wild and Scenic Rivers, and Coastal Resources)

There would be no direct use or constructive use of Section 4(f) resources as a result of launch activities at Spaceport America, and no protected farmlands are present. Therefore, there would be no impacts to Section 4(f) resources or protected farmlands resulting from operation of the launch facility.

Direct impacts to land use from launch operations would be limited to lands converted from rangeland to vertical and horizontal launch and support facilities, and areas already designated on the White Sands Missile Range for landing. Because the actual land area disturbed for launch operations would be less than 6 percent of the total of more than 16,000 acres of land within the Spaceport America site, direct impacts to land use from launch operations would be minimal.

Indirect impacts from operations could come from noise, air emissions, and visual effects generated by vertical or horizontal launch activities and nonlaunch activities. Effects would be minor and intermittent and would not result in a substantial impairment of current land uses.

Recreational uses of the State Trust Lands would continue, although in some areas access would be restricted to protect facilities and for safety concerns. Access to recreation on adjacent BLM land would be maintained. Spaceport America would not affect the development of interpretive and recreational sites for the National Historic Trail. The presence of Spaceport America and X Prize Cup events could increase visitor knowledge and interest in the National Historic Trail and other recreational opportunities in the vicinity. The quality of the rural setting and recreational experience that current Trail visitors enjoy would be changed, but not substantially.

During X Prize Cup activities, there could be a temporary influx of up to 20,000 spectators per day to the area. This could result in temporary visual, noise, and air quality impacts as a result of large numbers of buses and other vehicles and increased fugitive dust conditions. There could be impacts to adjacent lands during special events from increased recreation, such as camping on adjacent BLM land and unauthorized parking near roads. The quality of the recreational experience of the Trail setting would be diminished during these events. These impacts would be temporary and would have no permanent effect on current land use.

4.9.8 Light Emissions and Visual Resources

Horizontal launch vehicles departing the airfield could fly over visually sensitive areas, and rocket exhaust plumes and contrails could be visible. However, contrails that result from high-altitude military and commercial aircraft operations are routinely and commonly visible throughout Spaceport America, and rocket plumes from activities at the White Sands Missile Range are visible whenever there is a launch. Therefore, launch operations would not represent a large percentage change to these occurrences, and no significant visual impacts would result from launch operations.

The visual impacts of launch and landings and aircraft operations would be low because of their low frequency and distance from viewpoints. Effects of security and safety lighting would be kept at insignificant levels by minimizing use and by using only lighting products and designs that are consistent with the standards of the International Dark-Sky Association (IDA, 2002). Visual impacts on the El Camino Real National Historic Trail and Yost Escarpment would be infrequent, temporary, and minor.

4.9.9 Natural Resources and Energy Supply

Various fuels would be required at Spaceport America to launch and land vehicles and to operate vehicles and infrastructure to support launches and recoveries. The actual amounts and types of rocket fuels would depend on the specific launch operations and types of landing vehicles finally selected. Most of the rocket fuel supply would be trucked to the site from national or regional suppliers. Gasoline and diesel needs would be relatively small. There would be no impact to energy supplies as a result of the Proposed Action.

The demand for electrical energy in the region would increase if the Proposed Action were implemented. However, the limited electrical distribution capacity to the site makes it unlikely that other system users would be affected by electricity use at Spaceport America.

Under two of three water supply scenarios, water would be pumped from onsite wells to supply operations activities. Aquifer drawdowns calculated for these use scenarios indicate that nearby users would not be affected.

4.9.10 Noise and Compatible Land Use

Rocket and airplane take-offs and landings and traffic would be primary sources of noise. Vertical launches would have the highest noise levels (90 dBA), but only for short periods of time (approximately 2 minutes) and average once every 3 days and only during daylight hours. Persons within 3 miles of the launch site would experience very loud, but not damaging, sound levels. The communities of Hatch and Truth or Consequences, New Mexico, would be shielded from the launch site by the Caballo Mountains and therefore would experience lower noise levels.

Horizontal launches and airport operations would generate noise that is more frequent than vertical launches, but noise peaks would be lower (up to approximately 75 dBA for both horizontal launches and airport operations). The noise levels expected from X Prize Cup event activities would be greater and the DNL at the nearby Yost Escarpment would increase to that of a small town (between 46.1 and 47.2 dBA).

Operations traffic noise would be less than that of peak of construction, except during the X Prize Cup event, when noise levels are estimated at about 50 dBA at 300 feet from Sierra County Road A013 a level the EPA associates with a small town.

4.9.11 Socioeconomic Resources, Environmental Justice, and Children's Environmental Health and Safety

4.9.11.1 Socioeconomic Impacts

Under the Proposed Action, the FAA would issue permits for launches of reusable suborbital rockets at Spaceport America, resulting in minor short-term impacts to local socioeconomics. Such impacts would result from launch and reentry support staff working at the launch or reentry site for the duration of each event. Because of the relatively small number of support staff and short duration of the event, demands on the local infrastructure (*e.g.*, power, water, disposal, transportation system) would not result in a noticeable change in existing conditions. In addition, the Experimental Permit Program might aid in increasing the size of the U.S.-based commercial space industry by facilitating the research and development of reusable suborbital rockets. The potential national socioeconomic effect would be a small increase in the employment of skilled and professional workers. This would result in an economically beneficial impact.

Jobs associated with the commercial launch industry are generally technology based and require employees with specialized skills and higher levels of education. The creation of jobs in the commercial launch industry would have secondary economic effects on local communities due to increased personal income and the associated tax base. Furthermore, the new or additional workers could increase the size of the surrounding community and create a need for more local services, which in turn would create additional jobs within that community.

4.9.11.2 Environmental Justice and Children's Environmental Health and Safety

In assessing potential environmental justice impacts, the FAA reviewed the impacts of the Proposed Action to identify any large and adverse human health or environmental effects that would disproportionately affect minority and/or low-income populations. The impacts analysis in this PEIS does not identify any large and adverse human health or environmental effects associated with the

Proposed Action. Therefore, no minority or low-income populations would be disproportionately affected.

In assessing environmental health risks and safety risks that might disproportionately affect children, the FAA reviews each experimental permit application to ensure that the launch and reentry areas have an appropriate clear hazard area and all key flight-safety events occur over unpopulated or sparsely populated areas. In addition, the operating area of the reusable suborbital rocket may not contain or be adjacent to a densely populated area or large concentrations of members of the public. Considering these factors, the FAA determined that the Proposed Action would not be likely to adversely affect children's environmental health and safety.

4.9.12 Water Quality

4.9.12.1 Surface Water

As discussed in Section 3.9.12.1, surface water is limited to storm water runoff. No impacts to these ephemeral surface waters would be expected.

4.9.12.2 Groundwater

The accidental release of hazardous materials, including fuels, from operational activities or an accident could affect water resources by contaminating groundwater (see Section 4.1.14 for additional information). However, impacts would be expected to be minimized through adherence to all site-specific spill prevention and control requirements at each site. Additionally, no impacts to groundwater supply would be anticipated because demand on groundwater to support the Proposed Action at Spaceport America would be negligible.

4.9.13 Wetlands

There are no wetlands at Spaceport America. Thus, there would be no adverse impacts to wetlands as a result of the Proposed Action.

4.9.14 Accidents

Section 4.1.14 describes potential impacts from accidents at any of the sites evaluated in this PEIS. In the unlikely event of an accident, potential impacts at Spaceport America would be the same as those described in Section 4.1.14.

4.10 Potential Cumulative Impacts

This section describes the potential programmatic and site-specific cumulative impacts that would result from the incremental impact of the Proposed Action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR 1508.7). Because the Proposed Action does not include construction of new facilities or infrastructure, the FAA focused its cumulative impacts analysis on the effects associated with operation of launch vehicles under the Proposed Action combined with effects of other past, present, and reasonably foreseeable actions. The FAA considered other projects and activities whose effects could have a potential interaction in time or space with the effects of the Proposed Action.

In accordance with FAA Order 1050.1E, Change 1, and the Council on Environmental Quality NEPA implementing regulations, the FAA analyzed the potential cumulative impacts to the resources that would be adversely affected by implementation of the Proposed Action or the No Action Alternative. Because the scope of this PEIS includes the FAA Experimental Permit Program, which applies to all permitted launches within the United States and permitted launches by U.S. companies outside the United States, the cumulative impacts analysis includes a general cumulative analysis and site-specific cumulative analyses for the eight proposed launch sites addressed in this PEIS.

Based on the findings and potential impacts described in Section 4.1, the general cumulative impacts analysis focuses on the most affected resource areas, air quality and noise. Based on the findings and potential impacts described in Sections 4.2 through 4.9, the site-specific cumulative impacts analysis includes air quality and biological resources.

The FAA has determined that the potential impacts described in Section 4.1 to 4.9 at both the general and site-specific levels for historical, architectural, archaeological, and cultural resources; floodplains; hazardous materials, pollution prevention, and solid waste; health and safety; land use; light emissions and visual resources; natural resources and energy supply; socioeconomics, environmental justice, and children's environmental health and safety; water quality; wetlands; and accidents would not meaningfully interact in time and space with the potential effects of other projects. In addition, for each experimental permit application it received, the FAA would complete a site-specific environmental review in accordance with this PEIS, as discussed in Section 2.1. The environmental review would tier from this PEIS and address the potential for any cumulative impacts beyond what is addressed in this PEIS.

4.10.1 General Cumulative Impacts

The following sections describe the general cumulative impacts to air quality and noise for the Proposed Action and No Action Alternative. The general cumulative impact analysis considers all FAA-licensed launches and all non-FAA-licensed launch and reentry activities (U.S. and foreign government and foreign commercial launches and reentries) estimated for 2009 to 2014. To assess the potential impacts associated with the launches, the FAA classified the FAA-licensed commercial launches and foreign commercial launches based on whether the launch vehicle was suborbital or orbital. For orbital launch vehicles, the FAA used weight of the payload and its destined orbit to further classify the launch vehicles. Exhibit 4-12 lists the weight class for suborbital and orbital, Geosynchronous Transfer Orbits (GEO) and Low Earth Orbits (LEO), launches.

Exhibit 4-13 lists the number of horizontal and vertical launches and reentries estimated for 2009 to 2014. Exhibit 4-14 lists estimated total orbital reentries for the same period.

The FAA assumes that static rocket engine testing would be performed to support the development of reusable suborbital rockets for which applicants would seek an experimental permit, and for other U.S. and foreign commercial and government launch vehicles. However, the FAA does not know the details about the static rocket engine tests, including the number, engine type, duration of test, and propellants to be used. Because of the number of assumptions that would have to be made to calculate an amount of total emissions, and the relatively minor influence the potential emissions would have on overall cumulative impacts, the FAA did not include static rocket engine tests in its cumulative impacts analysis.

4.10.1.1 Cumulative Air Quality Impacts to the Troposphere

Potential impacts to the troposphere related to emissions, particularly impacts from emissions of criteria pollutants, air toxics, precursors of acid rain, and regional haze are discussed in this Section.

Exhibit 4-15 lists the total estimated emissions (from the Proposed Action and from other Federal and non-Federal launch and reentry activities) in the troposphere for 2009 to 2014. The portion of these emissions associated with the Proposed Action is summarized in this chapter and detailed in Appendix D. The FAA calculated the emissions from Other Launches and Reentries (*i.e.*, FAA-licensed launches, U.S. government launches, and foreign commercial and government launches) by estimating the emissions per launch or reentry for each vehicle type and then multiplying these per-launch and reentry emissions by the estimated number of launches and reentries for each vehicle type. Appendix D describes how the FAA calculated the emissions per launch and reentry for each vehicle type.

Exhibit 4-15 includes non-launch operations emissions at Spaceport America as a cumulative impact because, unlike the other launch sites, Spaceport America is a new facility and has no existing emissions. The sources of non-launch emissions at Spaceport America include general spaceport and airfield operations, X Prize event operations, static test firings of rocket engines, and storage and handling of fuels and propellants (FAA, 2008a). The non-launch operations emissions at Spaceport America are reasonably foreseeable for the purposes of the cumulative impacts assessment.

Criteria Pollutants

The criteria pollutant in Exhibit 4-15 with the largest mass emissions is NO_x (part of which is the criteria pollutant NO_2). The estimated amount of NO_X, approximately 12,284 tons released to the troposphere during the study period (an average of about 2,047 tons per year) by all launches and reentries worldwide, would not result in a significant cumulative impact on ambient air quality. As a point of comparison, the total emissions of NO_X for all U.S. sources for 2005 were estimated to be about 19 million tons (EPA 2006). This figure is about three orders of magnitude larger than the total NO_X released by all orbital and suborbital rockets worldwide for the period 2009 through 2014 considered in this PEIS. Considering the total annual NO_X emissions from all sources worldwide would further reduce the proportion of NO_X emissions released by all orbital and suborbital rockets. Because the cumulative amount of NO_X emissions associated with all orbital and suborbital rockets would be such a small portion of the global NO_X emissions, and because all orbital and suborbital rockets emissions would be distributed globally, the cumulative emissions would not have a significant impact on the formation of ground-level ozone or ambient air quality. The other criteria pollutants, all of which have lower emissions than NO_X, also would not have a significant impact on the formation of ground-level ozone or ambient air quality.

Exhibit 4-12. Payload Weight Class

Weight Class	Suborbital or Orbital Mass
Other[a]	Suborbital – 270 kilograms (594 pounds)
Small	Orbital – < 2,000 pounds GTO or < 5,000 pounds LEO
Medium	Orbital – 2,000-3,999 pounds GTO or 5,000-15,000 pounds LEO
Intermediate	Orbital – 4,000-8,999 pounds GTO or >15,000 pounds LEO
Heavy	Orbital – 9,000-10,000+ pounds GTO

Note: All FAA-licensed horizontally launched launch vehicles are considered suborbital and are included in the "Other" weight class.

Exhibit 4-13. Horizontal and Vertical Launch Totals by Maximum Payload Capacity[a,b]

Category	Payload Capacity	2009	2010	2011	2012	2013	2014
U.S. Commercial (FAA Licensed)	Other/Suborbital	129	161	150	152	154	158
	Small	1	2	2	2	2	2
	Medium	2	1	1	2	1	1
	Intermediate	0	0	0	0	0	0
	Heavy	6	6	7	6	6	6
U.S. Government	Other/Suborbital	24	24	26	24	22	24
	Small	2	3	2	2	2	2
	Medium	9	9	9	9	9	9
	Intermediate	0	0	0	0	0	0
	Heavy	14	14	13	9	10	9
Foreign Government	Other/Suborbital	10	8	15	10	8	8
	Small	2	2	3	2	3	2
	Medium	15	15	14	15	15	14
	Intermediate	2	1	2	1	2	1
	Heavy	7	7	9	8	7	7
Foreign Commercial	Other/Suborbital	1	3	4	6	8	10
	Small	1	2	2	3	3	3
	Medium	2	1	1	1	1	1
	Intermediate	0	0	0	0	0	0
	Heavy	13	13	15	15	15	15
Totals		**240**	**272**	**275**	**267**	**268**	**272**

[a] Source: FAA, 2005, based on Exhibit 5-2.
[b] Based on vehicle full payload capacity, not estimated payload(s) mass. Most commercial vehicles are no longer in Intermediate class, but in the Heavy class. Foreign and U.S. Government suborbital estimates are based on vehicles similar to criteria for an FAA-licensed launch.

Exhibit 4-14. Total Orbital Reentries[a,b]

Category	Reentry	2009	2010	2011	2012	2013	2014
U.S. Commercial (Licensed)	Horizontal	1	1	2	5	7	9
	Vertical	0	1	2	2	3	3
U.S. Government	Horizontal	4	0	0	0	0	0
	Vertical	0	0	1	2	2	4
Foreign Government	Horizontal	0	0	0	0	0	0
	Vertical	4	5	4	5	4	5
Foreign Commercial	Horizontal	0	0	0	0	0	0
	Vertical	0	0	1	2	2	3
Totals		**9**	**7**	**10**	**16**	**18**	**24**

[a] Source: FAA, 2005, based on Exhibit 5-3.
[b] Capsule and/or parachute landings counted as vertical reentry. Vertical also includes International Space Station cargo return. Reentries only counted for vehicles that land substantially intact. Suborbital launches and subsequent reentries not included.

Exhibit 4-15. Summary of Emission Loads to the Lower Troposphere Below 3,000 Feet from 2009 to 2014 (tons)

Launch/ Reentry Type	Cl	CO	CO_2	HCl	H_2O	NO_X	PM	SO_X	VOCs
Proposed Action	0.30	8,099.00	24,560.00	23.82	8,546.00	115.53	52.33	9.29	22.35
Other Launches and Reentries[a]	47.57	48.04	27,967.00	5,997.00	47,776.00	11,993.00	10,845.00	0.13	n.c.[b]
Non-Launch Emissions at Spaceport America[c]	0.00	417.82	33,500.70	0.00	n.c.	176.03	171.52	7.84	46.53
Totals (rounded)	**47.87**	**8,564.43**	**86,027.93**	**6,020.44**	**56,321.83**	**12,284.20**	**11,069.31**	**17.26**	**68.88**

[a] Source: FAA, 2005, Exhibits 5-2 and 5-4. Also includes an additional 300 launches of V-1 suborbital reusable launch vehicles at Mojave Air and Space Port that are not part of the Proposed Action.
[b] n.c. = not calculated.
[c] Source: FAA, 2008a, Exhibit 4.6-8.

Air Toxics

As indicated in Section 4.1.1, at all launch sites except Spaceport America, none of the proposed reusable suborbital rockets would use solid rocket motors at altitudes of less than 3,000 feet. Therefore, no HCl or Cl would be emitted to the lower troposphere except possibly at Spaceport America. Therefore, while emissions from the Proposed Action would not significantly affect air quality in the troposphere, the emissions would contribute to cumulative air quality impacts in the area of Spaceport America (see Section 4.9.1).

Regional Haze

As indicated in Section 4.1.1, the Proposed Action would result in minimal emissions of haze-related pollutants and have a negligible impact on visibility. However, the cumulative impacts to regional haze from the Proposed Action and other existing and reasonably foreseeable projects would be greater in areas where regional haze is a problem due to the contribution of pollutants from those other projects.

4.10.1.2 Cumulative Air Quality Impacts to the Stratosphere

Potential impacts to the stratosphere include climate change from contributions of greenhouse gases and depletion of the stratospheric ozone layer. Exhibit 4-16 lists the total estimated emissions (from the Proposed Action and from other Federal and non-Federal launch and reentry activities) to the stratosphere for 2009 to 2014. The FAA calculated the portion of these emissions associated with the Proposed Action, as summarized in this chapter and described in detail in Appendix D. The FAA calculated the remaining emissions (*i.e.*, FAA-licensed vertical launches, U.S. government launches, and foreign commercial and government launches) by estimating the emissions per launch or reentry for each vehicle type and then multiplying these per-launch and reentry emissions by the estimated number of launches and reentries for each vehicle type. Appendix D describes how the FAA calculated the per-launch and reentry emissions for each vehicle type.

Exhibit 4-16. Summary of Emission Loads to the Stratosphere from 2009 to 2014 (tons)

Launch/ Reentry Type	Cl	CO	CO_2	HCl	H_2O	NO_X	PM	SO_X	VOCs
Proposed Action	3.59	7,833.00	21,736.00	495.94	11,084.00	10.86	92.94	0.00	0.00
Other Launches and Reentries[a]	47.57	570.00	29,557.00	6,023.00	48,568.00	11,993.00	10,888.00	0.13	n.c.[b]
Totals (rounded)	**51.17**	**8,402.67**	**51,293.54**	**6,519.08**	**59,653.02**	**12,004.10**	**10,980.56**	**0.13**	**0.00**

[a] Source: FAA, 2005. Also includes an additional 300 launches of V-1 suborbital reusable launch vehicles formerly forecasted for Mojave Air and Space Port.
[b] n.c. = not calculated

The cumulative emissions that could affect climate change directly as greenhouse gases include CO_2 and H_2O. The estimated cumulative emissions of CO_2 to the stratosphere would be about 51,294 tons annually. By comparison, the total annual CO_2 emissions from all U.S. sources for 2006 were more than 6.59 billion tons (5.98 billion metric tons) (EPA, 2008b). The incremental contribution of reusable suborbital rocket emissions would be an extremely small fraction of this amount. Unlike criteria pollutants, impacts of greenhouse gas emissions are global and cannot be attributed to any particular source. Greenhouse gases are well mixed throughout the lower atmosphere such that anthropogenic climate change is directly related to the global concentration of CO_2 in the atmosphere. Local emissions are quantifiable and contribute cumulatively to global CO_2 concentrations. The Proposed Action would make a relatively small incremental contribution to increasing global CO_2 concentrations. Emissions of H_2O would also contribute to the cumulative effect on climate change.

The potential impacts from climate change have been identified and discussed by the Intergovernmental Panel on Climate Change (IPCC) in its fourth assessment report (IPCC, 2007). Studies such as the IPCC report support the premise that relatively small levels of CO_2 emissions from activities such as the Proposed Action would contribute to global greenhouse gas emissions and a cumulative impact on climate change. The IPCC report identifies the predicted consequences of climate change by region.

CO and NO_X, two photochemical pollutants that can influence the creation and destruction of greenhouse gases, also would be emitted. The estimated cumulative emissions of CO and NO_X annually to the stratosphere would be about 8,403 and tons and 12,004 tons, respectively. However, contributions of these pollutants to the atmospheric burden would be extremely small in relation to U.S. annual emissions (more than 89 million tons and 19 million tons of CO and NO_X, respectively) in 2005 (EPA, 2006). Thus, CO and NO_X emissions associated with the Proposed Action and other existing and reasonably foreseeable projects would make a small contribution to cumulative impacts on air quality in the stratosphere.

Ozone Depletion

The primary chemicals of concern for potential ozone depletion are HCl and Cl. The FAA used the same process to assess the impacts of the Proposed Action (see Section 4.1.1) to assess cumulative impacts. The total HCl and Cl (about 6,145 tons) that would be released due to global launch and reentry activities would result in a minor cumulative impact on ozone depletion.

A study entitled *Atmospheric Environmental Implications of Propulsion Systems* concluded that even vastly increased launch activities (*e.g.*, 50 Space Shuttle or Energia launches per year) would not significantly impact stratospheric ozone depletion. This study found that although reusable suborbital rockets do release chlorine into the atmosphere as HCl, the global effects would be far below and indistinguishable from the effects of other natural and man-made causes (McDonald *et al.*, 1994).

PM also would be emitted to the stratosphere, which could affect stratospheric ozone by acting as a catalytic site for ozone destruction; however, the exact impact of PM on ozone depletion is unclear. A 1999 study on the stratospheric impact of solid rocket motor launch emissions (prepared for the U.S. Air Force) concluded that the global impacts of PM from such emissions on ozone depletion are very small (Ko *et al.*, 1999). The estimated total emissions of Al_2O_3 (*i.e.*, PM) to the stratosphere used in calculations for that study were approximately 1,120 tons per year (1,015 metric tons per year).

Releases of NO_X can also result from reusable suborbital rocket emissions, and NO_X is a chemical of concern for ozone depletion. However, cumulative emissions of NO_X (about 11,993 tons annually) would be extremely small in relation to total U.S. emissions of NO_X. About 19 million tons were released in the U.S. in 2005 alone (EPA, 2006).

4.10.1.3 Cumulative Air Quality Impacts to the Mesosphere

As indicated in Section 4.1.1, the Proposed Action would result in no impacts to the mesosphere because it is a relatively narrow band of the atmosphere through which rockets tend to pass fairly quickly and there are no known impacts to the mesosphere associated with the compounds emitted by reusable suborbital rockets. Therefore, there would be no cumulative impacts on the mesosphere.

4.10.1.4 Cumulative Air Quality Impacts to the Ionosphere

Emission products (specifically, CO_2, H_2O, and H) from launch vehicles have been found to have a temporary effect on electron concentrations in the F layer of the ionosphere. These compounds can react with ambient electrons and ions in the F layer to effectively form a “hole” in this region by reducing the concentration of electrons and ions within the path of the vehicle. The reactions that take place can result in a net decrease in electron concentration in the F layer, potentially affecting radio communication, such as short-wave broadcasts, which interact with the ionosphere (U.S. DOT, 1992). However, as described in more detail in Section 4.1.1, the ionospheric hole that would be created as a result of launch emissions would be temporary and appears to dissipate in a matter of minutes. Therefore, it does not appear that the effects of this phenomenon would accumulate to any degree, unless there were launches through the same region of the atmosphere every few minutes. It is expected that cumulative impacts to the ionosphere from the Proposed Action and other existing and reasonably foreseeable projects would be negligible.

4.10.1.5 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of cumulative impacts to air quality associated with the No Action Alternative would fall within the envelope of cumulative impacts to air quality discussed under the Proposed Action. However, if the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate potential cumulative impacts to air quality, and would not use the information and analyses provided in this PEIS. This would result in increased paperwork, duplication, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.10.1.6 Cumulative Noise Impact

As indicated in Section 4.1.10.1, the noise associated with the Proposed Action, from both jet and rocket engines, would not notably alter the noise environment at an active launch or reentry facility. In reviewing the cumulative impacts associated with noise, the FAA found that the duration of a launch event, up to 3 minutes, and the overall frequency at a particular site would not result in a significant impact on the existing noise environment.

The FAA also reviewed sonic booms and determined that because it does not know the actual flight paths of reusable suborbital rockets evaluated under the Proposed Action, it could not perform a cumulative impacts analysis of sonic booms at this time. In general, because key flight-safety events and the reusable suborbital rocket operating area would be over unpopulated or sparsely populated areas, sonic booms would have minimal noise impacts. If the FAA received an application for an experimental permit, it would complete a site-specific environmental review in accordance with NEPA and FAA Order 1050.1E, Change 1, that could tier from this PEIS and include a review of cumulative noise impacts that would include a review of any potential sonic booms.

4.10.1.7 No Action Alternative

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets. The nature and extent of cumulative impacts related to increased noise levels associated with the No Action Alternative would fall within the envelope of cumulative impacts related to increased noise levels discussed under the Proposed Action. However, if the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate potential cumulative impacts related to increased noise levels, and would not use the information and analyses provided in this PEIS. This would result in increased paperwork, duplication, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.10.2 Site-Specific Cumulative Impacts

Site-specific cumulative impacts are based on the existing and forecast government and commercial space activities at each of the eight launch sites. To develop estimates of the impacts that would apply to each site, the FAA updated the portion of the launch activity data in Exhibit 4-13 that corresponds to expected operations in the United States. The FAA allocated numbers of launches to each of the eight sites based on known launch schedules and forecast launch projections for each type or model of rocket the FAA expects would be used for government and commercial launches from U.S. launch sites. Exhibit 4-17 lists the forecast government and commercial space operations at the eight sites addressed in this PEIS.

The values in Exhibit 4-17 were primarily collected from the 2006 Space Report and subsequent updates, with supplemental information collected from site-specific launch reports. The data in Exhibit 4-17 represent a reasonable annual number of launches from each facility and the launch numbers are not expected to substantially change during 2009 to 2014. The site-specific cumulative emissions and impacts described below are based on the launch numbers provided in Exhibit 4-16.

The following site-specific cumulative impacts analyses focus on the impact categories with notable potential impacts, as described in Sections 4.2 through 4.9. Therefore, the following sections focus on air quality in the troposphere and on protected species that could be affected by implementation of the Proposed Action. Under the No Action Alternative, the nature and extent of cumulative impacts at the eight launch sites would fall within the envelope of cumulative impacts described for the Proposed Action. However, if the FAA received an application for an experimental permit, the FAA would develop a separate site-specific NEPA document to evaluate potential cumulative impacts, and would not use the information and analyses in this PEIS. This would result in increased paperwork, duplication of effort, and time needed to develop site-specific and project-specific analyses, compared to the Proposed Action.

4.10.2.1 California Spaceport

Air Quality

The California Spaceport is in an attainment area for all NAAQS, but has been designated nonattainment for the more stringent California standards for PM_{10} and ozone. Exhibit 4-18 shows estimated annual emissions from ground level to 3,000 feet for the Proposed Action and other launches projected at the California Spaceport. The emissions would be of very short duration and would be rapidly dispersed due to the mechanical and thermal turbulence of the exhaust gases and the movement of the vehicle. Therefore, while emissions from the Proposed Action at the California Spaceport would not significantly affect air quality in the troposphere, the emissions would contribute to cumulative air quality impacts in the area.

Biological Resources – Protected Species

Although launches of vehicles under experimental permits would represent short-term, discrete events, the overall result would be an increase in launch noise and sonic boom events and rocket emissions released at the California Spaceport. Through coordination and consultations with the U.S. Fish and

Exhibit 4-17. Estimated Launch Activities per Year (2009 – 2014), Government and Commercial Launches, Orbital and Suborbital[a]

	Pegasus XL	Minotaur	Taurus I and II[b]	Delta II[c]	Delta IV	Atlas V	Falcon 1	Falcon 9	Space Shuttle	RLV/ Other[d]	Total
California Spaceport and Vandenberg Air Force Base, California	0 to 1	1 to 2	0 to 2	3 to 4	1 to 2	1 to 2	–[e]	–[d]	0	0	6 to13
KSC, Florida	0	0	0	0	0	0	0	0	4[f]	–	4
Oklahoma Spaceport	0	0	0	0	0	0	0	0	0	5 to 50[g]	5 to 50
KLC, Alaska	0	0 to 9	0	0	0	0	0	0	0	0	0 to 9
MARS and Wallops Flight Facility, Virginia	0 to 1	1 to 12	1 to 6[h]	0	0	0	0	0	0	1 to 60[i]	1 to 78
Mojave Air and Space Port, California	0	0	0	0	0	0	0	0	0	25 to 50[j]	25 to 50
Space Florida and CCAFS, Florida	0 to 1	0	0	2 to 3	3 to 5	3 to 5	–[d]	1 to 4	0	0	9 to 18
Spaceport America	FAA did not develop a site-specific launch forecast for government and commercial launches at Spaceport America. All launches at Spaceport America are considered as part of the Proposed Action, rather than as cumulative impacts, for purposes of this PEIS.										

[a] Estimates are based on past history and future projections, which are subject to change. For example, typical orbital commercial launch contracts for expendable launch vehicles (ELVs) are finalized 2 to 3 years in advance, so future projections are not definitive.
[b] The Taurus II is in development and plans are for launches to begin in late 2010.
[c] There are a limited number of Delta II launches scheduled past 2011.
[d] Many suborbital reusable launch vehicles (RLVs) are still under development, so the exact year that flights would occur, their locations, and the flight rates for many vehicles are still to be determined. There could be large numbers of suborbital flights at certain locations if particular RLVs began providing regular operations by 2014.
[e] It is unknown at this time whether there will be launches of this vehicle type from this launch site between 2009 and 2014.
[f] Space Shuttle flights are planned to end in 2010.
[g] Projection based on Rocketplane XP testing and operations, with flights not planned to begin until 2010 or later.
[h] These launch activities could include Falcon I and Falcon II. Taurus II used for analysis because it is the largest liquid propelled launch vehicle and represents a more conservative (higher emissions) analysis.
[i] All suborbital ELVs from Wallops.
[j] Based on Scaled Composites testing of SpaceShipTwo, planned to conduct around 50 to 100 test flights during 2009 and 2010 only, after which operations will move to Spaceport America. XCOR Aerospace plans to begin flights of its Lynx RLV from the Mojave Air and Space Port around 2010.

Wildlife Service and the NOAA Marine Fisheries Service, the U.S. Air Force has implemented various plans and measures to limit the extent and frequency of potential launch impacts to protected and sensitive species. In addition, protected species, including California brown pelicans and southern sea otters are regularly monitored during launches for evidence of injury, mortality, or abnormal behavior. Though launches under experimental permits would increase the number of short-term impact events, the FAA does not anticipate long-term significant cumulative effects to biological resources. Consequently, the FAA does not anticipate cumulative adverse effects on threatened and endangered species or critical habitats.

Exhibit 4-18. Estimated Annual Emissions Below 3,000 Feet at California Spaceport[a] (tons)

Launch Activity	Cl	CO	CO_2	HCl	H_2O	NO_X	PM[b]	SO_X	VOCs
Proposed Action	0.00	186.29	77.44	0.00	203.38	0.00	0.00	0.00	0.00
Other Launches[c]	0.06	11.00	114.35	60.89	70.23	0.80	106.12	0.00	0.00
Totals	**0.06**	**197.29**	**191.79**	**60.89**	**273.61**	**0.80**	**106.12**	**0.00**	**0.00**

[a] Values of less than 0.005 ton are shown as 0.00.
[b] Includes all Al_2O_3.
[c] Entire troposphere.

4.1.1.1 John F. Kennedy Space Center

Air Quality

KSC is in an attainment area for all NAAQS and State of Florida standards for criteria pollutants. Exhibit 4-19 lists the estimated annual emissions from ground level to 3,000 feet for the Proposed Action and other launches from KSC. The emissions would be of very short duration and would be rapidly dispersed due to the mechanical and thermal turbulence of the exhaust gases and the movement of the vehicle. Future emissions from Ares rockets as a result of the Constellation Program are expected to have impacts similar to those of the Space Shuttle launches, and are not expected to result in long-term impacts to air quality (NASA 2008a). Therefore, while emissions from the Proposed Action at KSC would not significantly affect air quality in the troposphere, the emissions would contribute to cumulative air quality impacts in the area.

Exhibit 4-19. Estimated Annual Emissions Below 3,000 Feet at KSC[a] (tons)

Launch Activity	Cl	CO	CO_2	HCl	H_2O	NO_X	PM[b]	SO_X	VOCs
Proposed Action	0.00	187.79	208.51	0.00	197.48	0.10	0.00	0.06	0.54
Other Launches[c]	0.01	0.00	1.01	0.46	0.98	0.00	0.84	0.00	0.00
Totals	**0.01**	**187.79**	**209.52**	**0.46**	**198.46**	**0.10**	**0.84**	**0.06**	**0.54**

[a] Values of less than 0.005 ton are shown as 0.00.
[b] Includes all Al_2O_3.
[c] Entire troposphere.

Biological Resources – Protected Species

Although launches of vehicles under experimental permits would represent short-term, discrete events, the overall result would be an increase in launch noise and sonic booms and rocket emissions released at KSC. Through coordination and consultations with the U.S. Fish and Wildlife Service and the NOAA Marine Fisheries Service, NASA has implemented various plans and measures to limit the extent and frequency of potential launch impacts to protected and sensitive species. In addition, certain species are regularly monitored during launches to ensure no long-term or cumulative impacts.

Though launches under experimental permits would result in an increase in the number of short-term impact events, the FAA does not anticipate long-term significant cumulative effects to biological resources. Consequently, the FAA does not expect cumulative adverse effects to threatened and endangered species or critical habitats.

4.1.1.2 Kodiak Launch Complex

Air Quality

KLC is in an attainment area for all NAAQS and State of Alaska standards for criteria pollutants. Exhibit 4-20 lists the estimated annual emissions from ground level to 3,000 feet. The Proposed Action would not contribute to lower tropospheric emissions of hazardous air pollutants (Cl and HCl). Emissions would be of very short duration and would be rapidly dispersed due to the mechanical and thermal turbulence of the exhaust gases and the movement of the vehicle. Therefore, while emissions from the Proposed Action at KLC would not significantly affect air quality in the troposphere, the emissions would contribute to cumulative air quality impacts in the area.

Exhibit 4-20. Estimated Annual Emissions Below 3,000 Feet at KLC[a] (tons)

Launch Activity	Cl	CO	CO_2	HCl	H_2O	NO_X	PM[b]	SO_X	VOCs
Proposed Action	0.00	186.29	77.44	0.00	203.38	0.00	0.00	0.00	0.00
Other Launches[c]	0.25	49.43	7.78	44.57	19.51	0.00	62.41	0.00	0.00
Totals	**0.25**	**235.72**	**85.22**	**44.57**	**222.89**	**0.00**	**62.41**	**0.00**	**0.00**

[a] Values of less than 0.005 ton are shown as 0.00.
[b] Includes all Al_2O_3.
[c] Entire troposphere.

Biological Resources – Protected Species

Although launches of vehicles under experimental permits would represent short-term, discrete events, the overall result would be an increase in launch noise and sonic booms and rocket emissions released at the KLC. Through coordination and consultations with the U.S. Fish and Wildlife Service and the NOAA Marine Fisheries Service, various plans have been implemented to limit the extent and frequency of potential launch impacts to protected and sensitive species. In addition, certain species are regularly monitored during launches to ensure no long-term or cumulative impacts. Protected species such as stellar sea lions and northern sea otters could experience startle effects from launch operations. Though launches under experimental permits would result in an increase in the number of short-term impact events, the FAA does not anticipate long-term significant cumulative effects to biological resources. Consequently, the FAA does not expect cumulative adverse effects on threatened and endangered species or critical habitats.

4.1.1.3 Mid-Atlantic Regional Spaceport

Air Quality

MARS is in an attainment area for all NAAQS and Commonwealth of Virginia standards for criteria pollutants. Exhibit 4-21 lists the estimated annual emissions from ground level to 3,000 feet. Emissions would be of very short duration and would be rapidly dispersed due to the mechanical and thermal turbulence of the exhaust gases and the movement of the vehicle. Therefore, while emissions from the Proposed Action at MARS would not significantly affect air quality in the troposphere, the emissions would contribute to cumulative air quality impacts in the area.

Exhibit 4-21. Estimated Annual Emissions Below 3,000 Feet at MARS[a] (tons)

Launch Activity	Cl	CO	CO_2	HCl	H_2O	NO_X	PM[b]	SO_X	VOCs
Proposed Action	0.00	186.29	77.44	0.00	203.38	0.00	0.00	0.00	0.00
Other Launches[c]	0.33	65.93	0.38	59.43	26.01	0.00	83.22	0.00	0.00
Totals	**0.33**	**252.22**	**87.82**	**59.43**	**229.39**	**0.00**	**83.22**	**0.00**	**0.00**

[a] Values of less than 0.005 ton are shown as 0.00.
[b] Includes all Al_2O_3.
[c] Entire troposphere.

Biological Resources – Protected Species

Although launches of vehicles under experimental permits would represent short-term, discrete events, the overall result would be an increase in launch noise and sonic booms and rocket emissions released at MARS. Through coordination and consultations with the U.S. Fish and Wildlife Service, various plans have been implemented to limit the extent and frequency of potential launch impacts to protected and sensitive species. In addition, certain species are regularly monitored during launches to ensure no long-term or cumulative impacts. Though launches under experimental permits would result in an increase in the number of short-term impact events, the FAA does not anticipate long-term significant cumulative effects to biological resources. Consequently, the FAA does not expect cumulative adverse effects to threatened and endangered species or critical habitats.

4.1.1.4 Mojave Air and Space Port

Air Quality

The Mojave Air and Space Port is in the Eastern Kern County, California, nonattainment area (Mojave Desert Air Basin), which is classified as Basic Nonattainment for the 8-hour ozone NAAQS; accordingly, the conformity requirements apply to emissions of NO_X and VOCs. The general conformity *de minimis* thresholds for this area are 100 tons per year of NO_X and 100 tons per year of VOCs. Exhibit 4-22 lists the estimated annual emissions from ground level to 3,000 feet. There would be no lower tropospheric emissions of hazardous air pollutants (Cl and HCl), because propellants that contain chlorine would be burned only at higher altitudes and not below 3,000 feet. The emissions would be of very short duration and would be rapidly dispersed due to the mechanical and thermal turbulence of the exhaust gases and the movement of the vehicle. Therefore, while emissions from the Proposed Action at the Mojave Air and Space Port would not significantly affect air quality in the troposphere, the emissions would contribute to cumulative air quality impacts in the area. The total increases in emissions would be less than *de minimis* levels and would be less than the 10-percent threshold for regional significance.

Exhibit 4-22. Estimated Annual Emissions Below 3,000 Feet at Mojave Air and Space Port[a] (tons)

Launch Activity	Cl	CO	CO_2	HCl	H_2O	NO_X	PM[b]	SO_X	VOCs
Proposed Action	0.00	186.29	77.44	0.00	203.38	0.00	0.00	0.00	0.00
Other Launches[c]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Totals	**0.00**	**186.29**	**77.44**	**0.00**	**203.38**	**0.00**	**0.00**	**0.00**	**0.00**

[a] Values of less than 0.005 ton are shown as 0.00.
[b] Includes all Al_2O_3.
[c] Entire troposphere.

Biological Resources – Protected Species

Although launches of vehicles under experimental permits would represent short-term, discrete events, the overall result would be an increase in launch noise and sonic booms and rocket emissions released at the Mojave Air and Space Port. However, the FAA does not anticipate long-term significant cumulative effects on biological resources. In addition, as indicated in Section 4.6.2, the Proposed Action would not be expected to affect the desert tortoise or Mojave ground squirrel. Consequently, the FAA does not expect cumulative adverse effects on threatened and endangered species or critical habitats.

4.1.1.5 Oklahoma Spaceport

Air Quality

The Oklahoma Spaceport is in an attainment area for all NAAQS. Exhibit 4-23 lists the estimated annual emissions from ground level to 3,000 feet. There would be no lower tropospheric emissions of hazardous air pollutants (Cl and HCl), because propellants that contain chlorine would be burned only at higher altitudes and not below 3,000 feet. Emissions would be of very short duration and would be rapidly dispersed due to the mechanical and thermal turbulence of the exhaust gases and the movement of the vehicle. Therefore, while emissions from the Proposed Action at the Oklahoma Spaceport would not significantly affect air quality in the troposphere, the emissions would contribute to cumulative air quality impacts in the area.

Exhibit 4-23. Estimated Annual Emissions Below 3,000 feet at Oklahoma Spaceport[a] (tons)

Launch Activity	Cl	CO	CO_2	HCl	H_2O	NO_X	PM[b]	SO_X	VOCs
Proposed Action	0.00	215.35	276.03	0.00	238.82	0.10	0.00	0.06	0.54
Other Launches[c]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Totals	**0.00**	**215.35**	**276.03**	**0.00**	**238.82**	**0.10**	**0.00**	**0.06**	**0.54**

[a] Values of less than 0.005 ton are shown as 0.00.
[b] Includes all Al_2O_3.
[c] Entire troposphere.

Biological Resources – Protected Species

As indicated in Section 4.7.2, there are no known federally protected species or designated critical habitats at the Oklahoma Spaceport. Therefore, there would likely be no cumulative impacts to protected species.

4.1.1.6 Space Florida

Air Quality

LC-46 is in an attainment area for all NAAQS and State of Florida standards for criteria pollutants. Exhibit 4-24 lists the estimated annual emissions from ground level to 3,000 feet. Emissions would be of very short duration and would be rapidly dispersed due to the mechanical and thermal turbulence of the exhaust gases and the movement of the vehicle. Therefore, while emissions from the Proposed Action at LC-46 would not significantly affect air quality in the troposphere, the emissions would contribute to cumulative air quality impacts in the area.

Exhibit 4-24. Estimated Annual Emissions Below 3,000 Feet at LC-46[a] (tons)

Launch Activity	Cl	CO	CO_2	HCl	H_2O	NO_X	PM[b]	SO_X	VOCs
Proposed Action	0.00	186.29	77.44	0.00	203.38	0.00	0.00	0.00	0.00
Other Launches[c]	0.00	88.02	496.76	127.40	296.57	2.00	230.53	0.00	0.00
Totals	**0.00**	**274.31**	**574.20**	**127.40**	**499.95**	**2.00**	**230.53**	**0.00**	**0.00**

[a] Values of less than 0.005 ton are shown as 0.00.
[b] Includes all Al_2O_3.
[c] Entire troposphere.

Biological Resources – Protected Species

Although launches of vehicles under experimental permits would represent short-term, discrete events, the overall result would be an increase in launch noise and sonic booms and rocket emissions released at CCAFS. Through coordination and consultations with the U.S. Fish and Wildlife Service and the NOAA Marine Fisheries Service, various plans have been implemented to limit the extent and frequency of potential launch impacts to protected and sensitive species. In addition, certain species are regularly monitored during launches to ensure no long-term or cumulative impacts. Though launches under experimental permits would result in an increase in the number of short-term impact events, the FAA does not anticipate long-term significant cumulative effects on biological resources. Consequently, the FAA does not expect cumulative adverse effects on threatened and endangered species or critical habitats.

4.1.1.7 Spaceport America

Air Quality

Spaceport America is in an attainment area for all NAAQS and State of New Mexico standards for criteria pollutants. Exhibit 4-25 lists the estimated annual emissions from ground level to 3,000 feet. Emissions from launches would be of very short duration and would be rapidly dispersed due to the mechanical and thermal turbulence of the exhaust gases and the movement of the vehicle. Therefore, while emissions from the Proposed Action at Spaceport America would not significantly affect air quality in the troposphere, the emissions would contribute to cumulative air quality impacts in the area.

Exhibit 4-25. Estimated Annual Emissions Below 3,000 Feet at Spaceport America[a] (tons)

Launch Activity	Cl	CO	CO_2	HCl	H_2O	NO_X	PM[b]	SO_X	VOCs
Proposed Action	0.05	13.48	3,090.54	3.97	54.88	18.95	8.71	1.37	2.10
Other Launches[c]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Non-Launch Emissions	0.00	69.64	5,583.45	0.00	0.00	29.34	28.59	1.31	7.76
Totals	**0.05**	**83.12**	**8,673.99**	**3.97**	**54.88**	**48.29**	**37.30**	**2.68**	**9.86**

[a] Values of less than 0.005 ton are shown as 0.00.
[b] Includes all Al_2O_3.
[c] All launches at Spaceport America are considered as part of the Proposed Action for purposes of this PEIS.

Biological Resources – Protected Species

Although launches of vehicles under experimental permits would represent short-term, discrete events, the overall result would be an increase in launch noise, sonic booms, and rocket emissions released at Spaceport America. Though launches under experimental permits would result in an increase in the number of short-term impact events, the FAA does not anticipate long-term significant cumulative effects to biological resources. Therefore, the FAA does not expect cumulative adverse effects to threatened and endangered species or critical habitats. The U.S. Fish and Wildlife Service, through consultation under Section 7 of the Endangered Species Act, has concurred with the FAA's determination that the Proposed Action would not be likely to affect listed species or critical habitat.

5. MITIGATION

This chapter describes potential general or program-wide mitigation measures that could be implemented to prevent or reduce the environmental impacts of activities considered in this Programmatic Environmental Impact Statement (PEIS). Because the actions evaluated in this PEIS are hypothetical and have been maximized to develop an upper bound for potential impacts, it does not propose site-specific mitigation measures. However, launch operators would be expected to implement site-specific mitigation measures that are consistent with those currently employed by the eight launch facilities addressed in this PEIS. Additional site-specific mitigation measures could be developed and presented in site-specific National Environmental Policy Act (NEPA) documents that tier from this PEIS. The FAA would consult with the appropriate agencies to develop all mitigation measures. Site-specific mitigation measures would be based on the parameters of the FAA-permitted activity. The FAA does not consider compliance with existing regulatory standards to be a mitigation measure, because compliance with such standards would be mandatory with any action.

In developing program-wide mitigation measures for the activities considered in this PEIS, the FAA reviewed its permitting procedures to identify operational controls or methods that could be implemented as mitigation measures. The FAA would continue to develop and implement environmental monitoring programs case by case, as appropriate. The FAA would specify monitoring and reporting programs for applicants to ensure that applicants meet the requirements of various regulations and associated permits, including the Endangered Species Act, the Marine Mammal Protection Act, and the National Historic Preservation Act. Applicants would be responsible for performing required monitoring and providing monitoring reports and related data to FAA. These monitoring requirements would be listed as part of the terms and conditions of future permits. In addition to the development of monitoring programs, the FAA would continue to prepare the following:

- Commercial Space Transportation Forecasts;
- Quarterly Launch Reports;
- Licensing and Safety Reports;
- Annual Development and Concept Reports; and
- Commercial Space Transportation, Year End Reports.

Such reports allow the FAA to maintain accountability of commercial launch activities, monitor noncommercial launch activities, track successful and failed launches, maintain current safety standards, and remain abreast of future launch activities and concepts. The FAA would also continue to make this information available to the public via its website at http://www.faa.gov/ about/office_org/ headquarters_ offices/ast/. As the commercial space industry grows and expands into new areas or surpasses the level of activity or technologies analyzed in existing FAA NEPA documents, this process would allow the FAA to proactively identify new concepts or increased levels of activities that would require review in accordance with NEPA.

6. UNAVOIDABLE ADVERSE IMPACTS, IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES, AND SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

6.1 Unavoidable Adverse Impacts

Unavoidable adverse impacts could arise when there are no reasonable practicable mitigation measures to entirely eliminate impacts, and there are no reasonable practicable alternatives to a proposed project that would meet the purpose and need of the action, eliminate the impact, and not cause other or similar adverse impacts. This Programmatic Environmental Impact Statement (PEIS) does not identify any significant unavoidable adverse impacts. Although not significantly affected, the PEIS identifies five impact categories as subject to the unavoidable adverse impacts of most consequence – air quality, biological resources, Section 4(f) resources, light emissions, and noise. These categories are of most consequence or relevance for both the eight specific launch sites addressed in this PEIS and for the more general impact analysis that has been included for other launch sites where no major, new construction would be required to accommodate experimental launches.

6.1.1 Air Quality

Of the chemicals generated by emissions from reusable suborbital rockets, the emissions of concern are hydrogen chloride, chlorine, particulate matter, nitrogen oxides, sulfur oxides, carbon monoxide, carbon dioxide, water (in the stratosphere), hydrogen ions (in the ionosphere), and volatile organic compounds. Emissions from reusable suborbital rockets on or near the ground would be of very short duration and would rapidly disperse. Ambient pollutant concentrations at locations accessible to the public would be low and not expected to result in violations of any National Ambient Air Quality Standards or state standards. Emissions of ozone-depleting substances and greenhouse gases would be negligible compared to atmospheric emissions worldwide.

6.1.2 Biological Resources

The launch and landing of reusable suborbital rockets in or near vegetated areas could result in adverse impacts to the local vegetative community. Deposition of rocket engine emissions, exposure to exhaust heat, the removal of a vegetative community or decrease in its fitness, and the noise associated with reusable suborbital launch could adversely impact wildlife. Vegetation and wildlife in the vicinity of a launch site would experience direct, but minor and temporary adverse impacts. The Proposed Action could result in location and species-specific adverse impacts to protected species. Previous consultations with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service regarding protected species at several of the site-specific locations addressed in this PEIS have resulted in conclusions of either no impact to such species or not likely to adversely impact such species. The latter conclusion has generally been reached as a result of the launch operators' commitments to incorporate specified precautionary and mitigation measures into their launch planning, implementation, and monitoring activities.

6.1.3 Section 4(f) Resources

The potential for land-use conflicts under the Proposed Action remains remote. Because no new permanent facilities or infrastructure would be developed under the scope of the Proposed Action, there would be no physical taking of lands protected under Section 4(f). However, such resources that are near launch sites, such as public parklands, may experience minor adverse impacts due to their temporary closures during launches. The PEIS indicates that these closures would be both infrequent and of short duration. Additionally, the PEIS identifies for the eight specific launch sites both their known, affected Section 4(f) resources and the steps that have been taken to avoid or reduce adverse impacts to them, and in particular, those Section 4(f) resources of ecological importance.

6.1.4 Light Emissions

Launches and reentries of reusable suborbital rockets would generate light emissions. These emissions would conform to the visual resource management policies and statutes of Federal, state, and local agencies and tribes. Because the scope of the Proposed Action does not involve constructing new launch sites but rather the use of a site existing at the time of the submission of the experimental permit application, there would not be a resulting introduction of new and major sources of light emissions into the affected area. For the same reason, there would not be significant adverse impacts on aesthetics and visual resources.

6.1.5 Noise

Launches and reentries under the Proposed Action would generate additional noise. The upper-bound noise levels for horizontal launches would be similar to existing aircraft activity at launch facilities. Given that the scope of the Proposed Action does not involve the construction of new launch sites, the increase in the number of horizontal launches would not result in a significant increase in noise at launch sites with existing activity. Estimated noise levels from vertical launch vehicles would be expected to produce day/night average sound level (DNL) 65 noise contours up to approximately 450 feet from the launch pad. Noise-sensitive receptors more than 450 feet from the launch pad would not be significantly affected because they would not be expected to experience an increase in noise of 1.5 A-weighted decibels or more at or above DNL 65. Additionally, because the reusable suborbital rocket operating area would be over unpopulated or sparsely populated areas, sonic booms would be expected to have minimal noise impacts. Landing noise would be the same or less than noise generated by takeoff.

6.2 Irreversible and Irretrievable Commitment of Resources

National Environmental Policy Act (NEPA) Section 102 (42 United States Code [U.S.C.] 4332) and Council on Environmental Quality (CEQ) regulations that implement the procedural requirements of NEPA (40 Code of Federal Regulations [CFR] 1502.16) require that environmental impact statements include identification of "…any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented." An irreversible commitment of resources represents a loss of future options. It applies primarily to nonrenewable resources, such as minerals or cultural resources, and to those factors that are renewable only over long time spans, such as soil productivity, whereas an irretrievable commitment of resources represents opportunities that are foregone for the period of the proposed action. Examples include the loss of production, harvest, or use of renewable resources. The decision to commit the resources is reversible, but the utilization opportunities foregone are irretrievable.

Natural and human-made resources would be expended during implementation of the Proposed Action. The development of reusable suborbital rockets would require the use of various natural resources. The materials used to manufacture such vehicles include a modest amount of metals, such as aluminum, nickel, stainless steel, carbon, copper, titanium, and other materials. These materials are readily available in large quantities and their use associated with the Experimental Permit Program would not notably alter their overall production or consumption rates.

Composite materials or fiber-reinforced plastics would also be used in the construction of reusable suborbital rockets. Composites can be composed of glass, carbon, or aramide fibers imbedded in resin.

Specific vehicle structural parts or tanks would be fabricated by winding filaments or tape or laying up impregnated cloth or tape as required by the application. In general, the amount of metal and composite materials that would be required for the reusable suborbital rockets would be negligible compared to the quantities routinely produced.

Solid and liquid propellants and other consumable fluids, including jet fuel for support aircraft, would be expended during the permitted launch or reentry of a reusable suborbital rocket. These materials are readily available in large quantities and their use associated with the Experimental Permit Program would not notably alter their overall production or consumption rates.

Human effort would be irretrievably committed for the preparation and processing of permit applications and their associated reviews, and during development of the reusable suborbital rocket and its permitted operation. Any site-specific environmental impact statement that would tier from this PEIS would further analyze irreversible and irretrievable commitments of resources.

6.3 Relationship between Short-Term Uses and Long-Term Productivity

CEQ regulations that implement the procedural requirements of NEPA require consideration of "the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity" (40 CFR 1502.16). This includes using "…all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generation of Americans" (NEPA, Section 101, 42 U.S.C. 4331).

This section discusses the short-term use of the environment and the maintenance of its long-term productivity. Chapter 4 provides more detailed discussions of the impacts and resource utilization associated with implementation of the Proposed Action. Implementation of the Proposed Action would not require any short- or long-term uses of land. The relationship between short-term uses and long-term productivity would not be meaningfully altered through the implementation of the Proposed Action.

Any loss of vegetation from implementation of the Proposed Action would have little impact on the regional productivity of plants and animals. Because the Proposed Action would not require any new permanent infrastructure, no wetlands or waterways would be filled or drained and there would be no loss of short- or long-term productivity. Groundwater withdrawals would be negligible and would not result in an impact on groundwater availability or well productivity.

7. LIST OF PREPARERS

This chapter lists the primary contributors to the technical content of this Programmatic Environmental Impact Statement.

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8. DISTRIBUTION LIST

8.1 Federal Agencies

Advisory Council on Historic Preservation

Executive Office of the President

Council on Environmental Quality
Office of Management and Budget
Office of Science and Technology Policy

Marine Mammal Commission

National Aeronautics and Space Administration

National Science Foundation

U.S. Congress

House of Representatives
Alaska
California, Districts 22 and 24
Florida, Districts 15 and 24
New Mexico, District 2
Oklahoma, District 3
Virginia, District 2
Senate
Alaska
California
Florida
New Mexico
Oklahoma
Virginia

U.S. Department of Agriculture

Natural Resources Conservation Service

U.S. Department of Commerce

National Oceanic and Atmospheric Administration

U.S. Department of Defense

Department of the Air Force
Department of the Army
Department of the Navy

U.S. Department of Health and Human Services

U.S. Department of Homeland Security

Federal Emergency Management Agency
Office of the Undersecretary of Management
Transportation Security Administration
U.S. Coast Guard

U.S. Department of Housing and Urban Development

U.S. Department of the Interior

Bureau of Indian Affairs
Bureau of Land Management
Bureau of Reclamation
U.S. Fish and Wildlife Service
National Park Service
Policy, Management and Budget

U.S. Department of Labor

Occupational Safety and Health Administration

U.S. Department of State

U.S. Department of Transportation

U.S. Environmental Protection Agency

Office of Federal Activities
Region 3 Office
Region 4 Office
Region 6 Office
Region 9 Office
Region 10 Office

8.2 State Agencies

State of Alaska

Alaska Department of Environmental Conservation
Alaska Department of Natural Resources
Alaska Department of Fish and Game
State of Alaska, House of Representatives
State of Alaska, Office of Governor
State of Alaska, Senate

State of California

California Coastal Commission
California Department of Fish and Game
California Department of Transportation
California Environmental Protection Agency
California State Clearinghouse
California State Parks
Native American Heritage Commission
State of California, House of Representatives
State of California, Office of Governor
State of California, Senate

State of Florida

Florida Department of Agriculture and Consumer Services
Florida Department of Environmental Protection
Florida Department of State
Florida Fish and Wildlife Conservation Commission
State of Florida, House of Representatives
State of Florida, Office of Governor
State of Florida, Senate
St. Johns River Water Management District

State of New Mexico

New Mexico Department of Cultural Affairs
New Mexico Department of Labor
New Mexico Department of Public Safety
New Mexico Department of Transportation
New Mexico Energy, Mineral and Natural Resources Department
New Mexico Environment Department
New Mexico Game and Fish
New Mexico Indian Affairs Department
New Mexico Office of the State Engineer
New Mexico State Land Office
State of New Mexico, House of Representatives
State of New Mexico, Office of Governor
State of New Mexico, Senate

State of Oklahoma

Oklahoma Conservation Commission
Oklahoma Corporation Commission
Oklahoma Department of Environmental Quality
Oklahoma Department of Commerce
Oklahoma Department of Education
Oklahoma Department of Wildlife Conservation
Oklahoma Geology Survey
Oklahoma Historical Society
Oklahoma Office of the Secretary of the Environment
Oklahoma Space Industry Development Authority
Oklahoma Tax Commission
Oklahoma Tourism and Recreation Department
State of Oklahoma, House of Representatives
State of Oklahoma, Office of Governor
State of Oklahoma, Senate

Commonwealth of Virginia

Commonwealth of Virginia, House of Representatives
Commonwealth of Virginia, Office of Governor
Commonwealth of Virginia, Senate
Virginia Department of Agriculture and Consumer Services
Virginia Department of Conservation and Recreation
Virginia Department of Environmental Quality
Virginia Department of Forestry
Virginia Department of Game and Inland Fisheries
Virginia Department of Health
Virginia Department of Historic Resources
Virginia Department of Mines, Minerals, and Energy
Virginia Department of Transportation
Virginia Marine Resources Commission

8.3 County Agencies

State of Alaska

Kodiak Island Borough
Borough Manager
Community Development Department
Chiniak Public Library
Kodiak Library

State of California

Kern County
County Administrative Officer
Department of Planning and Development Services
Kern county Library
Mojave Public Library
Santa Barbara County
County Executive Office
Planning and Development Department
Santa Barbara County Air Pollution Control District
Lompoc Library
Lompoc Public library

State of Florida

Brevard County
County Manager
Development and Environmental Services
Emergency Operations Center
Metropolitan Planning Organization
Natural Resources Management Office

Planning and Zoning Office
Public Safety Department
Volusia County
County Manager

State of New Mexico

Doña Ana County
Commissioner's Office
County Manager
Facilities and Parks
Planning Department
Hatch Public Library
Otero County
Commissioner's Office
County Administrator
Sierra County
Commissioner's Office
County Manager
County Road Department
Truth or Consequences Library

State of Oklahoma

Southwestern Oklahoma Development Authority
Washita County
County Commissioner
Custer County
Clinton Public Library
Beckham County
Elk City Carnegie Library

Commonwealth of Virginia

Accomack County
County Administrator
Accomack-Northhampton Planning District Commission
Island Library
Eastern shore Public Library
York County
County Administrator

8.4 Local Agencies

State of Alaska

City of Kodiak
Office of the Mayor

State of California

California City
Office of the Mayor
City of Lake Isabella
Kern River Valley Library
City of Lancaster
Antelope Valley Air Pollution Control District
Office of the Mayor
Planning Commission
City of Los Angeles
Office of the Mayor
City of Palmdale
Office of the Mayor
Palmdale City Library
Planning Department
City of Santa Barbara
Office of the Major

City of Victorville
Lahonton Regional Water Quality Control Board
Mojave Desert Air Quality Management District

State of Florida

City of Cape Canaveral
Canaveral Port Authority, Chief Executive Officer
Office of the Mayor
Public Library
City of Cocoa
Office of the Mayor
City of Cocoa Beach
Office of the Mayor
Public Library
City of Melbourne
Office of the Mayor
Public Library
City of Titusville
Office of the Mayor
Planning Department
Public Library
Merritt Island
Commissioner's Office
Public Library

State of New Mexico

City of Alamorgordo
Commissioner's Office
City Manager
City of Las Cruces
City Council
City Manager
Office of the Mayor
Parks Management
Planning Department
City of Truth or Consequences
City Manager
Commissioner's Office
Office of the Mayor
White Sands Missile Range
Office of the Garrison Commander

State of Oklahoma

City of Burns Flat
Chambers of Commerce
Office of the Mayor
City of Clinton
Chambers of Commerce
Office of the Mayor
City of Elk City
Chambers of Commerce
Office of the Mayor
City of Frederick
Chambers of Commerce
City of Oklahoma City
Public Library
Town of Canute
Office of the Mayor
Town of Sayre
Chambers of Commerce
Office of the Mayor

State of Virginia

City of Hampton
City Manager
Office of the Mayor
City of Poquoson
City Manager
Office of the Mayor
Hampton Roads Planning District Commission
Town of Chincoteague
Office of the Mayor

8.5 Organizations

Aerospace Industries Association
Adelta Environmental Consulting
Aircraft Owners and Pilots Association
Alaska Aerospace Corporation
AluminumHat Perception Engineering
American Institute of Aeronautics and Astronautics
California Native Plant Society
Clinton-Sherman Industrial Airport
Community Sciences Corporation
Cornerstones Community Partnerships
Cutter Cattle Company, Inc.
Diamondhead Property Owners Association
Doña Ana County Associated Sportsmen
DynCorp International
East Kern Airport District
Economic Development Commission of Florida's Space Coast
Enercon Services, Inc.
Environmental Defense Center
Environmental Defense Fund
El Camino Real De Tierra Adentro Trail Association
Experimental Aircraft Association
Federation of American Scientists
Florida Coalition for Peace and Justice
Florida Natural Areas Inventory
Florida Today Newspaper
Friends of the Earth
Frontier Astronautics
Futron Corporation
Gannett-Fleming West, Inc.
Global Network Against Weapons and Nuclear Power in Space
GlobalSecurity.org
Greenpeace International
Kiewit
Kodiak Daily Mirror
La Purisima Audubon Society
Merrick and Company
Mesa Project Development Corporation
Mesilla Valley Aububon Society
Mid-Atlantic Regional Spaceport
Molzen-Corbin and Associates
NASA John F. Kennedy Space Center
National Audubon Society
National Congress of American Indians
National Fish and Wildlife Foundation
National Hispanic Environmental Council
National Society of Black Engineers
National Tribal Environmental Council
National Trust for Historic Preservation
National Wildlife Federation
Natural Resources Defense Council
New Mexico Heritage Preservation Alliance
New Mexico Spaceport Authority
New Mexico State University
New Mexico Tech
Oklahoma Aeronautics Commission
Oklahoma Archeological Survey
Oklahoma Space Industry Development Authority
Parsons Corporation
Partnership for a Sustainable Future, Inc.
Personal Spaceflight Federation
Physicians for Social Responsibility
Providence Technologies, Inc.
Quail Unlimited
Scaled Composites, LLC
Sierra Club National Headquarters
Sierra Club, Las Padres Chapter
Sierra Electric Cooperative, Inc
Sounder, Miller, and Associates
Southwest Consolidated Sportsmen
Southwest Network for Environmental and Economic Justice
Space Florida
Space Frontier Foundation
Spaceport Systems International
Spec Pro
Starchaser Industries, Inc.
The Aerospace Corporation
The American Association for the Advancement of Science
The Mars Society
The National Space Society
The Nature Conservancy
The Planetary Society
The Space Foundation
The Wilderness Society
Union of Concerned Scientists
United Risk Solutions
University of California
U.S. Pilots Association
Virgin Galactic
Virginia Institute of Marine Science

8.6 Tribal Entities

Apache Tribe of Oklahoma
Comanche Indian Tribe
Comanche Nation
Fort Sill Apache Tribe of Oklahoma
Hopi Tribe
Jicarilla Apache Nation
Kiowa Tribe of Oklahoma
Mescalero Apache Tribe
Navajo Nation
Pawnee Nation of Oklahoma
Pueblo of Isleta
Pueblo of Zia
San Carlos Apache Tribe
White Mountain Apache Tribe
Ysleta del Sur Pueblo
Zuni Tribe

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10. GLOSSARY

A-weighted decibel (dBA): A number representing the sound level that is frequency-weighted according to a prescribed frequency response of the human ear, as established by the American National Standards Institute (ANSI). (*See definition for decibel*.)

Accident scenario: A probable, possible, and/or plausible incident or sequence of failure events that can lead to the occurrence of an accident.

Acid rain: Rain with a potential of hydrogen (pH) level of less than 5.6. (*See definition for potential of hydrogen [pH]*.)

Airspace: The portion of the atmosphere that lies above a nation and comes under its jurisdiction. Airspace is a finite resource that can be defined vertically, horizontally, and temporally. The FAA controls U.S. airspace from ground level to a ceiling of 18,288 meters (60,000 feet).

Ambient air quality standards (AAQS): Defined limits for airborne concentrations of designated criteria pollutants. They are established on a state or Federal level to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility, and materials (secondary standards). (*See definition for criteria pollutant*.)

Apogee: The point during a vehicle's flight path where the vehicle is furthest from Earth.

Attainment area: A region that meets the U.S. EPA National Ambient Air Quality Standards (NAAQS) for a criteria pollutant under the Clean Air Act. (*See definitions for criteria pollutant and NAAQS*.)

Aquifer: An underground bed or layer of earth, gravel, or porous stone that yields water for wells, springs, and other water bodies.

Biological resources: Terrestrial and aquatic plants and animals and the various ecosystems that they inhabit.

Brackish: Descriptive term for water having salinity values ranging from approximately 0.50 to 17.00 parts per thousand (ppt). Brackish water may result from mixing of seawater with fresh water, as in estuaries, or it may occur naturally, as in brackish fossil aquifers.

Carbon monoxide (CO): A colorless, odorless, poisonous gas produced by incomplete fossil fuel combustion. Carbon monoxide is one of the six criteria pollutants for which there is a NAAQS. (*See definition for criteria pollutant*.)

Criteria pollutant: A pollutant determined to injure health, harm the environment, and cause property damage and regulated under EPA's NAAQS (carbon monoxide, lead, nitrogen dioxide, ozone [1-hour and 8-hour], particulate matter [2.5 and 10], and sulfur dioxide). The 1970 amendments to the Clean Air Act require EPA to describe the health and welfare impacts of a pollutant as the "criteria" for inclusion in the regulatory regime.

Cryogenic: A type of propellant for launch vehicle propulsion systems that is gaseous at room temperature and maintained as liquid at very low temperatures (*e.g.*, liquid oxygen [LOX], liquefied hydrogen [LH_2]).

Cultural resources: Includes prehistoric and historic structures, artifacts, archaeological sites, underwater sites, burial sites, and Native American/ Hawaiian religious sites. Related to cultural resources are historic properties, which include artifacts, archaeological sites, standing structures, or other historic resources listed, or potentially eligible for listing, on the *National Register of Historic Places*.

Cumulative impact: The impact to the environment that results from the incremental impact(s) of an action when added to other past, present, or reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Day-night average noise level (DNL): A noise metric combining the levels and durations of noise events and the number of events over an extended time period. It is a cumulative average computed over a set of 24-hour periods to represent total noise exposure. DNL also accounts for more intrusive night time noise, adding a 10-decibel penalty for sounds after 10:00 p.m. and before 7:00 a.m. (*See definition for decibel*.)

Decibel (dB): A unit used to express the intensity of a sound wave, equal to 20 times the common logarithm of the ratio of the pressure produced by the sound wave to a reference pressure (typically 1 micropascal at 1 meter).

***De minimis* level:** In the context of air quality, the level at which emissions do not have an impact.

Endangered species: Animal, bird, fish, plant, or other living organism threatened with extinction throughout all or a significant portion of its range. Requirements for declaring a species endangered are contained in the Endangered Species Act.

Environmental justice: The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Executive Order 12898 specifies how Federal agencies should address the issue.

Erosion: The wearing away of the land surface by wind, water, ice or other geologic agents. It occurs naturally from weather or runoff but is often intensified by human land use practices.

Footprint: The surface area of Earth likely to be impacted by something, such as falling orbital debris or sonic booms.

Floodplain: Low-lying areas adjacent to rivers and streams that are subject to natural inundations typically associated with precipitation.

Fugitive dust: Any solid particulate matter that becomes airborne, other than that emitted from an exhaust stack, either directly or indirectly as a result of the activities of man. Fugitive dust may include emissions from dirt roads, wind erosion of exposed soil surfaces, and other activities in which soil is either removed or redistributed. (*See definition for particulate matter*.)

Geology and soils: Geology is the science and study of Earth, its composition, structure, physical properties, history, and the processes that shape it. Soil is the layer of minerals and organic matter on the land surface, and includes components of moisture and air.

Geosynchronous Earth orbit (GEO): An orbit 35,890 kilometers (22,300 miles) in altitude that is synchronized with Earth's rotation. If a satellite in geosynchronous orbit is not at 0 degrees inclination, its ground path forms a figure eight as it travels around Earth.

Global warming: The progressive gradual rise of Earth's surface temperature thought to be caused by the greenhouse effect. Global warming may be responsible for changes in global climate patterns. Global warming has occurred in the past as the result of natural influences, but the term is most often used to refer to the warming predicted to occur as a result of increased emissions of greenhouse gases. (*See definition for Greenhouse Gases*.)

Greenhouse gases: Gases that raise the temperature of Earth's atmosphere by absorbing part of the long-wave radiation reflected back from Earth's surface, also known as the greenhouse effect. Greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, ozone, chlorofluorocarbons, hydrofluorocarbons, and perfluorinated carbons.

Groundwater: Water, both fresh and saline, that is stored below Earth's surface in pores, cracks, and crevices below the water table.

Geosynchronous transfer orbit (GTO): An orbit attained when a spacecraft is first launched into an elliptical orbit with an apogee altitude (the point of orbit which is farthest from Earth) of approximately 37,000 kilometers (22,991 miles).

Hazardous air pollutants (HAPs): A group of 188 chemicals identified in the 1990 Clean Air Act Amendments. Exposure to these pollutants can cause or contribute to cancer, birth defects, genetic damage, and other adverse health effects.

Hazardous materials and waste: Substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to the public health, welfare, or the environment when released.

High payload capacity: The ability of a launch vehicle to lift from 4,082 to 4,536 kilograms (9,000 to 10,000 pounds) into GTO. (*See definition for payload*.)

Hybrid propulsion systems/fuels: A propulsion system that uses solid fuel with a liquid oxidizer, giving it the ability to throttle, shut-off, and restart in mid-flight. (*See definition for propulsion system*.)

Hydrazine (N_2H_4): A toxic, flammable, fuming, corrosive, strongly reducing liquid used as launch vehicle fuel. (*See definitions of propellant and propulsion systems*.)

Hydrocarbon fuel: A carbon-based propellant used for launch vehicle propulsion systems (*e.g.*, Rocket Propellant 1 [RP1], kerosene plus an oxidizer like liquid oxygen [LOX]).

Hypergolic: Term applied to describe the self-ignition of a fuel and an oxidizer upon mixing with each other without a spark or other external aid.

Impact analysis: An assessment of the meaning of changes in all attributes being studied for a given resource, an aggregation of all effects, usually measured using a qualitative and nominally subjective technique.

Intermediate payload capacity: The ability of a launch vehicle to carry between 1,814 and 4,082 kilograms (4,000 and 9,000 pounds) into GTO or more than 2,268 kilograms (5,000 pounds) into Low Earth Orbit (LEO). (*See definitions for LEO and payload*.)

Ion: An atom or molecule that has acquired an electric charge by the loss or gain of one or more electrons.

Ionization: A process by which a neutral atom or molecule loses or gains electrons, thereby acquiring a net charge and becoming an ion.

Ionosphere: The part of Earth's upper atmosphere which is sufficiently ionized by solar ultraviolet radiation so that the concentration of free electrons affects the propagation of radio waves. It begins between 85 and 105 kilometers (53 to 65 miles) above Earth's surface and is considered to extend upwards to 2,000 kilometers (1,243 miles), though it has no well-defined upper boundary.

Land use: The way land is developed and used in terms of the kinds of anthropogenic activities that occur (*e.g.*, agriculture, residential areas, industrial areas).

Launch vehicle: A rocket launched to deliver a payload from Earth into space. (*See definition for payload*.)

Lead: A heavy metal element formerly added to gasoline and paint for improved performance characteristics. Ingestion and accumulation in humans results in damage to the central nervous system and the mental development of children. Lead is one of the six criteria pollutants for which there is a NAAQS.

Low Earth orbit (LEO): A flight path between Earth's atmosphere and the bottom of the Van Allen belts, from about 161 to 1,609 kilometers (100 to 1,000 miles) altitude. (*See definition of Van Allen belts*.)

Mach 1: Speed of sound, which measures approximately 1,223 kilometers per hour (760 miles per hour); traveling faster than this speed breaks the sound barrier.

Medium payload capacity: The ability of a launch vehicle to place a 907 to 1,814 kilogram (2,000 to 4,000 pound) payload into GTO. (*See definition for payload*.)

Mesosphere: The mesosphere is located between 50 and 80 kilometers (31 to 50 miles) above Earth's surface, characterized by a temperature that decreases as the altitude increases. The coldest temperatures at the mesopause (the upper boundary of the mesosphere) can reach -100°C (-148°F).

Mitigation: A method or action to reduce or eliminate adverse environmental impacts.

National Environmental Policy Act (NEPA): Public law 91-190, passed by Congress in 1969. The Act established a national policy designed to encourage consideration of the influences of human activities, such as population growth, high-density urbanization, or industrial development, on the natural environment. NEPA procedures require that environmental information be made available to the public before decisions are made. Information contained in NEPA documents must focus on the relevant issues to facilitate the decision-making process.

***National Register of Historic Places*:** A register of districts, sites, buildings, structures, and objects important in American history, architecture, archaeology, and culture, maintained by the Secretary of the Interior under authority of Section 2 (b) of the Historic Site Act of 1935 and Section 101 (1) of the National Historic Preservation Act of 1966, as amended.

Nitrogen dioxide (NO_2): Gas formed primarily from atmospheric nitrogen and oxygen when fuel combustion takes place at high temperature. NO_2 emissions contribute to acid rain and formation of atmospheric ozone. Nitrogen dioxide is one of the six criteria pollutants for which there is a NAAQS.

Nitrogen oxides (NO_X): A generic term referring to any one of six different oxides of nitrogen produced during fuel combustion: nitric oxide (NO), nitrogen dioxide (NO_2), nitrous oxide (N_2O), dinitrogen trioxide (N_2O_3), dinitrogen tetroxide (N_2O_4), and dinitrogen pentoxide (N_2O_5). They are believed to cause health problems, form atmospheric ozone, create acid rain, and cause other ecological problems.

Noise: Sound that is unwanted, either because of its effect on humans, its effect on fatigue or malfunction of physical equipment, or its interference with the perception or detection of other sounds.

Nonattainment areas: An area that has been designated by the EPA or the appropriate state air quality agency as exceeding one or more national or state AAQS.

Non-point source: Type of pollution originating from a combination of sources.

Orbital debris: Man-made material in Earth's orbit that is no longer serving any function (*e.g.*, outdated satellites or expended portions of spacecraft).

Overpressure: The local transient pressure exceeding existing atmospheric pressure, usually expressed in pounds per square inch.

Oxidizer: A substance that yields oxygen readily to support the combustion of organic matter, powdered metals, and other flammable material (*e.g.*, chlorate, perchlorate, permanganate, peroxide, nitrate, and oxide).

Ozone (O_3): A molecule made up of three atoms of oxygen. It occurs naturally in the stratosphere and provides a protective layer shielding Earth from harmful ultraviolet radiation. In the troposphere, it is a chemical oxidant and major component of photochemical smog. Ozone is one of the six criteria pollutants for which there is a NAAQS. (*See definitions of troposphere and stratosphere*.)

Ozone depleting substances: Substances that can catalyze reactions that break ozone into other compounds, which is an issue of concern in the stratosphere.

Parking orbit: A temporary Earth orbit for a spacecraft.

Particulate matter (PM): Dust, dirt, soot, smoke and liquid droplets directly emitted into the air by sources such as factories, power plants, cars, engines, construction activity, fires and natural windblown dust. Particles formed in the atmosphere by condensation or the transformation of emitted gases are also considered particulate matter. Particulate matter is one of the six criteria pollutants for which there is a NAAQS. (*See also PM_{10} and $PM_{2.5}$ definitions*.)

Payload: The item that an aircraft or rocket carries over and above what is necessary for the operation of the vehicle in flight (*e.g.*, spaceflight participants, cargo, or satellites).

Payload capacity: Payload capacity refers to the weight that a launch vehicle can lift into a particular orbit, such as LEO or GTO (expressed in pounds or kilograms).

PM_{10}: Particulate matter less than or equal to 10 micrometers in diameter.

$PM_{2.5}$: Particulate matter less than or equal to 2.5 micrometers in diameter.

Potential of hydrogen (pH): A measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions. A solution of 0 to 7 is acid, where decreasing values toward 0 indicates an increase in acidity. A solution of 7 to 14 is alkaline, where increasing values toward 14 indicates an increase in alkalinity.

Propellant: A mixture of fuel and oxidizer that reacts (with or without an initiating source) to produce a high-energy stream of product gases that can produce thrust at a controlled, predetermined rate.

Propulsion system: A mechanical system that provides a propelling or driving force to push an object forward. A propellant is accelerated by the engine, and a reaction produces a force on the engine.

Public health and safety: Health and safety includes consideration of any activities, occurrences, or operations that have the potential to affect the well being, safety, or health of workers or members of the general public.

Reentry: To return or attempt to return, purposefully, a reentry vehicle and its payload, if any, from Earth orbit or from outer space to Earth. (*See definition of reentry vehicle*.)

Reentry vehicle: A vehicle designed to return from Earth orbit or outer space to Earth substantially intact.

Reusable launch vehicle: A launch vehicle that is designed to return to Earth substantially intact and may be launched more than one time or that contains vehicle stages that may be recovered by a launch operator for future use in the operation of a substantially similar launch vehicle.

Scoping: A process initiated early during the NEPA process to identify the scope of issues to be addressed in the environmental document being prepared, including the significant issues related to the proposed action. During scoping, input is solicited from affected agencies and the interested members of the public. (40 CFR 1501.7)

Section 4(f) resources: Resources protected under section 4(f) of the U.S. Department of Transportation Act (recodified as section 303(c) of 49 U.S.C.), which includes any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance or land from an historic site of national, state, or local significance.

Small payload capacity: The ability of a launch vehicle to launch 907 kilograms (2,000 pounds) or less into GTO or 2,268 kilograms (5,000 pounds) or less into LEO.

Socioeconomics: The social and economic indicators specific to the human environment. Social indicators include statistical data related to population distributions, ethnicity, home ownership, education levels, and the availability of medical care, fire and rescue services, educational facilities, or other public amenities such as libraries or recreational opportunities. Key economic indicators include employment trends and unemployment rates, income levels, retail sales, industry, factory, and agricultural activities, and home purchases or sales.

Solid propellant: A rocket propellant in solid form, containing a fuel/oxidizer mix that continually combusts when ignited (*e.g.*, polybutadiene matrix with acrylonitrile oxidizer and powdered aluminum).

Sonic boom: A noise caused by a shock wave that emanates from an aircraft or other object traveling at or above the speed of sound (Mach 1).

Stratosphere: The atmospheric shell above the troposphere and below the mesosphere. It extends from the tropopause to about 55 kilometers (34 miles), where the temperature begins again to increase with altitude. (*See definitions for troposphere and tropopause*.)

Suborbital trajectory: The intentional flight path, or any portion of that flight path, of a launch vehicle or reentry vehicle, whose vacuum instantaneous impact point (IIP) does not leave the surface of the earth. The IIP of a launch vehicle is the projected impact point on Earth where the vehicle would land if its engines stop or where vehicle debris, in the event of failure and break-up, would land. The notion of a "vacuum" IIP reflects the absence of atmospheric effects in performing the IIP calculation. If the vacuum IIP never leaves Earth's surface, the vehicle would not achieve Earth orbit and would therefore be on a suborbital trajectory.

Suborbital vehicle: A rocket-propelled vehicle intended for flight on a suborbital trajectory and whose thrust is greater than its lift for the majority of the powered portion of its flight.

Sulfur dioxide (SO_2): A corrosive gas that combines with water vapor in the atmosphere to form sulfuric acid (H_2SO_4), which falls as acid rain. Sulfur dioxide is one of the six criteria pollutants for which there is a NAAQS.

Tiering: The coverage of general matters in broader environmental impact statements with subsequent more focused statements or environmental analyses, incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared.

Threatened species: Plant and wildlife species that are likely to become endangered in the foreseeable future.

Trajectory: The path followed by an object moving through space under the action of given forces such as thrust, wind, and gravity.

Troposphere: The layer of the atmosphere from Earth's surface up to the tropopause, comprised mostly of nitrogen (76.9 percent) and oxygen (20.7 percent). The troposphere is characterized by decreasing temperature with increasing altitude, vertical wind motion, appreciable water vapor content, and sensible weather (clouds, rain, *etc.*). It contains 75 percent of the total mass of Earth's atmosphere.

Visual and aesthetic resources: Natural or developed landscapes that provide information for an individual to develop their perceptions of the area. The size, type, gradient, scale, and continuity of landforms, structures, land use patterns, and vegetation are all contributing factors to an area's visual character and how it is perceived.

Volatile organic compounds (VOCs): Organic compounds that easily volatize or evaporate and can break down through photodestructive mechanisms. They contribute to air pollution, especially the generation of tropospheric ozone.

Water resources: This term includes both freshwater and marine systems, wetlands, floodplains, and groundwater.

Wetlands: Land or areas exhibiting the following characteristics: hydric soil conditions; saturated or inundated soil during some part of the year and plant species tolerant of such conditions; areas inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, under normal circumstances, a prevalence of vegetation typically adapted for life in saturated soil conditions. Examples include swamps, marshes, bogs, and similar areas.

11. INDEX

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

APPENDIX A

FEDERAL AVIATION ADMINISTRATION ENVIRONMENTAL CHECKLIST FOR EXPERIMENTAL PERMITS FOR THE LAUNCH AND REENTRY OF REUSABLE SUBORBITAL ROCKETS

Appendix A

Federal Aviation Administration Environmental Checklist for Experimental Permits for the Launch and Reentry of Reusable Suborbital Rockets

Date: ____

Applicant Name: ____________________________________

Application Number: _________________________________

Instructions: Begin by completing Part I. After completing Part I, follow the directions after item 5 of Part I.

If the PEIS does not address the Proposed Action and it requires an individual review, or if the Applicant proposes on-site construction activities associated with the Proposed Action, do not complete any questions and see Recommendation 4 or 5 at the end of this checklist.

Part I – Description of the Proposed Action			
1. Does the Applicant propose to use a rocket type addressed in the PEIS? *(See Section 2.1.1.1 of the PEIS for a description of rocket types.)*	**Yes** ☐	**No** ☐	
2. Does the Applicant propose to use a propellant type and volume addressed in the PEIS? *(See Section 2.1.1.2 of the PEIS for a description of propellant types.)*	☐	☐	
3. Does the PEIS address the Applicant's pre-flight activities? *(See Section 2.1.1.3 of the PEIS for a description of pre-flight activities.)*	☐	☐	
4. Does the PEIS address the Applicant's proposed flight profile? *(See Section 2.1.1.4 of the PEIS for a description of flight profiles.)*	☐	☐	
5. Does the PEIS address the Applicant's post-flight activities? *(See Section 2.1.1.5 of the PEIS for a description of post-flight activities.)*	☐	☐	
If the answer to any question in Part I is "No," at a minimum, Recommendation 4 at the end of this checklist applies. If the Applicant proposes to launch from one of the eight sites evaluated in the PEIS, complete Parts II and IV. If the Applicant proposes to launch from a site not evaluated in the PEIS, complete Parts III and IV.			

Part II – The Applicant proposes to launch from one of the eight sites evaluated in the PEIS.		
1. From which of the following sites does the Applicant propose to launch? *(Check one.)*		
California Spaceport	☐	
John F. Kennedy Space Center, Shuttle Landing Facility	☐	
Kodiak Launch Complex	☐	
Mid-Atlantic Regional Spaceport	☐	
Mojave Air and Space Port	☐	

Part II – The Applicant proposes to launch from one of the eight sites evaluated in the PEIS.

Oklahoma Spaceport	☐			
Space Florida, Launch Complex-46	☐			
Spaceport America	☐			
2a. For the checked site, have the appropriate sensitive resource consultation(s) and/or Section 4(f) determination(s) been completed? (*If "No," check Recommendation 2 at the end of this checklist.*)	**Yes** ☐	**No** ☐		
2b. If the answer to question 2a is "Yes," is there documentation: (1) of "no effect" for any needed ESA and/or MMPA consultation (2) that FAA/AST has determined for MBTA compliance and after coordination with FWS that no migratory birds will be taken, killed, or possessed (3) that FAA/AST has made either a "no effect," a "no substantial impairment," or a "*de minimis*" impact determination for any needed Section 4(f) compliance? (*If any box is checked "No," check Recommendation 2 at the end of this checklist.*)			**Yes** ☐	**No** ☐
• Endangered Species Act (ESA) completed			☐	☐
• Migratory Bird Treaty Act (MBTA) completed			☐	☐
• Marine Mammal Protection Act (MMPA) completed			☐	☐
• Section 4(f) of the Department of Transportation Act completed			☐	☐
3. Does the Applicant, by itself or cumulatively, plan a greater number of launch and reentry events than the maximum number of events for which the PEIS analyzes environmental impacts for this site? *(If "Yes," check Recommendation 4 at the end of this checklist.)*	**Yes** ☐	**No** ☐		
4. Would the proposed activities occur within the area analyzed in the PEIS? *(If "No," check #4 in the recommendation section below.)*	☐	☐		
5. Will the Proposed Action be subject to the applicable mitigation measures for this site? *(If "No," check Recommendation 4 at the end of this checklist.)*	☐	☐		

Part III – The Applicant proposes to launch from a site other than the eight sites evaluated in the PEIS.

1. Does the Applicant, by itself or cumulatively, plan a greater number of launch and reentry events than the maximum number of annual events for which the PEIS analyzed environmental impacts? The FAA projected that a maximum of 1,000 launch and reentry events could occur annually at any one location from 2009 to 2014. *(If "Yes," check Recommendation 4 at the end of this checklist.)*	**Yes** ☐	**No** ☐	
2. Does the PEIS address impacts to any of the following resources as a result of the Proposed Action the site? *(Check appropriate box(es). For those checked "No," check Recommendation 3 at the end of this checklist.)*			
• Air quality	☐	☐	

Part III – The Applicant proposes to launch from a site other than the eight sites evaluated in the PEIS.			
• Biological resources (fish, wildlife, and plants)	☐	☐	
• Historical, architectural, archaeological, and cultural resources	☐	☐	
• Floodplains	☐	☐	
• Hazardous materials, pollution prevention, and solid waste	☐	☐	
• Health and safety	☐	☐	
• Land use (including U.S. Department of Transportation Section 4(f) Resources, Farmlands, Wild and Scenic Rivers, and Coastal Resources)	☐	☐	
• Light emissions and visual resources	☐	☐	
• Natural resources and energy supply	☐	☐	
• Noise and compatible land use	☐	☐	
• Socioeconomic impacts	☐	☐	
• Environmental justice	☐	☐	
• Children's environmental health and safety	☐	☐	
• Water quality	☐	☐	
• Wetlands	☐	☐	
• Cumulative Impacts	☐	☐	

PART IV – Complete for all applications.			
1. Is there a high level of uncertainty about the Proposed Action's environmental effects? *(If "Yes," check Recommendation 4 at the end of this checklist.)* Consider first whether there is anything unknown about the Proposed Action's potential impacts, and then think about whether the unknown has any significance.	**Yes** ☐	**No** ☐	
2. Is the Proposed Action controversial for any environmental reason? *(If "Yes," check Recommendation 4 at the end of this checklist.)*	☐	☐	
3. Is the Proposed Action likely to have some other adverse effect on public health and safety or on any other environmental media or resources not specifically identified above? *(If "Yes," check Recommendation 4 at the end of this checklist.)*	☐	☐	

Recommendation *(Check appropriate recommendation(s).)*

Based on an examination and review of the application, I recommend that:

1. ☐ Because the Applicant proposes to launch from one of the eight sites evaluated in the PEIS and the potential environmental impacts of the Proposed Action are fully addressed in the PEIS and, as applicable, the documentation is provided in response to item 2 of Part II above, no further NEPA analysis is needed.

2. ☐ Although the Applicant proposes to launch from one of the eight sites evaluated in the PEIS, further interagency consultation(s) and/or Section 4(f) determination(s) are needed to analyze a potential adverse impact(s) and complete any resulting compliance procedures. I recommend that an environmental assessment, at a minimum, be developed that tiers from and incorporates the findings of the PEIS and focuses on the needed, remaining impact analysis and any procedural compliance.
3. ☐ Because the Applicant proposes to launch from a site not evaluated in the PEIS, I recommend that an environmental assessment, at a minimum, be developed that partially tiers from the PEIS in terms of the resource area(s) affirmatively checked in Part II of this checklist and focuses on those resource areas and their related compliance procedures that are checked "No" in Part II.
4. ☐ Because the Applicant proposes a launch component that is not addressed in the PEIS or for another reason as circled below, I recommend that an environmental assessment, at a minimum, be developed for the Proposed Action. *(Circle applicable reason(s).)* Tiering from the PEIS should be conducted as determined appropriate by AST.
    a. The Applicant proposes to use a rocket type that is not addressed in the PEIS.
    b. The Applicant proposes to use a type and/or volume of propellant not addressed in the PEIS.
    c. The PEIS does not address the Applicant's pre-flight activities.
    d. The PEIS does not address the Applicant's proposed flight profile.
    e. The PEIS does not address the Applicant's proposed post-flight activities.
    f. The Applicant's planned number of annual launches exceeds the maximum number of annual launches for the site.
    g. The proposed activities would not occur within the area analyzed in the PEIS.
    h. The Proposed Action is not subject to the applicable mitigation measures for the site.
    i. There is a high level of uncertainty about the Proposed Action's environmental impacts.
    j. The Proposed Action is controversial for an environmental reason.
    k. The Proposed Action is likely to have some other adverse effect on public health and safety or on another environmental media or resource not specifically identified above.
    l. The PEIS does not address the Proposed Action.
    m. The Applicant proposes on-site construction activities.
5. ☐ Because the Applicant's Proposed Action has the potential to cause one or more significant environmental impacts listed in Chapter 501e. of FAA's NEPA procedures (Order 10501.1E, Change 1), and the significant impact(s) is not addressed in the PEIS, I recommend that an environmental impact statement be initiated.

____

(Signature of Preparer)

____________________________________ __________________________

(Title) *(Date)*

____________________________________ __________________________

(Signature of Concurring Official) *(Date)*

APPENDIX B

FEDERAL REGISTER NOTICES

APPENDIX B
FEDERAL REGISTER NOTICES

This appendix contains copies of the following:

- *Notice of Intent to Prepare a Programmatic Environmental Impact Statement*, *Federal Register* Volume 71, Number 58, March 27, 2006
- *Notice of Extension of Scoping for the Programmatic Environmental Impact Statement (PEIS) for Experimental Permits*, *Federal Register,* Volume 71, Number 89, May 9, 2006
- *Notice of Availability and Request for Comment on the Draft Programmatic Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications, Federal Register,* Volume 74, Number 68, April 10, 2009

Federal Register / Vol. 71, No. 58 / Monday, March 27, 2006 / Notices 15251

instrument approach procedures for Runways 36L and 36R; relocation of a portion of Fox Farm Road to remove the facility from within the Runway Protection Zone (RPZ) for Runway 06; relocation of the existing Visual Approach Descent Indicator (VADI) lights and associated wind cone to serve the relocated Runway 36L threshold; installation of Medium Intensity Runway Lights (MIRL) on the extended and widened runway; installation of Medium Intensity Taxiway Lights (MITL) on the extended on widened taxiway; relocation of a portion of the Southern Illinois Power Company's electric lines to allow for the new SIAPs to Runways 36L and 36; removal of obstructions in the approaches to Runways 06 and 18L; mitigation of impacts to 2.7 acres of wetlands; and the approval of the Southern Illinois ALP.

Copies of the environmental decision and the Final EA are available for public information review during regular business hours at the following locations:

1. Southern Illinois Airport, 665 North Airport Road, Murphysboro, Illinois 62966.
2. Division of Aeronautics-Illinois Department of Transportation, One Langhorne Bond Drive, Capital Airport, Springfield, IL 62707.
3. Chicago Airports District Office, Room 320, Federal Aviation Administration, 2300 East Devon Avenue, Des Plaines, Illinois 60018.

FOR FURTHER INFORMATION, CONTACT: E. Lindsay Butler, Airports Environmental Program Manager, Federal Aviation Administration, Chicago Airports District Office, Room 320, 2300 East Devon Avenue, Des Plaines, Illinois 60018. Ms. Butler can be contacted at (847) 294–7723 (voice), (847) 294–7046 (facsimile) or by e-mail at *lindsay.butler@faa.gov.*

Issued in Des Plaines, Illinois on February 15, 2006.

Larry H. Ladendorf,

Acting Manager, Chicago Airports District Office, FAA, Great Lakes Region.

[FR Doc. 06–2913 Filed 3–24–06; 8:45 am]

BILLING CODE 4910–13–M

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Programmatic Environmental Impact Statement: Launches and Reentries Under an Experimental Permit

AGENCY: Federal Aviation Administration, Office of Commercial Space Transportation, DOT.

ACTION: Notice of intent to prepare a Programmatic Environmental Impact Statement.

SUMMARY: The Commercial Space Launch Amendments Act of 2004 (CSLAA), enacted on December 23, 2004, directs the Secretary of Transportation and, through delegations, the Federal Aviation Administration (FAA) Office of Commercial Space Transportation, to establish an experimental permit regime for developmental reusable suborbital rockets. The intent of Congress for the experimental permit regime is to reduce the regulatory burden on developers of reusable suborbital rockets. Congress intended that, ''[a]t a minimum, permits should be granted more quickly and with fewer requirements than licenses.'' (H. Rep. 108.429 Sec. VII) To address the intent of Congress and meet a reduced timeline for issuing permits, a congressionally mandated 120 day timeline, the FAA is preparing a Programmatic Environmental Impact Statement (PEIS) to evaluate the impacts of launches and reentries conducted under an experimental permit. The intent of the PEIS is to facilitate the development of a permit application package and the subsequent environmental review by FAA, and to ensure that the issuance of an experimental permit is consistent with the FAA's mission of protecting public health and safety, safety of property, and the national security and foreign policy interests of the United States.

The proposed action for this PEIS is to issue experimental permits for the launch and reentry of reusable suborbital rockets. Suborbital rocket means a vehicle, rocket-propelled in whole or in part, intended for flight on a suborbital trajectory, the thrust of which is greater than its lift for the majority of the rocket-powered portion of its ascent. Suborbital trajectory means the intentional flight path of a launch vehicle, reentry vehicle, or any portion thereof, whose vacuum instantaneous impact point does not leave the surface of the Earth.

The FAA will prepare the PEIS in accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality (CEQ) NEPA regulations (40 Code of Federal Regulations [CFR] Parts 1500–1508), and the FAA procedures for implementing NEPA in FAA Order 1050.1E.

DATES: The FAA invites interested agencies, organizations, Native American tribes, and members of the public to submit comments or suggestions to assist in identifying significant environmental issues, and in determining the appropriate scope of the PEIS. The public scoping period starts with the publication of this notice in the **Federal Register** and will continue until May 19, 2006. The FAA will consider all comments received or postmarked by May 19, 2006 in defining the scope of the Draft PEIS. Written comments postmarked or sent after this date will be considered to the degree practicable.

If an agency, organization, or a member of the general public desires to have a scoping meeting at a specific location, please contact Stacey M. Zee at the address listed in the **FOR FURTHER INFORMATION CONTACT** section of this Notice.

ADDRESSES: Written comments or suggestions on the scope and content of the PEIS and requests to receive a copy of the Draft PEIS when it is issued should be directed via mail to: PEIS Experimental Permits, c/o ICF Consulting, 9300 Lee Highway, Fairfax VA 22031; via e-mail at *PEIS-Experimental-Permits@icfconsulting.com*; or via fax at 703–934–3951. The subject line of e-mails or faxes should be labeled ''Scoping for the Experimental Permits PEIS.''

FOR FURTHER INFORMATION CONTACT: For information on the proposed project or to request a location for a scoping meeting, contact Stacey M. Zee via mail at: Federal Aviation Administration, Office of Commercial Space Transportation, Room 331, 800 Independence Avenue, SW., Washington, DC 20591; via phone at (202) 267–9305; via fax at (202) 267–5463; or via e-mail at *Stacey.Zee@faa.gov*. Additional information may also be found on the PEIS Web site at *http://ast.faa.gov/lrra/PEISSite.htm.*

SUPPLEMENTARY INFORMATION:

Background and Need for Agency Action

Under Title 49, U.S. Code, Subtitle IX, Sections 70101–70121, Commercial Space Launch Activities, the FAA oversees, licenses, and regulates both launches and reentries of launch and reentry vehicles, and the operation of launch and reentry sites when carried out by U.S. citizens or within the United States. (49 U.S.C. 70104, 70105) Chapter 701 directs the FAA to exercise this responsibility consistent with public health and safety, safety of property, and the national security and foreign policy interests of the United States; and to encourage, facilitate, and promote commercial space launch and reentry by

15252 Federal Register / Vol. 71, No. 58 / Monday, March 27, 2006 / Notices

the private sector. (49 U.S.C. 70103, 70105)

Under the CSLAA, which was signed into law on December 23, 2004, FAA can issue experimental permits rather than licenses for the launch and reentry of reusable suborbital rockets. Previously, the FAA could only issue a license for these operations. Congress directed that experimental permits could be issued for:

- Research and development to test new design concepts, new equipment, or new operating techniques;
- Showing compliance with requirements as part of the process for obtaining a license; or
- Crew training prior to obtaining a license for a launch or reentry using the design of the rocket for which the permit would be issued.

The CSLAA of 2004 also directs the FAA to make a determination on issuing an experimental permit within 120 days of receiving a complete application. The FAA currently has 180 days to make a license determination. Because of this reduced review time, the FAA is seeking to clearly define the requirements for an experimental permit application in the proposed rulemaking and streamline the environmental review process for such applications in the future. The Notice of Proposed Rulemaking (NPRM) that is being issued concurrent with this Notice of Intent specifies the proposed application requirements for an operator of a reusable suborbital rocket to obtain an experimental permit and the proposed operating requirements and restrictions on launch and reentry of a reusable suborbital rocket operating under a permit.

The FAA is preparing this PEIS to examine the environmental impacts of reusable suborbital rockets operating under an experimental permit. The PEIS will provide information and analyses common to all reusable suborbital rockets, will facilitate tiering of subsequent environmental assessments and environmental impact statements, and will allow the environmental analysis of an individual permit applicant to focus on the environmental effects specific to their permit application. The FAA's intent is to focus the scope of future environmental analyses and improve the efficiency of acting on individual permit applications.

Proposed Action

The proposed action for this PEIS is to issue experimental permits for the launch and reentry of reusable suborbital rockets, develop the environmental criteria for issuing those permits, and prepare documentation that can be referenced or tiered from in future applications. The proposed action includes four conceptual reusable suborbital rockets based on the type of take-off as follows:

1. A vertical take-off suborbital rocket,
2. A combination jet and rocket powered horizontal take-off suborbital rocket,
3. A horizontal take-off suborbital rocket, and
4. A suborbital rocket that requires a support aircraft or balloon to transport the rocket to altitude.

For each type of suborbital rocket, a range of propellants will be analyzed including those used in liquid and hybrid rocket engines. In addition, the type of landing, vertical or horizontal, will be analyzed in the PEIS. Under the proposed action, the launch and reentry would occur from an FAA licensed launch location. FAA will evaluate the impacts associated with each conceptual vehicle from the following locations: Mojave Airport, Mojave, California; California Spaceport, Vandenberg Air Force Base, California; Spaceport Florida, Cape Canaveral Air Force Station, Florida; Mid-Atlantic Regional Spaceport, Wallops Flight Facility, Virginia; the proposed Oklahoma Spaceport, Burns Flat, Oklahoma; and the proposed Southwest Regional Spaceport, Upham, New Mexico. Based on comments received during the scoping period and the advancement of the NPRM, the FAA may propose additional suborbital rocket concepts, propellant types, and locations for impacts analysis.

Under the proposed action, the FAA assumes that up to 50 launch and landing events per conceptual reusable suborbital rocket would occur annually, and no more than 100 annual launch and landing events would occur at any one location. The proposed action assumes that operations would take place from existing commercial launch sites and that no new infrastructure (*e.g.*, buildings, runways, launch pads) would be required. Therefore, infrastructure construction and use are not included in the scope of the PEIS.

Alternatives

Other than the proposed action and the no action alternative, the FAA does not have any defined alternatives to consider, at this time. Based on the comments received during the scoping period and the advancement of the NPRM, the FAA may consider additional alternatives based on its discretion in implementing the CSLAA. The FAA will assess alternatives in accordance with the CEQ NEPA regulations (40 CFR 1502.14).

Identification of Environmental Issues

The purpose of this notice is to solicit comments and suggestions for consideration in the preparation of the PEIS. As background for public comment, this notice contains a list of potential environmental issues that the FAA has tentatively identified for analysis. This list, which the FAA developed from preliminary review of the experimental permit regime and similar projects, is not intended to be all-inclusive or to imply any predetermination of impacts. Instead, it is presented to facilitate public comment on the planned scope and content of the PEIS. Additions to or deletions from this list may occur as a result of the public scoping process. The preliminary list of potential environmental issues that may be analyzed in the PEIS includes the following:

1. Air Quality—the effects of emissions associated with launch and reentry operations,
2. Water Resources—the effects of emissions of launch and reentry operations on water resources,
3. Biological Resources—the effects of launch and reentry operations on terrestrial and aquatic plants and animals, including state- and federally-listed threatened and endangered species, and other protected resources (*e.g.*, wetlands and essential fish habitat),
4. Public Health and Safety—the effects of launch and reentry operations on public health and safety, including potential incidental spills and releases of hazardous or toxic materials,
5. Socioeconomics—the effects of a potential influx of workers and the potential increase in demand for local services,
6. Cultural Resources—the potential effects on historical, archaeological, and culturally important sites, and
7. Environmental Justice—the potential for disproportionately high and adverse effects on populations protected under Executive Order 12898.

Scoping Process

To ensure that all issues related to this proposal are addressed, the FAA will conduct an open process to define the scope and content of the PEIS. Interested agencies, organizations, Native American tribes, and members of the public are encouraged to submit comments or suggestions concerning the content of the PEIS, issues and impacts to be addressed in the PEIS, and alternatives that should be considered. Written comments should be sent to the FAA as described in the **ADDRESSES** section above.

Federal Register / Vol. 71, No. 58 / Monday, March 27, 2006 / Notices 15253

Draft PEIS Schedule and Availability

The Draft PEIS is scheduled to be issued in the fall of 2006. The availability of the Draft PEIS, the methods by which the Draft PEIS will be made available for public review, and dates for public hearings soliciting comments on the PEIS will be announced in the **Federal Register.** Comments on the Draft PEIS will be considered in preparing the Final PEIS.

Those interested parties who do not wish to submit comments at this time, but who would like to receive a copy of the Draft PEIS and other project materials, should follow the guidance provided in the **ADDRESSES** section of this notice.

Issued in Washington, DC, on March 20, 2006.

Patricia G. Smith,

Associate Administrator for Commercial Space Transportation.

[FR Doc. E6–4373 Filed 3–24–06; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

RTCA Special Committee 186: Automatic Dependent Surveillance—Broadcast (ADS–B)

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of RTCA Special Committee 186 meeting.

SUMMARY: The FAA is issuing this notice to advise the public of a meeting of RTCA Special Committee 186: Automatic Dependent Surveillance—Broadcast (ADS–B).

DATES: The meeting will be held April 17–20, 2006 starting at 9 a.m. (unless stated otherwise).

ADDRESSES: The meeting will be held at MITRE/CAASD, 7515 Colshire Drive, McLean, VA 22102–7539.

FOR FURTHER INFORMATION CONTACT: RTCA Secretariat, 1828 L Street, NW., Suite 805, Washington, DC 20036; telephone (202) 833–9339; fax (202) 833–9434; Web site *http://www.rtca.org.* MITRE telephone (703) 983–6000. For map and directions: *http://www.mitre.org/about/locations.html.*

SUPPLEMENTARY INFORMATION: Pursuant to section 10(a)(2) of the Federal Advisory Committee Act (Pub. L. 92–463, 5 U.S.C., Appendix 2), notice is hereby given for a Special Committee 186 meeting.

Note: Specific working group sessions will be held on April 17, 18, 19.

- **April 17:**
- WG4 STP Subgroup MITRE 2 Room 2N103
- **April 18:**
- WG4 STP Subgroup MITRE 2 Room 2N103
- **April 19:**
- WG4 STP Subgroup MITRE 2 Room 2N105
- WG4 ASSAP Subgroup MITRE 1 Room 4H204
- WG–3—1090 MHz MOPS–MITRE 2 Room 0N136

Note: ASAS—Aircraft Surveillance Applications System

CDTI—Cockpit Display of Traffic Information

MOPS—Minimum Operational Performance Standards

STP—Surveillance Transmit Processing

- **April 20:**
- Opening Plenary Session (Chairman's Introductory Remarks, Review of Meeting Agenda, Review/Approval of Previous Meeting Summary, RTCA Paper No. 058–06/SC186–231 (currently in draft)
- ADS–B Program Review/Status
- Review/Approval—Change 1 to DO–260–Minimum Operational Performance Standards for 1090 MHz Automatic Dependent Surveillance—Broadcast (ADS–B)
- Review/Approval—Change 1 to DO–260A–Minimum Operational Performance Standards for 1090 MHz Automatic Dependent Surveillance—Broadcast (ADS–B) and Traffic Information Services (TIS–B)

RTCA Paper No. 059–06/SC186–232

March 16, 2006

Thirty-Sixth Meeting

SC–186

Automatic Dependent Surveillance—Broadcast (ADS–B)

Date: April 17–20, 2006.

Time: 9 a.m. (Unless Otherwise Noted).

Place: MITRE/CAASD, 7515 Colshire Drive McLean, VA 22102–7539, (703) 983–6000.

Map and Directions: *http://www.mitre.org/about/locations.html.*

Specific Sessions

Monday, April 17—WG4 STP Subgroup MITRE 2 Room 2N103

Tuesday, April 18—WG4 STP Subgroup MITRE 2 Room 2N103

Wednesday, April 19—WG4 STP Subgroup MITRE 2 Room 2N105; WG4 ASSAP Subgroup MITRE 1 Room 4H204; WG–3—1090 MHz MOPS—MITRE 2 Room 0N136.

Note: ASSAP—Aircraft Surveillance and Separation Assurance Processing System.

CDTI—Cockpit Display of Traffic Information.

MOPS—Minimum Operational Performance Standards.

STP—Surveillance Transmit Processing.

Thursday, April 20—Plenary Session—See Agenda Below—

Agendas—Plenary Session—Agenda

Thursday—April 20th, starting at 9 a.m. (MITRE 1 Auditorium)

1. Chairman's Introductory Remarks.
2. Review of Meeting Agenda.
3. Review/Approval of the Thirty Fifth Meeting Summary, RTCA Paper No. 058–06/SC186–231 (currently in draft).
4. Date, Place and Time of Next Meeting.
5. ADS–B Program Review/Status.
6. Review/Approval—Change 1 to DO–260—Minimum Operational Performance Standards for 1090 MHz Automatic Dependent Surveillance—Broadcast (ADS–B).
7. Review/Approval—Change 1 to DO–260A—Minimum Operational Performance Standards for 1090 MHz Automatic Dependent Surveillance—Broadcast (ADS–B) and Traffic Information Services (TIS–B).
8. WG4: STP MOPS progress.
10. New Business.
11. Other Business.
12. Review Actions Items/Work Program.
13. Adjourn.

- WG4: STP MOPS Review
- Requirement Focus Group—NRA Document Status
- Closing Plenary Session (New Business, Other Business, Review Action Items/Work Program, Date, Place and Time of Next Meeting, Other Business, Review Actions Items/Work Program, Adjourn)

Attendance is open to the interested public but limited to space availability. With the approval of the chairmen, members of the public may present oral statements at the meeting. Persons wishing to present statements or obtain information should contact the person listed in the **FOR FURTHER INFORMATION CONTACT** section. Members of the public may present a written statement to the committee at any time.

Issued in Washington, DC, March 20, 2006.

Francisco Estrada C.,

RTCA Advisory Committee.

[FR Doc. 06–2914 Filed 3–24–06; 8:45 am]

BILLING CODE 4910–13–M

DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

[Docket Number NHTSA–05–23389–2]

Reports, Forms and Record Keeping Requirements Agency Information Collection Activity Under OMB Review

AGENCY: National Highway Traffic Safety Administration (NHTSA), Department of Transportation.

Federal Register / Vol. 71, No. 89 / Tuesday, May 9, 2006 / Notices 27023

agreements, or intrude into areas preempted by the Federal government; and

(d) Program measures relating to the use of flight procedures can be implemented within the period covered by the program without derogating safety, adversely affecting the efficient use and management of the navigable airspace and air traffic control systems, or adversely affecting other powers and responsibilities of the Administrator as prescribed by law.

Specific limitations with respect to FAA's approval of an airport noise compatibility program are delineated in FAR part 150, section 150.5. Approval is not a determination concerning the acceptability of land uses under Federal, state, or local law. Approval does not by itself constitute a FAA implementing action. A request for Federal action or approval to implement specific noise compatibility measures may be required, and an FAA decision on the request may require an environmental assessment of the proposed action.

Approval does not constitute a commitment by the FAA to financially assist in the implementation of the program nor a determination that all measures covered by the program are eligible for grant-in-aid funding from the FAA under the Airport and Airway Improvement Act of 1982. Where Federal funding is sought, requests for project grants must be submitted to the FAA Regional Office in Burlington, Massachusetts.

The City of Portland submitted to the FAA, on August 31, 2005, noise exposure maps, descriptions, and other documentation produced during the noise compatibility planning study conducted from December 2001 to August 2005. The Portland International Jetport noise exposure maps were determined by FAA to be in compliance with applicable requirements on September 9, 2005. Notice of this determination was published in the **Federal Register** on September 22, 2005.

The Portland International Airport Jetport study contains a proposed noise compatibility program comprised of actions designed for implementation by airport management and adjacent jurisdictions from the date of study completion to beyond the year 2007. The City of Portland requested that the FAA evaluate and approve this material as a noise compatibility program as described in section 104(b) of the Act. The FAA began its review of the program on September 9, 2005, and was required by a provision of the Act to approve or disapprove the program within 180 days (other than the use of new flight procedures for noise control). Failure to approve or disapprove such a program within the 180-day period shall be deemed to be an approval of such a program.

The submitted program contained 13 proposed actions for noise mitigation on and off the airport. The FAA completed its review and determined that the procedural and substantive requirements of the Act and FAR part 150 have been satisfied. The Acting Associate Administrator therefore approved the overall program effective March 8, 2006.

Of the 13 proposed program elements, all were approved. The 13 program elements include new FMS/RNAV flight procedures, greater use of airspace over the Fore River for departures from Runway 11 and arrivals to Runway 29, a reduction in early left turns for aircraft departing Runway 29, runway use recommendations for Federal Express air cargo operations, increased use of Runway 11–29 over Runway 18–36, coordinated efforts with surrounding communities to reduce incompatible land use development, a new flight track monitoring system, periodic recalculation of noise exposure, establishment of engine run-up procedures, continued work with Federal Express to encourage conformance with noise abatement measures, a request that Brunswick Naval Air Station flight units curtail practice instrument operations at PWM, continued meetings with the Noise Advisory Committee, and attendance at meetings of local homeowner associations.

FAA's determinations are set forth in detail in a Record of Approval endorsed by the Acting Associate Administrator on March 8, 2006. The Record of Approval, as well as other evaluation materials and the documents comprising the submittal, are available for review at the FAA office listed above and at the administrative offices of Portland International Jetport, Portland, Maine.

Dated: Issued in Burlington, Massachusetts on April 21, 2006.

LaVerne Reid,

Manager, Airports Division, New England Region.

[FR Doc. 06–4327 Filed 5–08–06; 8:45 am]

BILLING CODE 4910–13–M

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Programmatic Environmental Impact Statement: Launches and Reentries Under an Experimental Permit

AGENCY: Federal Aviation Administration (FAA), Office of Commercial Space Transportation.

ACTION: Notice of extension of scoping for the Programmatic Environmental Impact Statement (PEIS) for Experimental Permits.

SUMMARY: On March 27, 2006, the FAA published a Notice of Intent to prepare a PEIS for Experimental Permits in the **Federal Register** (71 FR 15251). The FAA has decided to extend the scoping period for the preparation of the PEIS to June 2, 2006. All comments received by June 2, 2006 will be considered in the preparation of the Draft PEIS.

FOR FURTHER INFORMATION CONTACT: Questions regarding this notice may be directed to Ms. Stacey M. Zee, FAA Environmental Specialist, c/o ICF Consulting, 9300 Lee Highway, Fairfax, VA 22031; via E-mail *PEIS-Experimental-Permits@icfconsulting.com*; or via fax at 703–934–3951. Envelopes and the subject line of e-mails or faxes should be labeled "Scoping for the Experimental Permits PEIS."

Herbert Bachner,

Manager, Space Systems Development Division.

[FR Doc. E6–7049 Filed 5–8–06; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Availability of Record of Decision for the Final Environmental Impact Statement, Phoenix Sky Harbor International Airport, Phoenix, Maricopa County, AZ

AGENCY: Federal Aviation Administration, DOT.

ACTION: Notice of availability for Record of Decision.

SUMMARY: The Federal Aviation Administration (FAA) is issuing this notice to advise the public that it has published a Record of Decision (ROD) for the Final Environmental Impact Statement (FEIS) that evaluated a proposed Airport Development Program at Phoenix Sky Harbor International Airport (PHX), Phoenix, Maricopa County, Arizona.

Federal Register / Vol. 74, No. 68 / Friday, April 10, 2009 / Notices 16439

a map provided by San Benito, the line extends from near Hollister to near Carnardero.

The transaction is scheduled to take place in June 2009 or later (after the April 26, 2009 effective date of the exemption).

If the notice contains false or misleading information, the exemption is void *ab initio*.[2] Petitions to reopen the proceeding to revoke the exemption under 49 U.S.C. 10502(d) may be filed at any time. The filing of a petition to revoke will not automatically stay the transaction. Petitions for stay must be filed no later than April 17, 2009 (at least 7 days before the exemption becomes effective).

An original and 10 copies of all pleading, referring to STB Finance Docket No. 35225, must be filed with the Surface Transportation Board, 395 E Street, SW., Washington, DC 20423–0001. In addition, a copy of each pleading must be served on Janie Shang, K&L Gates LLP, 1601 K Street, NW., Washington, DC 20006.

Board decisions and notices are available on our Web site at *http://www.stb.dot.gov.*

Decided: April 6, 2009.

By the Board, Joseph H. Dettmar, Acting Director, Office of Proceedings.

Kulunie L. Cannon,

Clearance Clerk.

[FR Doc. E9–8076 Filed 4–9–09; 8:45 am]

BILLING CODE 4915–01–P

[2] A motion to dismiss has been filed in this proceeding. The motion will be addressed in a subsequent Board decision.

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Notice: Letter of Public Notification of the Airports Grants Program Including ARRA Requirements; Information Collection Activity

AGENCY: Federal Aviation Administration (FAA), DOT.

This request is being submitted to OMB via an Emergency Information Collection Request.

SUMMARY: New requirements within the American Recovery and Reimbursement Act of 2009 have made necessary a revision to the OMB-approved collection ''Airports Grants Program'' to include further burden. The information listed below represents the new totals for the complete ''Airports Grants Program'' with the new requirements per the American Recovery and Reimbursement Act of 2009.

FOR FURTHER INFORMATION CONTACT: Nancy S. Williams, APP–501 at *Nancy.S.Williams@faa.gov,* or 202–267–8822.

SUPPLEMENTARY INFORMATION:

Title: Airports Grants Program Including ARRA Requirements.

OMB Control Number: 2120–0569.

Forms(s) 5100–100, 5100–101, 5100–108, 5100–126, 5100–127, 5370–1.

Affected Public: An estimated 1,950 Respondents.

Frequency: This information is collected on occasion.

Estimated Average Burden per Response: Approximately 9 hours per response.

Estimated Annual Burden Hours: An estimated 86,240 hours annually.

Abstract: The FAA collects information from airport sponsors and planning agencies in order to administer the Airports Grants Program. Data is used to determine eligibility, ensure proper use of Federal Funds, and ensure project accomplishment.

Issued in Washington, DC, on March 31, 2009.

Carla Mauney,

FAA Information Collection Clearance Officer, IT Enterprises Business Services Division, AES–200.

[FR Doc. E9–7914 Filed 4–9–09; 8:45 am]

BILLING CODE 4910–13–M

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Office of Commercial Space Transportation; Notice of Availability and Request for Comment on the Draft Programmatic Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications

AGENCY: Federal Aviation Administration (FAA), Department of Transportation.

ACTION: Notice of availability and request for comment.

SUMMARY: In accordance with the National Environmental Policy Act of 1969, as amended (NEPA) (42 U.S.C. 4321 *et seq.*), Council on Environmental Quality NEPA implementing regulations (40 CFR parts 1500–1508), and FAA Order 1050.1E, Change 1, the FAA is announcing the availability of and requesting comments on the *Draft Programmatic Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications* (PEIS). The FAA Office of Commercial Space Transportation is the lead Federal agency for the development of the PEIS. The National Aeronautics and Space Administration and the U.S. Air Force are cooperating agencies. Under the Proposed Action evaluated in the PEIS, the FAA would issue experimental permits for the launch and reentry of reusable suborbital rockets from both FAA-licensed and non-licensed launch sites using the PEIS as the basis for determining the potential environmental consequences of issuing experimental permits.

Under the No Action Alternative, the FAA would continue issuing experimental permits for the launch and reentry of reusable suborbital rockets using its present method of analyzing environmental consequences case by case, without tiering from a programmatic document.

The PEIS examines the potential environmental impacts of issuing an experimental permit for the operation of reusable suborbital rockets anywhere in the U.S. and abroad, and the potential site-specific impacts of permitted launches from seven FAA-licensed commercial launch sites: California Spaceport, California; Mojave Air and Space Port, California; Kodiak Launch Complex, Alaska; Mid-Atlantic Regional Spaceport, Virginia; Space Florida Launch Complex-46 at Cape Canaveral Air Force Station, Florida; Oklahoma Spaceport, Oklahoma; Spaceport America, New Mexico; and one Federal range, the Shuttle Landing Facility at John F. Kennedy Space Center, Florida.

Subsequent environmental analyses that fall under the scope of the PEIS could tier from this document and incorporate the findings of the PEIS by reference, allowing an applicant and the FAA to focus on the relevant and unique impacts of an experimental permit application. Tiering and incorporation by reference would streamline the development of subsequent environmental analyses in accordance with NEPA and FAA Order 1050.1E.

The PEIS will not authorize the launch or reentry of reusable suborbital rockets from launch sites. Individual launch operators would be required to coordinate with site operators to gain access to a site. In addition, the launch operators would be required to apply to the FAA for an experimental permit, which would require an individual safety and environmental review.

DATES: The public comment period for the NEPA process begins with the publication of the U.S. Environmental Protection Agency's Notice of Availability of the Draft PEIS in the **Federal Register**. To ensure that all comments can be addressed in the Final PEIS, the FAA must receive comments no later than May 25, 2009.

ADDRESSES: Comments submitted by mail should be addressed to Ms. Stacey M. Zee, FAA Environmental Specialist, FAA Experimental Permits PEIS, c/o ICF International, 9300 Lee Highway, Fairfax, VA 22031. Comments may be submitted via electronic mail to *PEIS–Experimental-Permits@icfi.com*. Comments also may be submitted via fax to (703) 934–3951.

The Draft PEIS may be viewed at the following locations:

Alaska

Chiniak Public Library, Mile 41, Chiniak, AK 99615.
Kodiak Library, 319 Lower Mill Bay Road, Kodiak, Alaska 99615.

California

Kern County Library, 9507 California City Blvd., California City, CA 93505.
Lompoc Library, 3755 Constellation Rd., Lompoc, CA 93436.
Lompoc Public Library, 501 E North Ave., Lompoc, CA 93436.
Mojave Public Library, 16916–1/2 Highway 14, Mojave, CA 93501.

Florida

Merritt Island Public Library, 1195 North Courtenay Parkway, Merritt Island, FL 32953.
Titusville Public Library, 2121 S. Hopkins Ave., Titusville, FL 32780.

New Mexico

Truth or Consequences Library, 325 Library Lane, Truth or Consequences, NM 87901.
Hatch Public Library, 503 E Hall St., Hatch, NM 87937.

Oklahoma

Clinton Public Library, 721 Frisco Ave., Clinton, OK 73601.
Elk City Carnegie Library, 221 West Broadway, Elk City, OK 73644.

Virginia

Island Library, 4077 Main St., Chincoteague, VA 23336.
Eastern Shore Public Library, 23610 Front St., Accomac, VA 23301.

The FAA also sent the Draft PEIS to interested persons and agencies shown on the distribution list in Chapter 8 of the PEIS. The Draft PEIS, along with the Notice of Intent (NOI) to prepare the Draft PEIS, are available on the Internet in Adobe® portable document format at *http://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/review/documents_progress/*.

Additional Information: Under the Proposed Action, the FAA would issue experimental permits for the launch and reentry of reusable suborbital rockets from both FAA-licensed and non-licensed launch sites using the PEIS as the basis for determining the potential environmental consequences of issuing experimental permits. An experimental permit would implement the appropriate safety requirements as defined in 14 CFR part 437. A permit would be valid for 1 year and would authorize an unlimited number of launches and reentries of a particular reusable suborbital rocket design from a specified site(s). A permittee could renew the permit by submitting a written application to the FAA for renewal at least 60 days before the permit expired.

Based on the FAA's review of past activities and consultations with various organizations in the commercial space industry, the FAA projected that a maximum of 1,000 launch and reentry events could occur annually at any one location from 2009 to 2014. The FAA used this estimate to develop an upper bound to assess the potential impacts of the Experimental Permit Program. In some cases, the maximum number of events analyzed in the PEIS for specific sites are fewer than 1,000 if the site cannot support all of the flight profiles identified in the PEIS. The estimates used in the PEIS are extremely conservative and the actual number of launches per year would likely be lower.

The PEIS considers activities associated with the launch and reentry of reusable suborbital rockets, including pre-flight activities, flight profile (takeoff, flight, and landing), and post-flight activities (vehicle safing). The general suborbital rocket designs addressed in the PEIS include vehicles resembling conventional aircraft—30 to 140 feet long with unfueled weight of up to 9,921 pounds; vehicles resembling conventional rockets—6 to 33 feet long with unfueled weight of up to 5,500 pounds; and vehicles that hover—up to 20 feet in length or diameter with unfueled weight of up to 4,400 pounds. To assess potential impacts of the Experiment Permit Program, the PEIS also considers the approximate proportions of general reusable suborbital rocket flight profiles, as follows: (1) Horizontal takeoff (rocket or jet powered), flight, and horizontal landing (glide or jet powered); (2) vertical takeoff (rocket powered), flight, and vertical landing (rocket powered or parachute); and (3) rocket powered hovering flights (vertical takeoff and landing).

The PEIS analyzes the potential environmental effects of permitted launches on the impact categories described in FAA Order 1050.1E, Change 1. The PEIS does not analyze environmental consequences specific to construction because the Proposed Action and No Action Alternative do not involve construction activities. The PEIS also addresses potential cumulative impacts of the Proposed Action.

FOR FURTHER INFORMATION CONTACT: Ms. Stacey M. Zee, FAA Environmental Specialist, FAA Experimental Permits PEIS, c/o ICF International, 9300 Lee Highway, Fairfax, VA 22031; e-mail *PEIS–Experimental-Permits@icfi.com*; or fax (703) 934–3951.

Issued in Washington, DC, on March 26, 2009.

Michael McElligott,

Manager, Space Systems Development Division.

[FR Doc. E9–7913 Filed 4–9–09; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF TRANSPORTATION

Federal Highway Administration

Notice of Final Federal Actions on the Kosciuszko Bridge (Interstate 278) Over Newtown Creek, Kings and Queens Counties, NY

AGENCY: Federal Highway Administration (FHWA), U.S. Department of Transportation (DOT).

ACTION: Notice of limitation on claims for judicial review of actions by FHWA and other Federal agencies.

SUMMARY: This notice announces actions taken by the FHWA and other Federal agencies that are final within the meaning of 23 U.S.C. 139(l)(1). The actions relate to the proposed highway project and the replacement of the Kosciuszko Bridge over Newtown Creek. Those actions grant licenses, permits, and approvals for the project.

DATES: By this notice, the FHWA is advising the public of the final agency actions subject to 23 U.S.C. 139(l)(1). A claim seeking judicial review of the Federal agency actions on the highway project will be barred unless the claim is filed on or before October 7, 2009. If the federal law that authorizes judicial review of a claim provides a time period less than 180 days for filing such claim, then the shorter time period still applies.

FOR FURTHER INFORMATION CONTACT: Jeffrey Kolb, P.E., Division Administrator, Federal Highway Administration, New York Division, Leo W. O'Brien Federal Building, Suite 719, Clinton Avenue and North Pearl Street,

APPENDIX C

REUSABLE SUBORBITAL ROCKET PROPELLANTS

APPENDIX C
REUSABLE SUBORBITAL ROCKET PROPELLANTS

This appendix provides material-handling data and properties for the propellants (*i.e.*, fuels, oxidizers, monopropellants) used in the reusable suborbital rocket for the X Prize Cup, which are representative of reusable suborbital rockets that could be launched under an experimental permit. This appendix also lists relevant characteristics of the propellants (sorted by fuel, oxidizer, and monopropellants) that could be used in a reusable suborbital rocket. The characteristics include:

- Appearance/Odor
- Boiling Point
- Vapor Density
- Specific Gravity
- Solubility in Water
- Extinguishing Media
- Stability Conditions to Avoid
- Acute and Chronic Health Hazards
- Steps if Released/Spilled

For vapor density, the information identifies whether the vapor density of the fuel, oxidizer, or monopropellants is greater or less than the vapor density of air (1), which indicates whether it would sink in air or disperse into the atmosphere. For specific gravity, the information identifies if the specific gravity of the fuel, oxidizer, or monopropellants is greater or less than the vapor density of water (1), which indicates whether it would float or sink in water. The terms insoluble, negligible, slightly, soluble, miscible, and complete are used to characterize the solubility of the fuel, oxidizer, or monopropellant in water. Blank values in the tables indicate that the information is not available. Data for all chemicals without a specific source is from http://www.setonresourcecenter.com/MSDS_Hazcom/default_ search.asp

FUELS

Propane	
Appearance/Odor	Colorless gas with natural gas/unpleasant odor
Boiling Point	-54 to -10 degrees Fahrenheit (^{o}F)
Vapor Density	Sinks in air (>1)
Specific Gravity	Floats on water (<1)
Solubility in Water	Slightly
Extinguishing Media	Leaking gases could re-ignite after flame is extinguished. Heated containers could rupture, causing fuel cell to travel some distance.
Stability Conditions to Avoid	Exposures to temperatures above 120 ^{o}F
Acute and Chronic Health Hazards	Inhalation of gas can cause dizziness, rapid breathing, fatigue, or nausea.
Steps if Released/Spilled	Isolate area. Do not enter area without artificial respiration if in enclosed area. Keep all sources of ignition away.

FUELS (continued)

Rocket Propellant (RP)-1	
Appearance/Odor	Clear and bright liquid with red dye typical; hydrocarbon odor
Boiling Point	365 to 412 ^{o}F
Vapor Density	Sinks in air (>1)
Specific Gravity	Floats on water (<1)
Solubility in Water	Negligible
Stability Conditions to Avoid	If stored in drums, containers can rupture from internal pressure if confined to fire area.
Acute and Chronic Health Hazards	Ingestion of liquid will cause gastrointestinal distress irritation. Blood effects, possibly kidney effects. If inhaled, nervous system depression, vapors can be narcotic/anesthetic/irritating. Aspiration hazard.
Steps if Released/Spilled	Small spills: pick up with absorbent media and store as hazardous waste. Large spills: contain with dikes and pick up with a vacuum truck.

Ethanol	
Appearance/Odor	Water clear/characteristic odor
Boiling Point	173 ^{o}F
Vapor Density	Sinks in air (>1)
Specific Gravity	Floats on water (<1)
Solubility in Water	Complete
Stability Conditions to Avoid	Above the flashpoint, vapor-air mixtures or explosive vapors can flow along surfaces to ignition sources and flash back. Sensitive to static discharge.
Acute and Chronic Health Hazards	Can irritate mucous membranes of the upper respiratory tract; can cause headache, drowsiness throat irritation, diarrhea, vomiting and in acute cases, death. Chronic exposure can cause drying and cracking of the skin. Can affect nervous system, liver, blood, and reproductive system.
Steps if Released/Spilled	Collect liquid in an appropriate container or absorb with an inert material. Do not use combustible materials such as sawdust.

FUELS (continued)

Isopropanol	
Appearance/Odor	Clear, colorless liquid with a medicinal odor similar to rubbing alcohol
Boiling Point	180 ^{o}F
Vapor Density	Sinks in air (>1)
Specific Gravity	Floats on water (<1)
Solubility in Water	Complete
Extinguishing Media	Use water fog, carbon dioxide, foam or dry chemical.
Stability Conditions to Avoid	High temperatures and strong oxidizing conditions
Acute and Chronic Health Hazards	May cause moderate eye irritation, and slightly toxic by inhalation and ingestion. Chronic hazards include irritation of mucosal membranes.
Steps if Released/Spilled	Evacuate the area and limit access. Use protective equipment, remove all ignition sources, and stop the release. Keep from entering sewers or public waters, notify the authorities and blanket with firefighting foam. Once it is contained, collect the material.

Methanol	
Appearance/Odor	Clear, colorless liquid with a slightly alcoholic odor
Boiling Point	148 ^{o}F
Vapor Density	Sinks in air (>1)
Specific Gravity	Floats on water (<1)
Solubility in Water	Soluble
Extinguishing Media	For small fires, use dry chemical, CO_2, and water spray. For larger fires, use water spray or aqueous alcohol resistant film forming foam with a 3% or 6% foam proportioning system.
Stability Conditions to Avoid	Not applicable
Acute and Chronic Health Hazards	Acute hazards include blindness or death if ingested, irritated mucous membranes if inhaled, tearing and burning of the eyes if exposed, and can be toxic if absorbed through the skin. Chronic exposure can cause systemic poisoning, brain disorders, impaired vision and blindness, and can aggravate existing emphysema or bronchitis.
Steps if Released/Spilled	Eliminate all ignition sources, stop leak and use absorbent materials. Use diking methods if necessary. Apply fluorocarbon alcohol resistant foams to decrease vapor and fire hazard. Collect and recover methanol or dilute with water to reduce fire hazard.

FUELS (continued)

Kerosene	
Appearance/Odor	Colorless to light brown, mobile, oily liquid with a mild petroleum odor
Boiling Point	304 ^{o}F
Vapor Density	Sinks in air (>1)
Specific Gravity	Floats on water (<1)
Solubility in Water	Negligible
Extinguishing Media	Use water spray, regular foam, dry chemical, or carbon dioxide.
Stability Conditions to Avoid	Heat and flame
Acute and Chronic Health Hazards	Inhalation can cause respiratory irritation or central nervous system depressions with high concentrations. Exposure to skin and eyes can cause irritation, and ingestion can cause aspiration. Chronic exposure can cause skin dermatitis.
Steps if Released/Spilled	Eliminate all ignition sources, ventilate the area, and use water spray to reduce vapors. Control the spill, absorb with inert material, and contain.

Methane	
Appearance/Odor	Colorless, odorless gas
Boiling Point	-259 ^{o}F
Vapor Density	Disperses in air (<1)
Specific Gravity	Floats on water (<1)
Solubility in Water	Negligible
Extinguishing Media	Water, CO_2, dry chemical
Stability Conditions to Avoid	Do not store in temperatures greater than 125^{o} F
Acute and Chronic Health Hazards	High concentration excludes an adequate supply of oxygen to the lungs and can cause asphyxiation.
Steps if Released/Spilled	Evacuate and purge piping with inert gas prior to attempting repairs.

FUELS (continued)

Liquid Hydrogen (LH_2)	
Appearance/Odor	Colorless, odorless liquid
Boiling Point	-423 ^{o}F
Vapor Density	Disperses in air (<1)
Specific Gravity	Floats on water (<1)
Solubility in Water	0.0016 grams per liter
Extinguishing Media	All known media can be used.
Stability Conditions to Avoid	Heat, flames, and sparks, oxidizing agents, and carbon steel
Acute and Chronic Health Hazards	High concentrations may cause asphyxiation, loss of mobility, unconsciousness, dizziness, salivation, nausea, or vomiting. Direct contact may cause frostbite.
Steps if Released/Spilled	Wear self contained breathing apparatus. Remove ignition sources, and ventilate the area. Prevent leak from entering sewers or low-lying spaces and do not allow accumulation.

Source: UC Davis Institute of Transportation Studies, 2007.

Hydroxyl terminated polybutadiene (HTPB) rubber	
Appearance/Odor	N/A
Boiling Point	N/A
Vapor Density	N/A
Specific Gravity	Floats on water (<1)
Solubility in Water	N/A
Extinguishing Media	Water spray, carbon dioxide, dry chemical or appropriate foam
Stability Conditions to Avoid	Strong oxidizing agents, acids
Acute and Chronic Health Hazards	May irritate the skin and eyes.
Steps if Released/Spilled	Absorb on sand or vermiculite and place in closed containers for disposal. Ventilate area and wash spill site.

Source: Nanyang Technological University, 2007.

FUELS (continued)

Plexiglass (Ethyl Methacrylate)	
Appearance/Odor	Colorless, unpleasant smelling liquid
Boiling Point	117 degrees Centigrade (^oC)
Vapor Density	Sinks in air (>1)
Specific Gravity	N/A
Solubility in Water	N/A
Extinguishing Media	N/A
Stability Conditions to Avoid	Light or heat, peroxides, oxidizing agents, bases, acids, reducing agents, halogens and amines
Acute and Chronic Health Hazards	Irritates skin, eyes and respiratory tract. May be harmful to inhale or ingest.
Steps if Released/Spilled	N/A

Source: University of Oxford Physical & Theoretical Chemistry Laboratory, 2007.

Jet Propellant (JP)-1	
Appearance/Odor	Colorless to light brown amber liquid/ petroleum like odor
Boiling Point	N/A
Vapor Density	Sinks in air (>1)
Specific Gravity	N/A
Solubility in Water	Insoluble
Extinguishing Media	Use foam, dry chemical or fog streams to extinguish burning liquid.
Stability Conditions to Avoid	Vapors are heavier than air and will collect and stay in low areas.
Acute and Chronic Health Hazards	N/A
Steps if Released/Spilled	Use large amounts of water to disperse vapors, and contain the run up. Consider the application of foam to large areas up to spilled liquid to control papers. Ventilate confined area.

FUELS (continued)

Alcohol	
Appearance/Odor	Clear, colorless liquid with a mild alcoholic odor
Boiling Point	173 ^{o}F
Vapor Density	Sinks in air (>1)
Specific Gravity	Floats on water (<1)
Solubility in Water	Complete
Extinguishing Media	Use dry chemical, alcohol foam, or carbon dioxide to extinguish burning liquid
Stability Conditions to Avoid	Excess heat and ignition sources
Acute and Chronic Health Hazards	Overexposure may cause eye irritation, skin irritation, drowsiness, and tracheal irritation. If ingested, it can cause nausea and vomiting.
Steps if Released/Spilled	For small spills, wear respirator and protective clothing if in a confined area, remove ignition sources, confine the spill with rags, paper or absorbent, and place in a closable container.

Jet A	
Appearance/Odor	Clear liquid with a paraffinic odor
Boiling Point	330 to 572 ^{o}F
Vapor Density	N/A
Specific Gravity	Floats on water (<1)
Solubility in Water	Insoluble
Extinguishing Media	Use water spray, dry chemical, carbon dioxide, or foam. Use water spray to flush spills away from exposures.
Stability Conditions to Avoid	Heat and flame
Acute and Chronic Health Hazards	Acute exposure may cause eye, lung, or skin irritation. Extreme exposure or aspiration may cause lung damage or death. Chronic exposure may damage the blood, eyes, and kidneys.
Steps if Released/Spilled	Contain spill, recover by vacuuming and then using absorbent materials. Contain for disposal.

OXIDIZERS

70% Hydrogen Peroxide	
Appearance/Odor	Clear, colorless solution with slightly pungent odor
Boiling Point	237 ^{o}F
Vapor Density	N/A
Specific Gravity	Sinks in water (>1)
Solubility in Water	Complete
Extinguishing Media	Use water spray, carbon dioxide, dry chemical, any ABC class fire extinguisher, foam, or halon.
Stability Conditions to Avoid	Contact with organic or oxidizable materials
Acute and Chronic Health Hazards	Inhalation of mist may cause pulmonary irritation, irritation of mucous membranes, coughing, sore throat, respiratory tissue damage, laryngitis, headache, nausea, and vomiting. Severe exposure can cause pneumonitis, pulmonary edema, and death. Irritates and reddens the eyes and skin. If ingested, it will burn digestive track.
Steps if Released/Spilled	Absorb liquid and neutralize area with sodium bicarbonate or acid neutralizer. Rinse area with water and test with starch iodide paper. If the paper discolors, neutralize area with 5% thiosulfate solution and decontaminate the area. Seal residue in a container and dispose of properly.

Liquid Oxygen (LOX)	
Appearance/Odor	Blue, odorless, cryogenic liquid
Boiling Point	-297.3^{o} F
Vapor Density	Disperses in air (<1)
Specific Gravity	Sinks in water (>1)
Solubility in Water	0.049
Extinguishing Media	Material is nonflammable. Will vaporize rapidly forming an oxygen-enriched vapor cloud. Immediately cool containers with water spray from maximum distance. Do not direct water spray at the container vent. When cool, move containers from fire area.
Stability Conditions to Avoid	Some materials that are inflammable in air burn in pure oxygen.
Acute and Chronic Health Hazards	Freezes tissues and can cause severe cryogenic burns
Steps if Released/Spilled	Prevent liquid from contacting grease, oil, asphalt, or combustibles. Ventilate area, evaporate and disperse oxygen. Flush area with water.

OXIDIZERS (continued)

50% Hydrogen Peroxide	
Appearance/Odor	Clear, colorless solution with slightly pungent odor
Boiling Point	237 °F
Vapor Density	N/A
Specific Gravity	Sinks in water (>1)
Solubility in Water	Complete
Extinguishing Media	Use water spray, carbon dioxide, dry chemical, any ABC class fire extinguisher, foam, or halon.
Stability Conditions to Avoid	Contact with organic or oxidizable materials
Acute and Chronic Health Hazards	Inhalation of mist may cause pulmonary irritation, irritation of mucous membranes, coughing, sore throat, respiratory tissue damage, laryngitis, headache, nausea, and vomiting. Severe exposure can cause pneumonitis, pulmonary edema, and death. Irritates and reddens the eyes and skin. If ingested, it will burn digestive track.
Steps if Released/Spilled	Absorb liquid, and neutralize area with sodium bicarbonate or acid neutralizer. Rinse with water and test with starch iodide paper. If the paper discolors, neutralize area with 5% thiosulfate solution and decontaminate the area. Seal residue in a container and dispose of properly.

High test peroxide (HTP) (70% Hydrogen Peroxide)	
Appearance/Odor	Clear, colorless, and odorless liquid
Boiling Point	246 °F
Vapor Density	N/A
Specific Gravity	Sinks in water (>1)
Solubility in Water	Complete
Extinguishing Media	Flood with water
Stability Conditions to Avoid	Extended heat or contamination
Acute and Chronic Health Hazards	Corrosive to eyes, skin, nose, throat, lungs, and intestinal tract. May cause irreversible eye damage.
Steps if Released/Spilled	Flood with water to cool. Wear protective clothing and fully-contained breathing apparatus.

Source: FMC Industrial Chemicals, 2007.

OXIDIZERS (continued)

Inhibited White Fuming Nitric Acid	
Appearance/Odor	Colorless, yellow, or red, fuming liquid with an acrid, suffocating odor
Boiling Point	181 ^{o}F
Vapor Density	N/A
Specific Gravity	Sinks in water (>1)
Solubility in Water	Miscible
Extinguishing Media	Use alcohol-resistant foams, water, dry chemical, dry sand for small fires. For larger fires, use water spray, fog or alcohol-resistant foam.
Stability Conditions to Avoid	N/A
Acute and Chronic Health Hazards	Inhalation, ingestion, or exposure may cause severe injury, burns, or death.
Steps if Released/Spilled	Isolate spill, stay upwind, and ventilate enclosed areas. Wear protective clothing and self-contained breathing apparatus. Move away ignitions sources and try to prepare for containment.

Source: Seton Compliance Resource Center, 2007.

Nitrous Oxide	
Appearance/Odor	Colorless, odorless gas
Boiling Point	N/A
Vapor Density	N/A
Specific Gravity	Equal to air (=1)
Solubility in Water	Sinks in water (>1)
Extinguishing Media	Use appropriate measures to surround the fire.
Stability Conditions to Avoid	Stable under normal conditions. Avoid storage in poorly ventilated areas or near heat source.
Acute and Chronic Health Hazards	Can cause rapid suffocation by displacing air necessary for life. Symptoms include rapid respiration, loss of muscular coordination, fatigue, dizziness, nausea, vomiting, unconsciousness, and death.
Steps if Released/Spilled	Evacuate and ventilate area. Remove leaking cylinder to ventilated area, shut off the source if possible and remove sources of heat.

MONOPROPELLANTS

Solid: 68% Ammoniums Perchlorate + 18% Aluminum + 14% HTPB	
Appearance/Odor	White crystal with no odor
Boiling Point	N/A
Vapor Density	N/A
Specific Gravity	Sinks in water (>1)
Solubility in Water	Soluble (20.8 grams per milliliter at 20 ^{o}C)
Extinguishing Media	Water – Note, when burned produces chlorine and chlorine dioxide – stay upwind
Stability Conditions to Avoid	Stable
Acute and Chronic Health Hazards	Local irritation and aggravation of existing respiratory problems. No long-term chronic effects have been reported.
Steps if Released/Spilled	Sweep up area and containerize, wash area with water.

Hydrazine (70% solution)	
Appearance/Odor	Clear, colorless liquid with ammonia or fishy odor
Boiling Point	246 ^{o}F
Vapor Density	N/A
Specific Gravity	Sinks in water (>1)
Solubility in Water	Miscible
Extinguishing Media	Water spray
Stability Conditions to Avoid	Temperatures higher than 124 ^{o}F. After extinguishing fire with water, remove from direct light and ignition sources.
Acute and Chronic Health Hazards	Inhalation can irritate respiratory tract and affect liver, kidneys, blood, and central nervous system. If ingested, it can irritate the digestive tract.
Steps if Released/Spilled	Evacuate area, remove ignition sources, and stop air leak. Suppress vapors with a water fog, and treat and dispose as a hazardous waste. If spilled in water, divert contaminated water and dilute to 10% with water, and neutralize. Absorb with commercial absorbent, clay, or sand, and decontaminate with detergent and lots of water.

MONOPROPELLANTS (continued)

Hydrogen Peroxide	
Appearance/Odor	Clear, colorless, odorless liquid
Boiling Point	218 ^{o}F
Vapor Density	Not available
Specific Gravity	Sinks in water (>1)
Solubility in Water	Complete
Extinguishing Media	Water
Stability Conditions to Avoid	Excessive heat or contamination
Acute and Chronic Health Hazards	Irritating and corrosive to eyes and digestive tract. May cause irreversible tissue damage to the eyes including blindness. Inhalation may severely irritate nose, throat and lungs. May cause skin irritation.
Steps if Released/Spilled	Flood with water to cool. Wear protective gear.

Source: FMC Corporation, 2007.

APPENDIX D

EMISSIONS ASSOCIATED WITH THE PROPOSED ACTION AND OTHER SPACE LAUNCH ACTIVITIES

TABLE OF CONTENTS

Section **Page**

Exhibit

ACRONYMS AND ABBREVIATIONS

Cl	chlorine
CO	carbon monoxide
CO_2	carbon dioxide
EDMS	Emissions and Dispersion Modeling System
FAA	Federal Aviation Administration
GTO	geosynchronous transfer orbit
H_2	molecular hydrogen
H_2O	water
H_2O_2	hydrogen peroxide
HC1	hydrogen chloride
HTP	kerosene/high test peroxide
HTPB	hydroxyl terminated polybutadiene
LH_2	liquid hydrogen
LOX	liquid oxygen
LTO	landing/takeoff
LV	launch vehicle
N_2	molecular nitrogen
N_2H_4	hydrazine
NO_x	nitrogen oxides
O_2	molecular oxygen
PEIS	Programmatic Environmental Impact Statement
PM	particulate matter
RV	reentry vehicle
SO_x	sulfur dioxide
UV	ultraviolet
VOC	volatile organic compound

APPENDIX D

EMISSIONS ASSOCIATED WITH THE PROPOSED ACTION AND OTHER SPACE LAUNCH ACTIVITIES

This appendix describes the methodology for determining per-launch/reentry emissions loads in various atmospheric layers. It identifies the emissions and associated afterburning products from various propellants that would be used in launch vehicles associated with the Proposed Action (see Chapter 2 for a description of the reusable suborbital rockets) and, for purposes of assessing cumulative impacts, emissions from other orbital reusable and expendable launch vehicles (other launch vehicles). The following sections describe the methodologies used to estimate emissions for both the Proposed Action and other launches. For the other Federal and non-Federal launch activities that could contribute to a cumulative impact, the Federal Aviation Administration (FAA) reviewed the findings of the *Final Programmatic Environmental Impact Statement for Horizontal Launch and Reentry of Reentry Vehicles* (FAA, 2005) and site-specific environmental documents and launch forecasts.

D.1 Methodology for Determining Emissions under the Proposed Action

The four principal layers in Earth's atmosphere are the troposphere, stratosphere, mesosphere, and ionosphere. These layers are generally defined by temperature, structure, density, composition, and degree of ionization. Exhibit D-1 lists the approximate altitude of these layers. The troposphere contains 75 percent of the total mass of Earth's atmosphere and is the turbulent region where weather occurs. The lower portion of the troposphere, within 3,000 feet of Earth's surface, is of concern for ground-level air quality because rocket emissions have the potential to increase the concentration of pollutants in the air or can increase the deposition of pollutants on Earth. The stratosphere contains the ozone layer that protects Earth's surface from ultraviolet (UV) radiation. Both the mesosphere and ionosphere contain sparse gaseous molecules, which decrease as altitude increases. The ionosphere also contains electrically charged particles. Because the lower troposphere and stratosphere are the layers of the atmosphere in which emissions from reusable suborbital rockets could have environmental impacts — the lower troposphere for ground-level air quality and the stratosphere when considering greenhouse gases and global climate change — this analysis focuses on those two layers of the atmosphere.

Exhibit D-1. Altitude Range for Various Atmospheric Layers

	Layer				
	Troposphere				
	Lower Troposphere	Upper Troposphere	Stratosphere	Mesosphere	Ionosphere
Altitude Range	Below 3,000 feet	3,000 feet to 6 miles	6 to 31 miles	31 to 53 miles	53 to 620 miles

Reusable suborbital rockets and other launch vehicles would be propelled through several layers of the atmosphere, including the troposphere, stratosphere, mesosphere, and ionosphere. The amount of emissions released in each atmospheric layer depends on the altitude the rocket engine and subsequent stages (if any) are fired, type of rocket engine, type of propellant, burn rate of propellant, and burn time in the atmospheric layer. In developing the following methodology, the FAA focused on the lower troposphere and the stratosphere, because these layers are most relevant to compliance with ambient air quality standards and to concerns about climate change.

The FAA estimated total emissions associated with the Proposed Action by completing the following steps:

1. Defining the likely types of rockets (concepts) and their flight profiles;
2. Estimating the annual number of launches and reentries that would occur by site;
3. Reviewing all the propellants that could be used and identifying a propellant by launch type (horizontal or vertical) and flight profile to calculate the emissions per launch;
4. Estimating the emissions per launch or reentry into each layer of the atmosphere for each type of vehicle; and
5. Multiplying the number of launches and reentries by the appropriate emissions per launch or reentry to estimate total emissions for the Proposed Action.

The discussion below provides further detail on each of these steps.

D.1.1 Emissions per Launch Associated with the Proposed Action

D.1.1.1 Rocket Concepts and Flight Profiles

This Programmatic Environmental Impact Statement (PEIS) considers two primary types (or concepts) of reusable suborbital rockets: rockets that take off horizontally and rockets that take off vertically. The FAA assumed a total of 1,000 launches as the maximum number of reusable suborbital rocket launches (400 horizontal and 600 vertical) that could occur from any one location. For the reusable suborbital rockets that take off horizontally, the FAA defined three flight profiles:

- H-1 vehicles would take off from a runway under jet power and would ignite their rocket engine(s) at an altitude of 20,000 feet or more, and reentry and landing would be powered by a jet engine.
- H-2 vehicles would take off from a runway under rocket power and would have an unpowered reentry and landing.
- H-3 vehicles would take off from a runway while mated to a jet-powered assist aircraft and would ignite rocket engines at an altitude of 20,000 feet or more after being released from the assist aircraft. H-3 vehicle reentry and landing would be unpowered.

D.1.1.2 Number of Launches

Of the 400 reusable suborbital rockets that would take off horizontally, using the forecasted flight profiles of the licensed horizontal launches (FAA, 2005), the breakdown by type of launch would be:

- 38 percent (150 launches) would be jet powered at takeoff and ignite the rocket engine at or above 20,000 feet. The FAA used a Lear Jet with two CJ610-6 jet engines to calculate jet engine emissions.
- 44 percent (180 launches) would be rocket powered from take off and would have an unpowered landing.
- 18 percent (70 launches) would use an assist aircraft powered by jet engines on take off that would release the suborbital rocket for rocket ignition at or above 20,000 feet. The FAA used an aircraft using two J-85-GE-5H engines with afterburners as the assist aircraft to calculate emissions.

For H-1 and H-3 vehicles, the FAA calculated the emissions generated by jet engines separately from rocket emissions, as described below.

For the reusable suborbital rockets that take off vertically, two flight profiles have been defined, as follows:

- V-1 vehicles would take off vertically, accelerate, and ascend to peak altitude; their reentry and landing would be unpowered.
- V-2 vehicles would take off vertically and hover within 3,000 feet of the ground surface; they would land under rocket power.

D.1.1.3 Identification of Likely Propellants

Because the exact mix of future reusable suborbital rocket types and characteristics cannot be known with certainty, the FAA developed "typical" reusable suborbital rockets for each flight profile discussed above. The FAA used the typical reusable suborbital rockets and their representative characteristics for purposes of the emissions analysis. The typical reusable suborbital rocket characteristics were developed from launch data (FAA, 2005), FAA forecasts of launch activity, and data on the X Prize Cup website at http://www.xprize.com. To assess the air quality impacts, the FAA reviewed the past and forecasted reusable suborbital rocket launches and identified the most likely propellants that would be used by flight profile. Exhibit D-2 provides a brief overview of each of the typical reusable suborbital rockets and its propellant.

Exhibit D-2. Overview of Launch and Reentry Vehicle Types

Vehicle Type	Rocket Propellant Type and Load* (pounds)	Notes
Horizontal		
H-1	(Liquid Oxygen (LOX)/Kerosene (8,122)	Jet engine for lift off; jet engine shut down at or above 20,000 feet; rocket engine ignited at or above 20,000 feet; jet engine started during descent; reentry powered by jet engines.
H-2	LOX/Kerosene (10,500)	Rocket engine ignited for lift off; no jet engine; rocket engine stops; unpowered reentry.
H-3	Solid (3,358)	Assist aircraft with jet engine for lift off; assist aircraft releases reusable suborbital rocket at or above 20,000 feet; rocket engine ignited at or above 20,000 feet; rocket engine stops; unpowered reentry. Assist aircraft returns to base under jet power.
Vertical		
V-1	LOX/Kerosene (11,023)	Rocket engine ignites and reusable suborbital rocket accelerates to termination of rocket thrust, ascends to apogee, and returns unpowered or powered to Earth.
V-2	LOX/Ethanol (2,205)	Rocket engine ignites and reusable suborbital rocket attains altitude less than 3,000 feet, performs spatial maneuvers, and lands under rocket power.

* Propellant load is based on previous licensed or permitted launch activities or is assumed to be 11,023 pounds.

For the known propellants that could be used in a reusable suborbital rocket, the FAA completed a mass balance equation (assuming complete combustion of the propellant). The assumption of complete stoichiometric combustion may underestimate potential emissions of products of incomplete combustion such as volatile organic compounds (VOCs). However, combustion would be essentially complete with the high temperatures and turbulent mixing that occur in the engine combustion chamber, nozzle, and exhaust plume, and thus potential emissions of incomplete combustion products are expected to be negligible. Also, potential emissions due to reactions of exhaust products with atmospheric gases are not calculated. Minor emissions of nitrogen oxides (NO_X) would be expected by this mechanism. However, data are not available to quantify emissions due to reactions of exhaust products with atmospheric gases.

D.1.1.4 Jet Engine Launch and Reentry Emissions

To estimate jet engine emissions per launch and reentry for H-1 and H-3 launch vehicles, the FAA used emission factors based on the types and number of jet engines that would be used. These factors express emissions as the mass of pollutant released per landing-takeoff (LTO) cycle (taxi/idle, takeoff, climbout to 3,000 feet altitude, descent starting at 3,000 feet altitude, approach, and landing) and were derived using the FAA's Emissions and Dispersion Modeling System (EDMS) software (FAA, EDMS, version 5.0.1, March 21, 2007, release). The FAA used a Lear Jet with two CJ610-6 jet engines for H-1 and an aircraft using two J-85-GE-5H engines with afterburners for H-3. Exhibit D-3 lists the emission factors, expressed as weight fractions of emissions per unit weight of jet fuel, for assist aircraft propellant types used with the reusable suborbital rockets being evaluated in this PEIS.

Exhibit D-3. Jet Engine Emission Factors for Applicable Vehicles[a]

Vehicle Type	Assist Aircraft and Engine	Mode	Time in Mode (minutes)	Fuel Rate per Engine (kilograms/ second)	Emission Factor per Engine (grams per kilogram of fuel)					
					CO_2	CO	NO_x	VOCs	SO_x	PM
H-1	Learjet – two CJ610-6 engines	Approach	1.60	0.129	2,908	88.00	0.0030	1.50	1.20	0.05
		Climbout	0.50	0.288	2,908	28.00	0.22	3.50	1.20	0.05
		Idle	13.00	0.064	2,908	155.00	19.70	0.90	1.20	0.05
		Takeoff	0.40	0.350	2,908	27.00	0.11	4.20	1.20	0.05
		Ascent[b]	5.50	0.288	2,908	28.00	0.22	3.50	1.20	0.05
		Descent[b]	11.73	0.129	2,908	88.00	0.0030	1.50	1.20	0.05
H-3	Aircraft – two J-85-GE-5H w/ afterburner engines	Approach	3.80	0.1349	2,908	93.67	3.33	2.86	1.20	0.05
		Climbout	0.90	0.2715	2,908	28.38	0.70	5.67	1.20	0.05
		Idle	19.20	0.0638	2,908	158.22	16.79	2.11	1.20	0.05
		Takeoff	0.40	1.0250	2,908	14.19	2.51	2.09	1.20	0.05
		Ascent[b]	9.90	0.2715	2,908	28.38	0.70	5.67	1.20	0.05
		Descent[b]	27.87	0.1349	2,908	93.67	3.33	2.86	1.20	0.05

[a] Sources:
Times in mode – FAA, EDMS, version 5.0.1, March 21, 2007, release. International Civil Aviation Organization default values as used in EDMS 5.0.1: "Civil Bizjet" (Learjet 25C aircraft type) for H-1 Reusable Launch Vehicle; "Military Trainer USAF" (T-38 aircraft type) for H-3 Reusable Launch Vehicle.
Fuel rates, CO, NO_x, and VOCs – FAA, Emissions and Dispersion Modeling System, version 5.0.1, March 21, 2007, release.
CO_2 – The CO_2 emission factor in lb CO_2 per pound fuel was calculated from the following values, converted to grams per kilogram (g/kg) fuel, and applied to the jet fuel flow rates taken from EDMS:

156.258	pound CO_2 per million British thermal unit (Btu) jet fuel	Source: U.S. Department of Energy, Energy Information Administration, *Table of Fuels and Energy Codes*. www.eia.doe.gov/oiaf/1605/coefficients.html
18,610	Btu per pound jet fuel	Source: Chevron Products Co., *Aviation Turbine Fuel Performance*, Table 2.1. 2000.

SO_X – SO_X emissions were calculated assuming 0.06 percent sulfur in fuel, per International Panel on Climate Change *Aviation and the Global Atmosphere*, Ch.7.8.1, 2001.
PM – PM emissions were calculated assuming 0.05 grams of particulate matter per kilogram, per European Environment Agency, *EMEP/CORINAIR Emission Inventory Guidebook - 3rd edition September 2003 UPDATE.* http://reports.eea.eu.int/EMEPCORINAIR4/en

[b] Above 3,000 feet altitude. Not included in LTO cycle. Times are extrapolated from EDMS time-in-mode data.

Exhibit D-4 lists the total emissions below 3,000 feet per LTO cycle for reusable suborbital rockets that use an assist aircraft (types H-1 and H-3). There would also be emissions from jet engines above 3,000 feet in the upper troposphere that are not part of the LTO cycle. The FAA assumed that the H-1 reusable suborbital rocket would use the jet engine for approximately 17 minutes operating above 3,000 feet, and the H-3 support aircraft approximately 38 minutes operating above 3,000 feet, based on the average climbout mode (ascent) and approach mode (descent) rates used for the LTO cycle in EDMS. The overall emissions estimates in this PEIS include these jet aircraft emissions in the upper troposphere.

Exhibit D-4. Jet Engine Emissions (pounds) per Landing/Takeoff Cycle for Applicable Vehicles Below 3,000 Feet

Vehicle Type	CO_2	CO	NO_x	VOCs	SO_x	PM
H-1	1,017.34	40.99	4.35	0.57	0.42	0.02
H-3	1,840.15	67.35	6.21	1.66	0.76	0.03

Source: FAA, EDMS, version 5.0.1, March 21, 2007, release.

D.1.1.5 Rocket Launch and Reentry Emissions

To estimate rocket emissions per launch for each reusable suborbital rocket, the FAA estimated the propellant consumed in each atmospheric layer and then multiplied these estimates by propellant-specific emissions weight fractions for each pollutant. The FAA estimated the propellant consumed in each atmospheric layer for each vehicle type using available data on the total propellant used by that vehicle type and the percentage of time spent in each atmospheric layer based on the vehicle flight profile. Where vehicle-specific data were not available, the FAA used data for a similar vehicle.

Based on other permitted launches of reusable suborbital rockets, the FAA used 3 minutes as a representative total time of rocket engine operation, during which all the propellant would be consumed. For all reusable suborbital rockets that ignite the rocket engine at ground surface and do not hover, Exhibit D-5 lists the assumed time that the rocket engine would be operating within each layer of the atmosphere.

Exhibit D-5. Duration of Engine Operation for Reusable Suborbital Rocket by Atmospheric Layer

Layer of Atmosphere	Duration
Troposphere – 0 to 3,000 feet	15 seconds
Troposphere – 3,000 feet to 6 miles	45 seconds
Stratosphere – 6 to 31 miles	60 seconds
Mesosphere – 31 to 53 miles	50 seconds
Ionosphere – 53 to 620 miles	Remaining time – 10 seconds
Total rocket engine operating time	180 seconds (3 minutes)

Exhibit D-6 lists the propellant type and estimated propellant consumption in each atmospheric layer for each representative vehicle type.

Exhibit D-6. Estimated Rocket Propellant Consumption by Atmospheric Layer

Vehicle Type	Propellant Type	Rocket Propellant Consumption (pounds per launch)				
		Below 3,000 Feet	Upper Troposphere	Stratosphere	Mesosphere	Ionosphere
H-1	LOX/Kerosene	-	952	7,132	-	-
H-2	LOX/Kerosene	1,312	1,312	5,688	2,187	-
H-3	Solid	-	-	3,351	-	-
V-1	LOX/Kerosene	917	2,750	3,667	3,056	612
V-2	LOX/Ethanol	2,200	-	-	-	-

Exhibit D-7 lists the emission factors, expressed as weight fractions of emissions per unit weight of propellant, for the three rocket propellant types used in the reusable suborbital rockets being evaluated in this PEIS. Exhibit D-8 lists the estimated emissions per launch (from both rockets and jet engines) for each vehicle; the emissions data includes both launch and reentry emissions.

D.1.2 Emissions from All Launches for the Proposed Action

Exhibits D-9 through D-13 list the annual launch and reentry emissions to the atmosphere below 3,000 feet, the upper troposphere, the stratosphere, the mesosphere, and the ionosphere, respectively, associated with the Proposed Action. Exhibit D-9 corresponds to Exhibit 4-3 and Exhibit D-11 corresponds to Exhibit 4-6. Exhibit D-14 lists the total emissions, including both jet engine and rocket emissions, to all layers of the atmosphere for each vehicle type included in this analysis. Emissions to the atmosphere below 3,000 feet are given here because ground-level ambient air quality is affected by emissions up to 3,000 feet above ground surface. Emissions to the stratosphere are given because emissions to the stratosphere are of concern for climate change. As discussed in Chapter 4 of this PEIS, emissions to the ionosphere are considered negligible because the emissions would be both short lived and occur relatively infrequently.

D.2 Methodology for Determining Cumulative Impacts

To assess the cumulative impacts of the Proposed Action and launch related activities other than the Proposed Action, the FAA collected the emissions associated with other launch and reentry activities from the *Final Programmatic Environmental Impact Statement for Horizontal Launch and Reentry of Reentry Vehicles* (FAA, 2005). The following paragraphs summarize the information presented in that document, which reviewed all launches from 2005 through 2015. For purposes of assessing cumulative impacts, this PEIS considers only launches that would occur in the 2009 to 2014 study period.

D.2.1 Overall Cumulative Emissions

First, the FAA identified all Federal and non-Federal launch activities by their weight class; see Exhibit D-15. Next, the FAA identified the number of launches and reentries by year for each category. Exhibit D-16 lists the number of FAA-licensed horizontal and vertical launches, and the launches of U.S. and foreign governments and foreign commercial enterprises from 2005 to 2015. Exhibit D-17 lists the corresponding numbers of reentries.

Exhibits D-18 and D-19 list the total emissions associated with FAA-licensed horizontal and vertical launches, and the launches of U.S. and foreign governments and foreign commercial enterprises from 2005 to 2015 in the lower troposphere and the stratosphere, respectively.

Exhibit D-7. Emissions Weight Fractions by Propellant[b] (pounds emitted per pound of propellant)

Propellant[c]	Cl	CO[d]	CO_2	H_2	HCl	H_2O	N_2	NO_X	PM[e]	SO_X	VOCs	O_2
Propane/70% Hydrogen Peroxide (H_2O_2)	0.00	0.00	0.09	0.15	0.00	0.76	0.00	0.00	0.00	0.00	0.00	0.00
RP-1 or JP-5/ 70% H_2O_2	0.00	0.05	0.22	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00
Ethanol or other alcohol/LOX	0.00	0.48	0.03	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.00
Isopropanol/LOX	0.00	0.00	0.65	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00
Methanol/50% H_2O_2	0.00	0.01	0.18	0.00	0.00	0.81	0.00	0.00	0.00	0.00	0.00	0.00
Kerosene/High Test Peroxide (HTP)	0.00	0.05	0.22	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00
Hydrocarbon X (proprietary)/ Inhibited White Fuming Nitric Acid	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RP-1 or Kerosene or Jet A/LOX	0.00	0.20	0.49	0.0042	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00
Propane/LOX	0.00	0.00	0.65	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00
Methane/LOX	0.00	0.00	0.55	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00
Liquid hydrogen (LH_2)/LOX	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00
Hydroxyl terminated polybutadiene (HTPB) rubber/ Nitrous Oxide	0.00	0.20	0.04	0.00	0.00	0.22	0.54	0.00	0.00	0.00	0.00	0.00
Plexiglass (Ethyl Methacrylate)/ Nitrous Oxide	0.00	0.00	0.35	0.00	0.00	0.11	0.54	0.00	0.00	0.00	0.00	0.00

Exhibit D-7. Emissions Weight Fractions by Propellant[b] (pounds emitted per pound of propellant) (continued)

Propellant[c]	Cl	CO[d]	CO_2	H_2	HCl	H_2O	N_2	NO_X	PM[e]	SO_X	VOCs	O_2
Solid Rocket Propellant (68% Ammonium Perchlorate + 18% Aluminum + 14% HTPB)	0.0015	0.00[f]	0.46[f]	0.00	0.21	0.27	0.000	0.0033	0.38	0.00	0.00	0.00
Hydrazine (N_2H_4) monopropellant	0.0000	0.00	0.00	0.125	0.00	0.00	0.875	0.0000	0.00	0.00	0.00	0.00
H_2O_2 monopropellant[g]	0.0000	0.00	0.00	0.00	0.00	0.52	0.000	0.0000	0.00	0.00	0.00	0.46

[a] Sources: FAA, 2001; FAA, 2002.

[b] Except as noted, emissions weight fractions assume complete stoichiometric combustion using a mass balance approach. The assumption of complete stoichiometric combustion may underestimate potential emissions of products of incomplete combustion such as VOCs. However, combustion would be essentially complete with the high temperatures and turbulent mixing that occur in the engine combustion chamber, nozzle, and exhaust plume, and thus potential emissions of incomplete combustion products are expected to be negligible. The calculations assume: (1) oxygen first oxidizes hydrogen completely to form H_2O, (2) the remaining oxygen then forms CO and CO_2, (3) water in dilute hydrogen peroxide passes through combustion as an inert ingredient, (4) due to the heat and turbulence of the emissions, all CO that would be emitted is assumed to oxidize into CO_2, and (5) potential emissions due to reactions of exhaust products with atmospheric gases are not calculated. Minor emissions of NO_x would be expected by this mechanism. However, data are not available to quantify mass emissions due to reactions of exhaust products with atmospheric gases.

[c] Assumes all propellants are pure mixtures.

[d] In the troposphere, all CO emissions are assumed to oxidize to CO_2 in the hot and turbulent emissions cloud.

[e] PM as aluminum oxides (Al_2O_3).

[f] In the mesosphere where oxidation is less likely to occur the weight fractions at the exhaust nozzle are 0.23 for CO and 0.03 for CO_2.

[g] Assuming the H_2O_2 monopropellant is 98 percent (2 percent H_2O) and that the decomposition reaction goes to completion, there will be emissions of steam (hot H_2O) and O_2 with approximate weight fractions of 0.54 and 0.46, respectively.

Exhibit D-8. Total Emissions per Launch of a Reusable Suborbital Rocket by Vehicle Type, Including Jet Engine Emissions (pounds per launch)

Vehicle Type	CO_2	CO	H2	H_2O	N_2	NO_X	VOCs	SO_X	PM	Cl	HCl
H-1	6,178	1,684	34.02	2,430	-	1.60	4.35	0.91	0.03	-	-
H-2	5,145	2,100	44.10	3,150	-	-	-	-	-	-	-
H-3	4,421	158	14.10	739	1,813	5.10	6.21	1.78	0.04	5.04	705
V-1	5,401	2,205	46.30	3,307	-	-	-	-	-	-	-
V-2	66.15	1,058	-	1,058	-	-	-	-	-	-	-

Exhibit D-9. Estimated Annual Emissions Loads Below 3,000 Feet under the Proposed Action[a] (Reusable Suborbital Rocket Flights)

Vehicle Type	No. of Launches	Tons/Year										
		CO	CO_2	H_2	H_2O	N_2	NO_X	VOCs	SO_X	PM	Cl	HCl
Horizontal 1 except Spaceport America	450	9.22	228.90	0.00	0.00	0.00	0.13	0.98	0.09	0.00	0.00	0.00
Horizontal 2 except Spaceport America	540	70.88	173.64	1.49	106.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Horizontal 3 except Spaceport America	210	7.07	193.22	0.00	0.00	0.00	0.17	0.65	0.08	0.00	0.00	0.00
All Horizontal Launches at Spaceport America[b]	757	13.48	2,945.55	n.c.[c]	0.00	n.c.	13.85	2.10	1.37	1.53	0.05	0.00
Vertical 1 at all sites[d]	1,606	137.79	437.88	n.c.	206.68	n.c.	5.10	0.00	0.00	7.18	0.05	3.97
Vertical 2 (hover) at all sites[e]	2,110	1,111.32	114.15	n.c.	1,111.32	n.c.	0.00	0.00	0.00	0.00	0.00	0.00
Totals	**5,682**	**1,349.76**	**4,093.34**	**1.49**	**1,424.32**	**0.00**	**19.25**	**3.73**	**1.55**	**8.72**	**0.05**	**3.97**

[a] Values of less than 0.005 ton are shown as 0.00.
[b] The Spaceport America FEIS did not report emissions by individual horizontal rocket types.
[c] n.c. = Not calculated in Spaceport America FEIS.
[d] Includes vehicle types designated V-1 and V-2 in Spaceport America FEIS, which are equivalent to Vertical 1.
[e] Includes vehicle type designated V-3 in Spaceport America FEIS, which is equivalent to Vertical 2.

Exhibit D-10. Estimated Annual Emissions Loads in the Upper Troposphere under the Proposed Action (Reusable Suborbital Rocket Flights) (pounds per year)

Vehicle Type	No. of Launches	CO	CO_2	H_2	H_2O	N_2	NO_X	VOCs	SO_X	PM	Cl	HCl
H-1 except Spaceport America	450	96,333	746,305	1,801	128,647	0	465	0	221	5	0	0
H-2 except Spaceport America	540	141,750	347,288	2,977	212,625	0	0	0	0	0	0	0
H-3 except Spaceport America	210	11,900	520,781	0	0	0	722	0	215	2	0	0
V-1 except Spaceport America	1,500	992,080	2,430,597	20,834	1,488,120	0	0	0	0	0	0	0
V-2 except Spaceport America	2,100	0	0	0	0	0	0	0	0	0	0	0
All launches at Spaceport America[a]	882	n.c.[b]	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.	48,420	356	25,760
Totals	**5,682**	**1,242,064**	**4,044,971**	**25,611**	**1,829,393**	**0**	**1,187**	**0**	**436**	**48,427**	**356**	**25,760**

[a] The Spaceport America FEIS (Exhibit 4.6-12) calculated emissions to the upper troposphere only for PM (as Al_2O_3), Cl, and HCl, and only for vehicle type V-1.
[b] n.c. = Not calculated in Spaceport America FEIS.

Exhibit D-11. Estimated Annual Emissions Loads in the Stratosphere under the Proposed Action[a] (Reusable Suborbital Rocket Flights) (pounds per year)

Vehicle Type	No. of Launches	CO	CO_2	H_2	H_2O	N_2	NO_X	VOCs	SO_X	PM	Cl	HCl
Horizontal 1 except Spaceport America	450	643,235	1,575,926	13,508	964,853	0	0	0	0	0	0	0
Horizontal 2 except Spaceport America	540	614,250	1,504,913	12,899	921,375	0	0	0	0	0	0	0
Horizontal 3 except Spaceport America	210	7,051	21,153	2,961	155,123	380,756	0	0	0	0	1,058	148,072
All Horizontal Launches at Spaceport America[b]	757	244,000	588,000	n.c.[c]	n.c.	n.c.	220	n.c.	n.c.	26,200	100	14,600
Vertical 1 at all sites[d]	1,605	1,102,311	3,357,803	n.c.	1,653,467	n.c.	3,400	0	0	4,780	40	2,640
Vertical 2 (hover) at all sites[e]	2,110	0	197,380	n.c.	0	n.c.	0	0	0	0	0	0
Totals	**5,682**	**2,610,848**	**7,245,175**	**52,517**	**3,694,818**	**380,756**	**3,620**	**0**	**0**	**30,980**	**1,198**	**165,312**

[a] Values of less than 0.005 ton are shown as 0.00.
[b] The Spaceport America FEIS did not report emissions by individual horizontal rocket types.
[c] n.c. = Not calculated in Spaceport America FEIS.
[d] Includes vehicle types designated V-1 and V-2 in Spaceport America FEIS, which are equivalent to Vertical 1.
[e] Includes vehicle type designated V-3 in Spaceport America FEIS, which is equivalent to Vertical 2.

Exhibit D-12. Estimated Annual Emissions Loads in the Mesosphere under the Proposed Action (Reusable Suborbital Rocket Flights) (pounds per year)

Vehicle Type	No. of Launches	CO	CO_2	H_2	H_2O	N_2	NO_X	VOCs	SO_X	PM	Cl	HCl
H-1 except Spaceport America	450	0	0	0	0	0	0	0	0	0	0	0
H-2 except Spaceport America	540	236,250	578,813	4,961	354,375	0	0	0	0	0	0	0
H-3 except Spaceport America	210	0	0	0	0	0	0	0	0	0	0	0
V-1 except Spaceport America	1,500	918,593	2,250,553	19,290	1,377,889	0	0	0	0	0	0	0
V-2 except Spaceport America	2,100	0	0	0	0	0	0	0	0	0	0	0
All launches at Spaceport America*	882	0	0	0	0	0	0	0	0	0	0	0
Totals	**5,682**	**1,154,843**	**2,829,365**	**24,252**	**1,732,264**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

* The Spaceport America FEIS estimates that launches from Spaceport America will have no emissions to the mesosphere.

Exhibit D-13. Estimated Annual Emissions Loads in the Ionosphere (Reusable Suborbital Rocket Flights) (pounds per year)

Vehicle Type	No. of Launches	CO	CO_2	H_2	H_2O	N_2	NO_X	VOCs	SO_X	PM	Cl	HCl
H-1 except Spaceport America	450	0	0	0	0	0	0	0	0	0	0	0
H-2 except Spaceport America	540	0	0	0	0	0	0	0	0	0	0	0
H-3 except Spaceport America	210	0	0	0	0	0	0	0	0	0	0	0
V-1 except Spaceport America	1,500	183,719	450,111	3,858	275,578	0	0	0	0	0	0	0
V-2 except Spaceport America	2,100	0	0	0	0	0	0	0	0	0	0	0
All launches at Spaceport America*	882	0	0	0	0	0	0	0	0	0	0	0
Totals	**5,682**	**183,719**	**450,111**	**3,858**	**275,578**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

* The Spaceport America FEIS estimates that launches from Spaceport America will have no emissions to the ionosphere.

Exhibit D-14. Estimated Total Annual Emissions Loads to All Layers of the Atmosphere[a] (Reusable Suborbital Rocket Flights) (tons per year)

Vehicle Type	No. of Launches	CO	CO_2	H_2	H_2O	N_2	NO_X	VOCs	SO_X	PM	Cl	HCl
H-1 except Spaceport America	450	379.01	1,390.02	7.65	546.75	0.00	0.36	0.98	0.21	0.01	0.00	0.00
H-2 except Spaceport America	540	567.00	1,389.15	11.91	850.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
H-3 except Spaceport America	210	16.55	464.18	1.48	77.56	190.38	0.54	0.65	0.19	0.00	0.53	74.04
All Horizontal Launches at Spaceport America[b]	757	135.48	3,239.55	7.30	188.00	n.c.[c]	13.96	n.c.	n.c.	14.63	0.05	0.00
Vertical 1 at all sites[d]	1,605	1,653.47	4,479.86	53.39	2,639.39	n.c.	6.80	n.c.	n.c.	33.78	0.25	0.00
Vertical 2 (hover) at all sites[e]	2,110	1,111.32	212.84	0.00	1,163.68	n.c.	0.00	n.c.	n.c.	0.00	0.00	0.00
Totals	**5,682**	**3,862.82**	**11,175.60**	**81.74**	**5,465.88**	**190.38**	**21.66**	**1.63**	**0.39**	**48.42**	**0.83**	**74.04**

[a] Values of less than 0.005 ton are shown as 0.00.
[b] The Spaceport America FEIS did not report emissions by individual horizontal rocket types.
[c] n.c. = Not calculated in Spaceport America FEIS.
[d] Includes vehicle types designated V-1 and V-2 in Spaceport America FEIS, which are equivalent to Vertical 1.
[e] Includes vehicle type designated V-3 in Spaceport America FEIS, which is equivalent to Vertical 2.

Exhibit D-15. Payload Weight Classes

Weight Class	Suborbital or Orbital Mass
Other*	Suborbital – 270 kilograms (594 pounds)
Small	Orbital – <2,000 pounds to Geosynchronous Transfer Orbit (GTO) or <5,000 pounds to low earth orbit (LEO)
Medium	Orbital – 2,000-3,999 pounds GTO or 5,000-15,000 pounds LEO
Intermediate	Orbital – 4,000-8,999 pounds GTO or >15,000 pounds LEO
Heavy	Orbital – 9,000-10,000+ pounds GTO

*All FAA-licensed horizontally launched launch vehicles are considered suborbital and are included in this weight class.

Exhibit D-16. Horizontal and Vertical Launch Totals by Maximum Payload Capacity[a,b]

Category	Payload Capacity	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
U.S. Commercial (FAA Licensed)	Other/Sub-orbital	19	51	103	128	129	161	150	152	154	158	165
	Small	2	1	2	2	1	2	2	2	2	2	2
	Medium	2	2	2	1	2	1	1	2	1	1	2
	Intermediate	0	0	0	0	0	0	0	0	0	0	0
	Heavy	7	6	7	7	6	6	7	6	6	6	7
U.S. Government	Other/Sub-orbital	22	30	25	20	24	24	26	24	22	24	22
	Small	2	3	2	4	2	3	2	2	2	2	2
	Medium	10	9	8	9	9	9	9	9	9	9	9
	Intermediate	0	0	0	0	0	0	0	0	0	0	0
	Heavy	14	13	12	13	14	14	13	9	10	9	10
Foreign Government	Other/Sub-orbital	8	15	12	8	10	8	15	10	8	8	15
	Small	3	3	5	2	2	2	3	2	3	2	3
	Medium	13	18	17	14	15	15	14	15	15	14	15
	Intermediate	2	1	2	1	2	1	2	1	2	1	2
	Heavy	7	6	9	8	7	7	9	8	7	7	7
Foreign Commercial	Other/Sub-orbital	2	0	2	0	1	3	4	6	8	10	12
	Small	2	4	3	2	1	2	2	3	3	3	4
	Medium	2	3	1	1	2	1	1	1	1	1	1
	Intermediate	1	0	0	0	0	0	0	0	0	0	0
	Heavy	11	10	12	13	13	13	15	15	15	15	14
Total 2005-2015 Launches = 2,647		**129**	**175**	**224**	**233**	**240**	**272**	**275**	**267**	**268**	**272**	**292**
Total Launches for 2009 to 2014 study period = 1,594												

[a] Source: FAA, 2005, Exhibit 5-2.

[b] Based on vehicle full payload capacity, not estimated payload(s) mass. Most commercial vehicles are no longer in Intermediate class. Foreign and U.S. Government suborbital estimates based on vehicles similar to criteria for an FAA-licensed launch.

Exhibit D-17. Total Orbital Reentries[a,b]

Category	Reentry	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
U.S. Commercial (Licensed)	Horizontal	0	0	0	0	1	1	2	5	7	9	12
	Vertical	0	0	0	0	0	1	2	2	3	3	3
U.S. Government	Horizontal	3	4	4	4	4	0	0	0	0	0	0
	Vertical	0	1	0	0	0	0	1	2	2	4	4
Foreign Government	Horizontal	0	0	0	0	0	0	0	0	0	0	0
	Vertical	4	5	5	4	4	5	4	5	4	5	4
Foreign Commercial	Horizontal	0	0	0	0	0	0	0	0	0	0	0
	Vertical	0	0	0	0	0	0	1	2	2	3	3
Totals		**7**	**10**	**9**	**8**	**9**	**7**	**10**	**16**	**18**	**24**	**26**

[a] Source: FAA, 2005, Exhibit 5-3.
[b] Capsule and/or parachute landings were counted as Vertical reentry. Vertical also includes International Space Station cargo return. Reentries were only counted for vehicles that land substantially intact. Suborbital launches and subsequent reentries are not included.

Exhibit D-18. Summary of Emissions Loads from Launch Vehicles and Reentry Vehicles to the Troposphere from 2005 to 2015[a,b] [metric tons (tons)]

Launch/Reentry Type		HCl	PM	CO_2	H_2O	Cl	NO_X	CO	SO_X
Proposed Action		-	8 (8.8)	999 (1,099)	428 (471)	-	0.8 (0.9)	70 (77)	0.2 (0.22)
Federal and Non-Federal Activities	U.S. Licensed Vertical	1,884 (2,071)	3,410 (3,750)	11,171 (12,288)	4,308 (4,740)	17 (19)	30 (33)	1 (1.1)	<0.01 (<0.02)
	U.S. Government	3,359 (3,694)	6,079 (6,687)	7,592 (8,351)	53,006 (58,306)	24 (26)	53 (58.3)	0.2 (0.22)	-
	Foreign Commercial	873 (960)	1,568 (1,724)	10,584 (11,642)	7,072 (7,779)	8 (8.8)	11,516 (12,667)	0.2 (.22)	-
	Foreign Government	2,937 (3,230)	5,308 (5,838)	11,874 (13,061)	7,296 (8,025)	22 (24)	6,506 (7,156)	0.1 (0.1)	-
	Totals	**9,053 (9,958)**	**16,365 (18,001)**	**41,220 (45,342)**	**71,696 (78,865)**	**72 (79)**	**18,105 (19,915)**	**2 (2.2)**	**<0.01 (<0.02)**
Totals All Launches		**9,053 (9,958)**	**16,373 (18,010)**	**42,219 (46,440)**	**72,124 (79,336)**	**72 (79)**	**18,106 (19,915)**	**72 (79)**	**0.2 (0.22)**

[a] Source: FAA, 2005, Exhibit 5-4.
[b] All values rounded.

Exhibit D-19. Summary of Emissions Loads from Launch Vehicles and Reentry Vehicles to the Stratosphere from 2005 to 2015[a,b] [metric tons (tons)]

Launch/Reentry Type		HCl	PM	CO_2	H_2O	Cl	NO_X	CO	SO_X
Proposed Action		39 (43)	71 (78)	2,049 (2,253)	1,316 (1,447)	0.3 (0.33)	0.6 (0.66)	860 (946)	0.2 (0.22)
Federal and Non-Federal Activities	U.S. Licensed Vertical	1,884 (2,072)	3,410 (3,751)	11,385 (12,523)	4,365 (4,801)	17 (19)	30 (33)	1 (1.1)	0.01 (0.01)
	U.S. Government	3,359 (3,694)	6,079 (6,686)	8,290 (9,119)	53,188 (58,506)	24 (26)	53 (58)	-	-
	Foreign Commercial	873 (960)	1,568 (1,724)	10,712 (11,783)	7,100 (7,810)	8 (9)	11,516 (12,667)	-	-
	Foreign Government	2,937 (3,231)	5,308 (5,838)	12,185 (13,404)	7,351 (8,086)	22 (24)	6,506 (7,157)	-	-
	Totals	**9,054 (9,959)**	**16,365 (18,002)**	**42,571 (46,828)**	**72,004 (79,204)**	**72 (79)**	**18,105 (19,916)**	**1 (1.1)**	-
Totals All Launches		**9,093 (10,002)**	**16,436 (18,080)**	**44,620 (49,082)**	**73,320 (80,652)**	**72 (79)**	**18,106 (19,916)**	**861 (946)**	**0.2 (0.22)**

[a] Source: FAA, 2005, Exhibit 5-5.
[b] All values rounded.

Exhibit D-20 lists the total estimated emissions (under the Proposed Action and from other Federal and non-Federal launch and reentry activities) in the troposphere for the 2009 to 2014 study period. Exhibit D-21 lists the total estimated emissions (from the Proposed Action and from other Federal and non-Federal launch and reentry activities) in the stratosphere for the 2009 to 2014 study period. Exhibit D-20 corresponds to Exhibit 4-14 and Exhibit D-21 corresponds to Exhibit 4-15. The FAA estimated the portion of these emissions associated with the Proposed Action, as described above.

The FAA calculated the remaining emissions (*i.e.*, FAA-licensed launches, U.S. Government launches, and foreign commercial and government launches) by adjusting the total launch and reentry emissions for 2005 to 2015 by the proportion of total launches forecasted for 2009 to 2014. As listed in Exhibit D-16, the total number of launches for 2005 to 2015 is 2,647, and the number of launches forecasted for 2009 to 2014 is 1,594. Thus, the proportion of total launches forecasted for the 2009-2014 study period is 60.2 percent (a rounded value). The FAA calculated the emissions shown for other launch and reentry activities by taking 60.2 percent of the total emissions shown in Exhibit D-18 for the lower troposphere and Exhibit D-19 for the stratosphere.

D.2.2 Site-Specific Cumulative Emissions

For the site-specific cumulative impacts analysis, the FAA reviewed projected launch data for each site that might allow the permitted launch of a reusable suborbital rocket (Exhibit 4-17). The FAA identified the annual average number of launches by vehicle type. For the Pegasus XL, only the LTO emissions of the L-1011, which is used to carry the Pegasus XL for an air drop launch, contribute to ground-level emissions. For the Minotaur, a four-stage rocket built with the initial two stages of a Minuteman intercontinental ballistic missile and a Pegasus as the final stages, the FAA assumed that all of the initial stage emissions would occur in the troposphere. The analysis of site-specific cumulative impacts is presented in Section 4.10 of this PEIS.

Exhibit D-20. Summary of Emissions Loads to the Lower Troposphere Below 3,000 Feet from 2009 to 2014 (tons)

Launch/ Reentry Type	Cl	CO	CO_2	HCl	H_2O	NO_X	PM	SO_X	VOCs
Proposed Action	0.30	8,099.00	24,560.00	23.82	8,546.00	115.53	52.33	9.29	22.35
Other Launches and Reentries[a]	47.57	48.04	27,967.00	5,997.00	47,776.00	11,993.00	10,845.00	0.13	Not calcu-lated
Non-Launch Emissions at Spaceport America[b]	0.00	417.82	33,500.70	0.00	Not calc.	176.03	171.52	7.84	46.53
Totals (rounded)	**47.87**	**8,564.43**	**86,027.93**	**6,020.44**	**56,321.83**	**12,284.20**	**11,069.31**	**17.26**	**68.88**

[a] Source: FAA 2005, Exhibits 5-2 and 5-4. Other Launches and Reentries also include an additional 300 launches of V-1 suborbital reusable launch vehicles at Mojave Air and Space Port that are not part of the Proposed Action.

[b] Source: FAA 2008, Exhibit 4.6-8.

Exhibit D-21. Summary of Emissions Loads to the Stratosphere from 2009 to 2014 (tons)

Launch/ Reentry Type	Cl	CO	CO_2	HCl	H_2O	NO_X	PM	SO_X	VOCs
Proposed Action	3.59	7,833.00	21,736.00	495.94	11,084	10.86	92.94	0.00	0.0
Other Launches and Reentries*	47.57	570.00	29,557.00	6,023.00	48,568	11,993.00	10,888.00	0.13	Not calcu-lated
Total Emissions – Proposed Action Plus All Cumulative Impact Sources (values rounded)	**51.17**	**8,402.67**	**51,293.54**	**6,519.08**	**59,653.02**	**12,004.10**	**10,980.56**	**0.13**	**0.0**

* Source: FAA 2005, Exhibit 5-2. Also includes an additional 300 launches of V-1 suborbital reusable launch vehicles formerly forecasted for Mojave Air and Space Port.

D.3 REFERENCES

Chevron Products Co. 2000. *Aviation Turbine Fuel Performance*, Table 2.1.

FAA (Federal Aviation Administration). 2001. *Programmatic Environmental Impact Statement for Licensing Launches. Appendix A.*

FAA (Federal Aviation Administration). 2002. *Final Environmental Assessment for the Site, Launch, Reentry, and Recovery Operations at the Kistler Launch Facility, Nevada Test Site (NTS).*

FAA (Federal Aviation Administration). 2005. *Final Programmatic Environmental Impact Statement for Horizontal Launch and Reentry of Reentry Vehicle*s.

FAA (Federal Aviation Administration). 2008. *Final Environmental Impact Statement for the Spaceport America Commercial Launch Site, Sierra County, New Mexico*.

FAA (Federal Aviation Administration). EDMS, version 5.0.1, March 21, 2007, release.

USDOE (U.S. Department of Energy). 2008. Energy Information Administration, *Table of Fuels and Energy Codes*. www.eia.doe.gov/oiaf/1605/coefficients.html (accessed in December 2008).

APPENDIX E

COMMENTS RECEIVED ON THE DRAFT PEIS AND FAA RESPONSES

APPENDIX E

COMMENTS RECEIVED ON THE DRAFT PEIS AND FAA RESPONSES

E.1 Comments and Responses

In accordance with NEPA and the implementing regulations of CEQ (40 CFR 1500-1508) the FAA initiated a public review and comment period for the Draft PEIS for Streamlining the Processing of Experimental Permit Applications. Sixteen comment documents were received during the Draft PEIS comment period. Comments received from cooperating agencies and from other lines of business within the FAA are not included in this appendix, but were addressed in the Final PEIS where appropriate.

Several of the comment documents contained a comment on more than one issue. Therefore, in this section of the appendix, the FAA has reproduced the full text of each comment document as provided by the commenter. No changes were made to the comment document to correct for grammatical or spelling errors. Specific comments within each comment document have been identified to allow for a specific response by the FAA.

Exhibit E-1 provides a summary of the comment documents received during the comment period for the Draft PEIS. Comment documents appear in the order the comment documents are listed in this exhibit, which is in the order received. FAA's response to comments in a given comment document are presented following the comment document. Individual comments are denoted by a dash and the comment number, i.e., 1-01 is the first comment within comment document 1.

Exhibit E-1
Summary of the Comment Documents Received on the Draft Environmental Impact Statement

Letter Number	Name	Organization	Comment Method	Date Authored
1	Robert L. Brooks	Oklahoma Archeological Survey	Mail	4/7/2009
2	Gayle J. Rosander	State of California – Department of Transportation	Mail	4/15/2009
3	George H. Badger, III	Commonwealth of Virginia - Marine Resources Commission	Fax	4/16/2009
4	Sal Cuccarese	Alaska Aerospace Corporation	Email	4/16/2009
5	Wally Murphy	United States Fish and Wildlife Service – New Mexico Ecological Services Field Office	Mail	4/23/2009
6	Melvena Heisch	Oklahoma Historical Society – State Historic Preservation Office	Mail	5/1/2009
7	John Baker	County of Santa Barbara, California	Fax	5/6/2009
8	Deborah S. Coles	Brevard County, Florida - Natural Resources Management Office	Email	5/7/2009
9	Georgia Cleverley	New Mexico Environment Department	Mail	5/13/2009
10	Ellie L. Irons	Commonwealth of Virginia - Department of Environmental Quality	Mail	5/14/2009
11	Carolyn Heitman	Citizen	Email	5/20/2009
12	Jan Zimmerman	California Regional Water Quality Control Board – Lahontan Region	Fax	5/21/2009
13	Dave Singleton	State of California – Native American Heritage Commission	Mail	5/21/2009
14	Susan Bromm	United States Environmental Protection Agency – Office of Federal Activities	Email	5/26/2009
15	Michael Gustin	State of New Mexico – Department of Game & Fish	Fax	5/26/2009
16	Willie R. Taylor	Department of the Interior – Office of Environmental Policy and Compliance	Mail	6/3/2009

Comment Letter: 1

Oklahoma Archeological Survey

THE UNIVERSITY OF OKLAHOMA

April 7, 2009

Stacy M. Zee
Environmental Specialist
Federal Aviation Agency
FAA Experimental Permits PEIS
c/o ICF International
9300 Lee Highway
Fairfax, VA 22031

Re: *Daft Programmatic Environmental Impact Statement for Streamlining The Processing of Experimental Permit Applications.*

Dear Ms. Zee:

1 I have completed a review and analysis of the above referenced action. As duly noted on page 18, there are no previously recorded archaeological sites for the Oklahoma spaceport. There have been a number of surveys conducted for a variety if agencies at the Burns Flat facility with negative findings. The setting is also not one that would be particularly conducive to the presence of prehistoric cultural resources. Thus, activities at the Oklahoma spaceport would not bring about potential effects to archaeological resources. **However, I will defer opinion on the historic resources of the old Burn Flat airfield and potential effect to the State Historic Preservation Office.**

This review has been conducted in cooperation with the State Historic Preservation Office, Oklahoma Historical Society.

Sincerely,

Robert L. Brooks
State Archaeologist

Cc: SHPO

111 E. Chesapeake, Room 102, Norman, Oklahoma 73019-5111 PHONE: (405) 325-7211 FAX: (405) 325-7604
A UNIT OF ARTS AND SCIENCES SERVING THE PEOPLE OF OKLAHOMA

Response to Comment Letter 1:

1-01
Thank you for your comment.

Comment Number: 2

STATE OF CALIFORNIA—BUSINESS, TRANSPORTATION AND HOUSING AGENCY ARNOLD SCHWARZENEGGER, Governor

DEPARTMENT OF TRANSPORTATION
District 9
500 South Main Street
Bishop, CA 93514
PHONE (760) 872-0785
FAX (760) 872-0754
TTY 711 (760) 872-0785

Flex your power!
Be energy efficient!

April 15, 2009

Stacey M. Zee, Environmental Specialist
Federal Aviation Administration Experimental Permits
c/o ICF International
9300 Lee Highway
Fairfax, Virginia 22031

File: 09-FED
DPEIS
SCH #: none

Dear Ms. Zee:

Streamlining Experimental Permit Applications – Draft Programmatic Environmental Impact Statement (DPEIS)

The California Department of Transportation (Caltrans) District 9 appreciates the opportunity to comment on the DPEIS for streamlining the Experimental Permit Process. Previously we have commented upon documents for the Mojave Space Port Launch License, Mojave Specific Plan, and East Kern Airport Runway Extension projects, which are referenced in the DPEIS.

We have the following comments related to the DPEIS:

1 • Since a safety and environmental review would be required for each individual permit application (page ES-1), it is during that review phase that our previous comments regarding State Highway impacts would need to be addressed. Please contact me at Caltrans using the address above to review future Mojave Air and Space Port experimental permit applications.

2 • The portrayal of State Highways on Exhibit 3-15 is incorrect. See the enclosure for the current State Highway routes.

We value a cooperative working relationship with your agency concerning surface transportation issues. You may call me at (760) 872-0785 with any questions.

Sincerely,

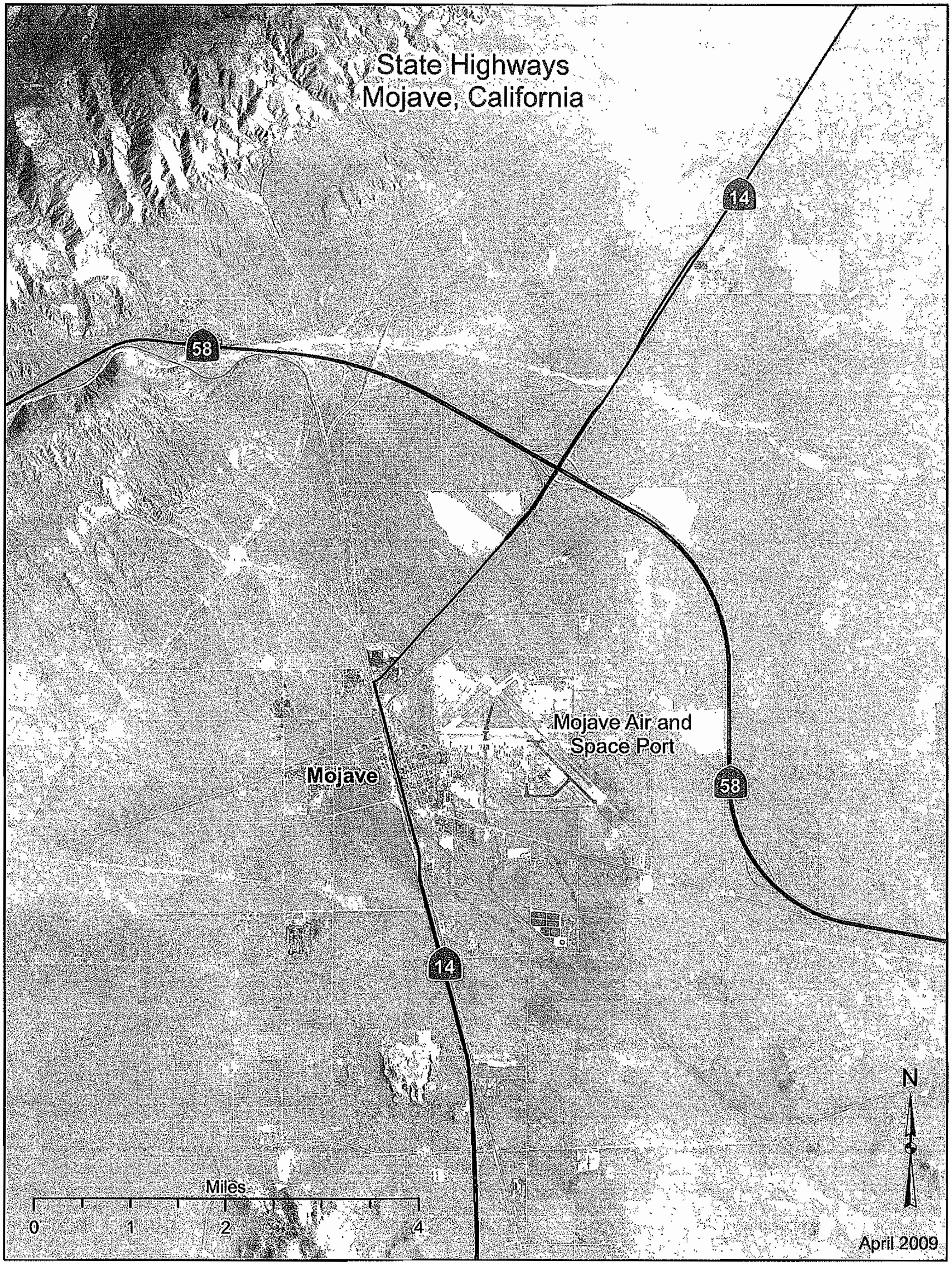
Gayle J. Rosander

GAYLE J. ROSANDER
IGR/CEQA Coordinator

Enclosure

c: Sandy Hesnard, Caltrans Aeronautics
Steve Wisniewski, Caltrans D-9

"Caltrans improves mobility across California"


State Highways
Mojave, California
14
58
Mojave Air and
Space Port
Mojave
58
14
N
Miles
0
1
2
4
April 2009

Response to Comment Letter 2:

2-01
Thank you for your comment, which has been noted for future reference. Site-specific safety and environmental impacts would be addressed during the individual experimental permit application process. At that time, consultation with all relevant agencies would be conducted.

2-02
Exhibit 3-15 has been revised as suggested by the commenter.

Comment Number: 3

COMMONWEALTH *of* VIRGINIA

L. Preston Bryant, Jr.
Secretary of Natural Resources

Marine Resources Commission
2600 Washington Avenue
Third Floor
Newport News, Virginia 23607

Steven G. Bowman
Commissioner

April 14, 2009

Ms. Stacey M. Zee, FAA Environmental Specialist
FAA Experimental Permits PEIS
c/o ICF International
9300 Lee Highway
Fairfax, Virginia 22031

Re: Experimental Permits

Dear Ms. Zee:

You have inquired regarding streamlining the processing of experimental permit applications for the launch and/or reentry of reusable suborbital rockets from the Mid-Atlantic Regional Spaceport (MARS) on Wallops Island, Virginia. The Marine Resources Commission requires a permit for any activities that encroach upon or over, or take use of materials from the beds of the bays, ocean, rivers and streams, or creeks which are the property of the
1 Commonwealth.

Based upon my review of the "Draft Programmatic Environmental Impact Statement for Streamlining the Processing of the Experimental Permit Applications", it would appear that your project will not be in the Commission's jurisdiction, therefore, no authorization would be required from the Marine Resources Commission. If, however, any portion of the reusable suborbital rockets or trash from the launch fall in the Atlantic Ocean within three miles of the coast of Virginia a permit may be required.

If I may be of further assistance, please do not hesitate to contact me at (757) 414-0710.

Sincerely,

George H. Badger, III
Environmental Engineer

An Agency of the Natural Resources Secretariat
Web Address: www.mrc.virginia.gov
Telephone (757) 247-2200 (757) 247-2292 V/TDD Information and Emergency Hotline 1-800-541-4646 V/TDD

Response to Comment Letter 3:

3-01
Thank you for your comment. As part of the environmental review process for experimental permit applications, the FAA would consult with applicants regarding the need for applicable state and federal permits, including those issued by the Marine Resources Commission.

Comment Letter: 4

Stacey:

Please find attached AADC's comments on the Draft Experimental Permits EIS. If you have any questions, please let me know.

Hope all is well,
Sal.

Sal Cuccarese
Chief of Staff & Director Lands and Environment
AADC
4300 B Street, Suite 101
Anchorage, AK 99504
Phone (907)-561-3338
FAX (907) 561-3339

4/16/2009

ALASKA AEROSPACE DEVELOPMENT CORPORATION

AADC Inputs
To
Draft Programmatic EIS
For
Streamlining the Processing
Of
Experimental Permit Applications

	PAGE NUMBER	PARAGRAPH	COMMENT
1	ES-6	Proposed Action column, 2nd paragraph, 2nd sentence, beginning "Disposition of rocket emissions".	This statement is overly negative given the long experience with monitoring rocket launch effects. Add the sentence from the next page (ES-7) Water Quality category, beginning " However, monitoring … has not shown long term effects", which places the comment in proper perspective.
2	ES-8	Proposed Action column, 2nd paragraph, 3rd sentence beginning "Activities under a experimental permit could affect".	Insert the phrase "could potentially have short term, negligible" between the words "could" and "affect".
3	ES-10	Proposed Action column, 2nd paragraph, 2nd sentence.	Apply the comment for ES-8 above.
4	ES-12	Proposed Action column, 2nd sentence, beginning "Activities under an experimental permit".	Insert the phrase "potentially result in short term, negligible disturbance to" between the words "could' and "affect". Our monitoring to date has shown NO affects to pinnipeds from our operations.
5	2-10	Section 2.1.2.3, KLC, 2nd sentence is not clear.	Replace the entire sentence with "The Alaska Aerospace Development Corporation, which was established by the Alaska State Legislature, owns and operates KLC."
6	2-10 thru 2-12	Exhibits 2-11 thru 2-16, cell labels 1 thru 3	These tables need links back to Exhibit 2-6 for clarity; as presented it is not readily clear what the referenced numbers refer to.
7	3-31	Exhibit 3-8	VABF also has marine mammal harassmen permits from NOAA for pinnipeds
8	3-12	List of whales	All of the species present at KLC are also present off of VABF. Further, all great whales, save for the grey, are listed species,

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			and all coastal launch ranges have whales offshore. NOAA recognizes there are no affects to whales from rocket operations anywhere since sound decouples at the air-sea interface. The list should be deleted.
9	3-49	1st paragraph, 1st sentence, last word.	The correct spelling is "Chiniak".
10	3-49	1st paragraph, 2nd sentence.	This sentence, while true, should be deleted since the area in question is more than 50 miles away on the other side of Kodiak. The area is up range from KLC and could in no way be affected by our operations. Keeping the sentence in implies the contrary.
11	4-35	Section 4.4.2.2, 2nd sentence is wrong.	Monitoring of basic water chemistry at KLC has shown that our operations have not had ANY effect on water chemistry. Replace the words "a long term effect" with "any effects".
12	4-35	Section 4.4.2.3, 1st sentence, reference to whales.	Whales cannot possibly be affected by launch operations for the reasons stated previously. Again, this is accepted by NOAA. Delete the reference to whales or explain the new research supporting the claim and make sure it is included in the discussions for all other coastal rocket ranges.
13	4-35	4.4.2.3, last sentence.	This statement is generic to all existing and proposed ranges and must either be included in all discussions or deleted. Having it here implies that KLC has potential issues our competitors do not, and that is not true. In fact, KLC has by far the fewest issues of any range.
14	4-36	Subsection labeled Steller Sea Lions, last paragraph, last sentence.	Replace the last sentence with "It was determined that launches of up to 9 Castor 120 motors per year would have negligible impact on marine mammal stocks. Since the experimental rockets that are subject to this EIS are orders of magnitude smaller than the Castor 120, their operation from KLC would not adversely affect Steller Sea Lions.
15	4-36	Subsection labeled Short-tailed Albatross	All reference to the species should be deleted. The existing narrative notes correctly that there have been no sightings of the species near KLC, but does not explain the reality that the species is pelagic

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		over deep water when seasonally present in Alaska. Its occurrence at KLC would be a remarkable and exceedingly rare and unusual event.

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Response to Comment Letter 4:

4-01
The FAA has amended the discussion of potential biological resource impacts at KLC to add a sentence to Exhibit ES-4 stating that monitoring has not shown long-term effects. The FAA cannot add this same statement to Exhibit ES-3 as it summarizes the general environmental impacts that could occur under the Proposed Action.

4-02
The summary of potential biological resource impacts at California Spaceport is based on the analysis presented in Section 4.2.2 of the PEIS. Should the FAA receive an application for an experimental permit that proposes to launch from the California Spaceport, the FAA would further define the level of impact based on the activities proposed by the applicant. The FAA would also coordinate with the USAF in determining if there is a need to further consult with the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service based on the proposed activity.

4-03
The summary of potential biological resource impacts at KSC is based on the analysis presented in Section 4.3.2 of the PEIS. Should the FAA receive an application for an experimental permit that proposes to launch from the Shuttle Landing Facility at the John F. Kennedy Space Center, the FAA would further define the level of impact based on the activities proposed by the applicant. The FAA would also coordinate with NASA in determining if there is a need to further consult with the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service based on the proposed activity.

4-04
The summary of potential biological resource impacts at KLC is based on the analysis presented in Section 4.4.2 of the PEIS. Should the FAA receive an application for an experimental permit that proposes to launch from the KLC, the FAA would further define the level of impact based on the activities proposed by the applicant. The FAA would also coordinate with the Alaska Aerospace Corporation in determining if there is a need to further consult with the U.S. Fish and Wildlife Service and/or the National Marine Fisheries Service based on the proposed activity. FAA cannot at this stage of the NEPA process make a determination as to the effects on species from the higher level of launch activity analyzed in the PEIS (up to 600 annual launches).

4-05
Section 2.1.2.3 has been edited for clarity as suggested by the commenter.

4-06
The FAA has added a link back to the descriptions of Horizontal 1, Horizontal 2, etc found in Exhibit 2-6 in each of the launch site sections in Chapter 2.

4-07
The FAA has added information to the discussion in Section 4.2.2.2 of potential impacts to pinnipeds from launches at California Spaceport. The additional information covers monitoring of Pacific harbor seals during pupping season and monitoring of all pinnipeds for impacts from sonic booms.

4-08
The FAA has amended Exhibit 3-8 to include all listed species in the vicinity of the California Spaceport, including marine mammals. A new paragraph has also been added to Section 4.2.2.3 describing potential impacts to whales in the vicinity of the California Spaceport.

4-09
The FAA has corrected the spelling of Chiniak in Section 3.4.2.

4-10
The FAA has revised Section 3.4.2 to remove reference to the Steller sea lion habitat on the western side of Kodiak Island.

4-11
The FAA has amended Section 4.4.2.2 to note that monitoring of water quality conducted by the Alaska Aerospace Corporation after launches at KLC has indicated that it does not appear that launches are having any measurable impact on local surface water quality.

4-12
The FAA has not consulted with NOAA on the potential impacts to whales of up to 600 launches at KLC. As stated in Section 4.4.2.3, if the FAA receives an application for an experimental permit that proposes to launch from KLC, the FAA would coordinate with the Alaska Aerospace Corporation on the need to consult with NOAA. Potential impacts to whales and other protected species would be included in any environmental document that tiers from this PEIS.

4-13
The sentence on determining the need for further consultation with U.S. Fish and Wildlife Service and the National Marine Fisheries Service appears for each launch site that has threatened or endangered species potentially present. The statement is not included for Oklahoma Spaceport because there are no known federally protected species or habitat at the site. The purpose of including the statement is to indicate that the FAA will determine the need for further consultation with the appropriate agencies if it receives an application for an experimental permit at a particular site. Any future consultation and any identified impacts would be described in the subsequent NEPA document that tiers from this PEIS.

4-14
FAA has amended Section 4.4.2.3 to indicate the type of rocket motor. However, the potential impacts to Steller sea lions from a potential 600 annual launches under the experimental permit program have not been determined at this time. The FAA is unable to directly relate impacts from 9 launches of a larger rocket to those associated with up to 600 launches under the experimental permit program. Thus, the FAA would follow the process outlined in the introductory paragraph of Section 4.4.2.3 by considering the need for further consultation with U.S. Fish and Wildlife Service and the National Marine Fisheries Service if FAA receives an application for an experimental permit to launch from KLC.

4-15
The subsection on short-tail albatrosses is included in this PEIS in Section 4.4.2.3 to illustrate that FAA has considered potential impacts to the species since they could be present in nearshore waters. The subsection states that no individuals were sighted during biological monitoring and that FAA would expect no impacts to the species.

Comment Letter: 5

United States Department of the Interior

FISH AND WILDLIFE SERVICE
New Mexico Ecological Services Field Office
2105 Osuna NE
Albuquerque, New Mexico 87113
Phone: (505) 346-2525 Fax: (505) 346-2542

April 23, 2009

Cons. # 22420-2009-FA-0047

Ms. Stacey M. Zee
FAA Environmental Specialist
FAA Experimental Permits PEIS
c/o ICF International
9300 Lee Highway
Fairfax, Virginia 22031

Dear Ms. Zee:

This letter is in response to your request for review and comments for the Programmatic Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications (Draft PEIS). Under the Proposed Action, the Federal Aviation Administration (FAA) would issue experimental permits for the launch and reentry of reusable suborbital rockets from both FAA-licensed and non-licensed launch sites using the Draft PEIS as the basis for determining the environmental consequences of issuing the permits. The information and analyses provided in the PEIS would be used to facilitate the preparation of environmental documents for the issuance of experimental permits to individual rocket operators. An experimental permit would authorize the operation of a reusable suborbital rocket and the activities directly associated with its operation, including pre-flight activities; takeoff, flight (including reentry), and landing activities; and post flight activities.

The FAA analyzed seven launch sites in the Draft PEIS. The U.S. Fish and Wildlife Service (Service) has reviewed the Draft PEIS and has the following specific comments concerning the Spaceport America, Sierra County, New Mexico.

<u>Wildlife</u>

1 Noise and visual disturbance from various proposed activities may adversely impact wildlife. Human presence and activity (additional vehicular traffic, etc.) during launches would likely result in disturbance, and a slightly increased probability of mortality to some wildlife species. It is unlikely to affect wildlife diversity within the area. Daily launches would be expected. Displacement of birds and wildlife as a result of the pre-flight activities; takeoff, flight (including reentry), and landing activities; and post flight activities should be addressed in the PEIS. Noise and human presence are potential activities that could impact wildlife and birds at the proposed Spaceport America. Noise levels in pre-flight activities; takeoff, flight (including reentry), and landing activities; and post flight activities could be high; some displacement of small mammals

Ms. Stacey M. Zee 2

and birds would be expected. This displacement would likely be permanent for some species and temporary for others.

Migratory Birds and Small Mammals

2 Concerning Migratory Bird Treaty Act (MBTA), the Draft PEIS did not indicate that the proposed activities would remove vegetation. If vegetation removal took place during the migratory bird nesting season (April 1 through August 31) removal and destruction of active nests could constitute "take" as defined in the MBTA. Migratory birds use the Spaceport America Area and may be impacted by various proposed activities. The Draft PEIS did not indicate that, to the extent possible, active bird nests would be relocated during pre-flight activities; takeoff, flight (including reentry), and landing activities; and post flight activities or avoided until the young birds fledge from the nest. Pre-flight activities; takeoff, flight (including reentry), and landing activities; and post flight activities during the migratory bird nesting season should be avoided where possible. The destruction of migratory bird nests with birds or eggs is prohibited as is the possession of said nests. Nest relocations would require Federal and state permits (i.e. nest relocation, temporary possession); training of field personnel on addressing active versus inactive nests; and reports may be required by the permit. Therefore, the Service recommends that presence/absence surveys and nest occupancy be conducted prior to pre-flight activities; takeoff, flight (including reentry), and landing activities; and post flight activities during the breeding season.

Federally Listed Species

There are ten federally listed or candidate species that have the potential to occur within Sierra and Doña Ana Counties, New Mexico. However, nine of these species or their habitats do not exist within the proposed Project Area. Therefore, impacts to those nine listed species and their habitat are not applicable or discussed further in this review.

Northern Aplomado Falcon

3 The proposed project is located within historic habitat of the northern aplomado falcon (falcon) (*Falco femoralis septentrionalis*) which was listed as an endangered species on February 25, 1986 (51 FR 6686). On July 26, 2006 (71 FR 42298) the reintroduced falcon population was designated as "nonessential experimental" and does not require land managers to specifically manage for reintroduced falcons. When nonessential experimental populations are located outside a National Wildlife Refuge or in a unit of the National Park System, the Service treats the population as proposed for listing and only two provisions of the Endangered Species Act apply: section 7(a)1 and section 7(a)4. Section 7(a)1 requires Federal agencies to use their authorities to further the conservation of listed species. Section 7(a)4 requires Federal agencies to confer (rather than consult) with the Service on actions that are likely to jeopardize the continued existence of a proposed species. The results of a conference are advisory in nature and do not restrict agencies from carrying out, funding, or authorizing activities.

Ms. Stacey M. Zee 3

The falcons prefer habitat that includes expansive grasslands with nearby perches (trees). Small open grassland areas observed at the proposed project site are marginally suitable for the falcons although continued efforts to increase grasslands and reduce shrub coverage would likely improve habitat suitability.

The Service recommends the following:

General Recommendations

1. To the extent possible, relocate active bird nests and avoid nests with young fledglings prior to pre-flight activities; takeoff, flight (including reentry), and landing activities; and post flight activities.

2. Obtain all proper Federal and state permits required for nest relocations (i.e. nest relocation, temporary possession).

3. Train field personnel on addressing active versus inactive nests; and reporting requirements.

4

4. Pre-flight activities; takeoff, flight (including reentry), and landing activities; and post flight activities during the migratory bird breeding season (April 1 – August 31) should be avoided where possible.

5. Presence/absence migratory bird surveys and nest occupancy should be conducted prior to pre-flight activities; takeoff, flight (including reentry), and landing activities; and post flight activities during the breeding season. Surveys would be conducted to ensure that pre-flight activities; takeoff, flight (including reentry), and landing activities; and post flight activities that occur before September 1 would not harm nesting migratory birds, and those activities that extend into the following breeding season, an additional migratory bird nest survey should be completed.

Species Specific Recommendations

Aplomado falcon

1. Conduct land use and management activities to maintain the quality of grasslands within areas of suitable topography that provide sufficient prey for the falcon.

5

2. Minimize disturbance and fragmentation of falcon habitat.

3. Restore and maintain natural grassland communities and prevent encroachment of brush species (such as creosote bush, mesquite, tarbush).

Ms. Stacey M. Zee 4

4. That the FAA confer (rather than consult) with the Service under section 7(a) 4 of the Endangered Species Act, as amended. The results of a conference would be advisory in nature and not restrict the FAA from carrying out, funding, or authorizing activities

Thank you for your concern for threatened and endangered species and New Mexico's wildlife habitats. We appreciate the analyses provided in the Draft PEIS and your efforts to protect fish and wildlife species. In future communication regarding this project please refer to Consultation #22420-2009-FA-0047. If you have any questions, please contact Santiago Gonzales of my staff at the letterhead address or at (505) 761-4720.

Sincerely,

Wally Murphy
Field Supervisor

cc:
Director, New Mexico Department of Game and Fish, Santa Fe, New Mexico
Director, New Mexico Energy, Minerals, and Natural Resources Department, Forestry Division, Santa Fe, New Mexico

Response to Comment Letter 5:

5-01
Some minor, short-term impacts to wildlife in the vicinity of Spaceport America may result from launch operations, including disturbance of wildlife through noise generated by launch activities and additional vehicular traffic (see Section 4.1.2.1 of the Draft PEIS). In the Record of Decision for the *Final EIS for the Spaceport America Commercial Launch Site, Sierra County, New Mexico,* FAA agreed that the following mitigation measures would be considered, as deemed necessary and appropriate, in order to mitigate impacts to wildlife:

- Enhancement of off-site desert grassland habitats, primarily through mesquite/creosote brush control to increase herbaceous growth, to replace those grassland habitats made un-usable or inaccessible by Spaceport America construction and/or operation; and
- Monitoring of wildlife populations within and/or near the project area to examine for potential shifts in density and diversity.

5-02
As launch activities at Spaceport America would be conducted over existing concrete pads, no vegetation removal is anticipated during launch operations (see Section 4.2.9.1 of the Draft PEIS). In the Record of Decision for the *Final EIS for the Spaceport America Commercial Launch Site, Sierra County, New Mexico,* FAA agreed that the following mitigation measure would be implemented to minimize impacts to migratory birds:

- Conducting surveys for nesting migratory birds prior to construction, resulting in avoidance and/or relocation of active nests to the extent possible, as permitted (Migratory Bird Treaty Act).

Should the FAA receive an application for an experimental permit that proposes to launch from Spaceport America, the FAA would coordinate with the New Mexico Spaceport Authority in determining if there is a need to further consult with the U.S. Fish and Wildlife Service regarding migratory birds based on any new activities proposed by the applicant. If potential impacts are identified, the FAA would consult with the Service to develop any mitigation measures that may be warranted, as described in Chapter 5 of the PEIS.

5-03
Marginal habitat for the northern aplomado falcon is present in the vicinity of Spaceport America. However, as noted in comments submitted by the New Mexico Ecological Services Field Office on the *Draft EIS for the Spaceport America Commercial Launch Site, Sierra County, New Mexico,* species-specific surveys conducted in 2006 and 2007 did not detect any falcons around Spaceport America. The mitigation measures mentioned in the response to comment 5-01 could contribute to an increase in grasslands and in the event that falcons do begin to colonize the area around the spaceport, FAA would be required to confer with U.S. Fish and Wildlife Service regarding potential impacts to the falcon.

5-04
See second part of response to comment 5-02.

5-05
Should the FAA receive an application for an experimental permit that proposes to launch from Spaceport America, the FAA would coordinate with the New Mexico Spaceport Authority in determining if there is a need to further confer with the U.S. Fish and Wildlife Service regarding the northern aplomado falcon based on any new activities proposed by the applicant. If potential impacts are identified, the FAA would confer with the Service to develop any mitigation measures that may be warranted, as described in Chapter 5 of the PEIS.

Comment Letter: 6

Oklahoma Historical Society *Founded May 27, 1893*

State Historic Preservation Office

Oklahoma History Center • 2401 North Laird Ave. • Oklahoma City, OK 73105-7914

(405) 521-6249 • Fax (405) 522-0816 • www.okhistory.org/shpo/shpom.htm

May 1, 2009

Ms. Stacey M. Zee
FAA Experimental Permits PEIS
C/O ICF International
9300 Lee Highway,
Fairfax, Virginia 22031

RE: File #1248-09; FAA Proposed PEIS for Streamlining Permits in Oklahoma

Dear Ms. Zee:

1 We have received and reviewed the documentation concerning the referenced project in Oklahoma. Additionally, we have examined the information contained in the Oklahoma Landmarks Inventory (OLI) files and other materials on historic resources available in our office. We find that there are no historic properties affected by the referenced project.

Thank you for the opportunity to comment on this project. We look forward to working with you in the future.

If you have any questions, please contact Charles Wallis, RPA, Historical Archaeologist, at 405/521-6381.

Should further correspondence pertaining to this project be necessary, the above underlined file number must be referenced. Thank you.

Sincerely,

Melvena Heisch
Deputy State Historic
Preservation Officer

MH:jr

Response to Comment Letter 6:

6-01
Thank you for your comment.

Comment Number: 7

COUNTY OF SANTA BARBARA

Michael F. Brown
County Executive Officer

EXECUTIVE OFFICE

105 East Anapamu Street, Suite 406
Santa Barbara, California 93101
805/568-3400 • Fax 805/568-3414
www.co.santa-barbara.ca.us

May 5, 2009

Ms. Stacy M. Zee, FAA Environmental Specialist
Planning and Environmental Services Department
ICF International
9300 Lee Highway
Fairfax, VA 22031

FAX: 703-934-3951
EMAIL: PEIS-Experimental-Permits@icfi.com

RE: Draft PEIS for Streamlining the Processing of Experimental Permit Applications

Dear Ms. Zee:

Thank you for the opportunity to comment on the draft Programmatic Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications. At this time, the County is submitting the following comments for your consideration:

1 Health and Safety (Section 3.2.6) & Land Use (Section 4.2.7):
The draft PEIS states that the approval of experimental rocket launches may result in additional closures of County roads and facilities such as Jalama Beach, Pt. Sal State Beach, and Ocean Beach. Throughout the emergence of the local rocket launch program, the County has enjoyed a productive working relationship with the United States Air Force. This relationship has been able to foster the continued growth of the local aerospace industry while still maintaining a high level of accessibility for County residents to the various public facilities located in the Vandenberg area. The County looks forward to extending this relationship to the Federal Aviation Administration. Hopefully, the FAA, USAF, and Santa Barbara County can continue to work productively with one another to maintain a balance which encourages the scientific and commercial proliferation of the local aerospace industry while being sensitive to the health, safety, and recreational needs of County residents.

John Baker
Assistant County Executive Officer
jbaker@co.santa-barbara.ca.us

Terri-Maus-Nisich
Assistant County Executive Officer
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Susan Paul
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Jason Stilwell
Assistant County Executive Officer
jstil@co.santa-barbara.ca.us

Ms. Stacy M. Zee, FAA Environmental Specialist
May 5, 2009
Page 2 of 2

The County has no further comments on this project at this time and looks forward to continued dialogue on future projects. If you should have further questions, please do not hesitate to contact my office directly, or David Matson, Deputy Director in the Office of Long Range Planning at (805) 568-2068.

Sincerely,

John Baker
Assistant County Executive Officer/Planning Director

cc: Derek Johnson, Director, Office of Long Range Planning
David Matson, Deputy Director, Office of Long Range Planning

Response to Comment Letter 7:

7-01
Thank you for your comment. The FAA looks forward to contributing to the productive working relationship between Santa Barbara County and the USAF.

Comment Letter: 8

BREVARD County
BOARD OF COUNTY COMMISSIONERS
FLORIDA'S SPACE COAST

NATURAL RESOURCES MANAGEMENT OFFICE
2725 Judge Fran Jamieson Way, Building A-219, Viera, FL 32940

May 7, 2009

Michael McElligott
Manager, Space Systems Development Division
Office of the Assoc. Administrator for Commercial Space Transportation
800 Independence Ave. S.W.
Washington, DC 20591

RE: FAA Draft Programmatic Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications -April 2009

Dear Mr. McElligott:

Thanks for letting us take a look at your draft PEIS. We have some recommendations and items that need attention in the report as listed below:

- **Section 1.5.3.1, Line 1** – Brevard County believes this should read- "If an applicant proposes to launch from a site not evaluated in this PEIS and not requiring infrastructure
1 development, the FAA could develop...." and "If an applicant proposes to launch from a site not evaluated in this PEIS and requiring infrastructure development or redevelopment, the FAA will develop an EA or EIS."

- **Exhibit 3-10. State and Federally Protected Species Possibly Present at KSC** – The
2 table lists the Gopher tortoise as a Species of Special Concern. The Gopher tortoise is currently listed as Threatened by the State of Florida.

- **Section 3.3.7, Paragraph 5 -** "In Brevard County, the no-development zone extends from the mean high water level inland 75 feet." It is unclear where the 75' reference came from. If the Authors are referencing the Coastal Construction Control Line, which is used to regulate construction along the Atlantic Coast within Brevard County, they
3 need to refer to Chapter 62B-33 F.A.C., which defines the Coastal Construction Control Line as "Coastal Construction Control Line" (CCCL) or "Control Line" is the line established pursuant to the provisions of Section 161.053, F.S., and recorded in the official records of the county, which defines that portion of the beach-dune system subject to severe fluctuations based on a 100-year storm surge, storm waves, or other

Main Line (321) 633-2016 • Remediation & Compliance (321) 633-2017 • Stormwater (321) 633-2014
Fax (321) 633-2029 •natres.brevardcounty.us

predictable weather conditions". This site gives contact information: http://www.dep.state.fl.us/beaches/programs/ccclprog.htm

- This site gives pertinent information on the CCCL. http://www.dep.state.fl.us/beaches/data/pdf/cccl-faq.pdf

- Brevard County has ordinances regarding construction along the Atlantic Coast. http://www.brevardcounty.us/environmental_permitting/documents/ARTICLEXIICoastalConstruction091107.pdf

- Construction along Brevard County's unincorporated lagoon frontage (Banana and Indian River Lagoon) is regulated differently. http://www.brevardcounty.us/environmental_permitting/documents/ARTICLEXDIVISION3SurfaceWaterProtectionrevised01-08.pdf

4

- **Section 3.8.7, Paragraph 5** – Same comment as Section 3.3.7.

5

- **Section 3.8.12, Paragraph 1, Line 4** – Please insert "on LC-46" in reference to surficial groundwater flows. Surficial groundwater flow direction varies across CCAFS.

6

- **Section 4.1.2.1** – "Some launch areas at non-licensed sites could consist of unmanaged vegetative terrestrial or aquatic vegetation". Both NASA and CCAFS actively manage coastal and scrub habitat on their properties for the benefit of listed species found within coastal or scrub habitat. Wetland areas are not as actively managed, but do exist within management units on these properties. Therefore, short term impacts to these fragile systems could lead to long term recovery periods and the potential for loss of this habitat to invasive exotic species. It is recommended that these areas be monitored for invasive species after launch activities and any invasive exotics found eradicated from site.

7

- **Section 4.1.7.1, Paragraph 2** – If a non-licensed site is proposed, as allowed under Section 1.5.3.1, long term loss to coastal resources may occur as a result of vegetative changes due to scarring and invasive exotic regrowth.

8

- **Section 4.1.13, Line 2** – If an applicant proposes use of a non-licensed area, wetland resources will be restored to native habitat and monitored for a period of no less than five years for recovery of native habitat characteristics.

9

- **Section 4.3.13, Line 2** – Same as Section 4.1.13, Line 2

10

- **Section 4.3.2.3, Bird Species** – Least Tern nesting on bare areas such as lime rock base within the proposed launch site should be evaluated prior to issuance of permits.

11

- **Section 4.3.2.3, Amphibian and Reptile Species** – Usage of non-paved areas within the SLF should be evaluated for the presence of Gopher tortoises prior to issuance of permits. Although no long term species impacts would occur with the program, individuals may be lost through burrow collapse or launch activities. It is recommended that any

2

Individuals found within the proposed launch area are temporarily excluded from the launch site until completion of all launch activities.

12 • It is recommended that launch personnel be made aware of the Indigo snake to prevent unintentional take.

13 • **Section 4.8.2.3, Bird Species** – Same as Section 4.3.2.3, Bird Species.

14 • **Section 4.8.2.3, Mammal Species** – LC-46 is located directly behind primary dunes along the Atlantic Ocean. The Southeastern Beach mouse is found within this area on CCAFS. It is recommended that all launch activities be kept away from the primary dune line and that launch personnel be kept off the primary dune line.

15 • **Section 4.8.2.3, Amphibian and Reptile Species** – Same as Section 4.3.2.3, Amphibian and Reptile Species.

16 • **Appendix A.** – Application should list the specific launch sites described within this document. JFK Space Center, SLF and CCAFS, LC-46.

Thanks for the copy, looking forward to the final report.

Regards,

Deborah S Coles

Deborah S Coles
Program Manager

File: Draft PEIS May 09.docx

3

Response to Comment Letter 8:

8-01
For each application for an experimental permit, the FAA would use the environmental checklist contained in Appendix A of this PEIS to determine the appropriate level of NEPA documentation required. The checklist states that if the applicant proposes on-site construction activities, an EA would be prepared at a minimum. Section 1.5 explains that any proposed construction activities would be addressed in separate site-specific environmental documentation.

8-02
The FAA has revised Exhibit 3-10 and Exhibit 3-22 to reflect this change.

8-03
Section 3.3.7 has been revised to include the current no-development zone along Florida's beaches. According to Chapter 62B-33 of Florida's Administrative Code, the "Fifty-foot Setback" or "Setback Line" is "the line of jurisdiction established pursuant to the provisions of Section 161.052, F.S., in which construction is prohibited within 50 feet of the line of mean high water at any riparian coastal location fronting the Gulf of Mexico or the Atlantic coast shoreline."

8-04
Section 3.8.7 has been revised to include the current no-development zone along Florida's beaches. According to Chapter 62B-33 of Florida's Administrative Code, the "Fifty-foot Setback" or "Setback Line" is "the line of jurisdiction established pursuant to the provisions of Section 161.052, F.S., in which construction is prohibited within 50 feet of the line of mean high water at any riparian coastal location fronting the Gulf of Mexico or the Atlantic coast shoreline."

8-05
The FAA has amended Section 3.8.12.2 to add LC-46 to the sentence on surficial groundwater flows.

8-06
Specific mitigation measures to address site-specific impacts would be developed through consultation with NASA and CCAFS and with the appropriate federal and state agencies. As explained in Chapter 5 of the PEIS, the FAA would consult with the appropriate agencies and develop site-specific measures based on the parameters of the FAA-permitted activity.

8-07
The FAA would consider potential impacts to coastal resources at a non-licensed site in a subsequent EA or EIS that tiers from this PEIS.

8-08
Specific mitigation measures to address site-specific impacts would be developed through consultation with the appropriate federal and state agencies. As explained in Chapter 5 of

the PEIS, the FAA would consult with the appropriate agencies and develop site-specific measures based on the parameters of the FAA-permitted activity.

8-09
See response to comment 8-08 above.

8-10
Should the FAA receive an application for an experimental permit that proposes to launch from KSC, the FAA would coordinate with NASA regarding any need to further consult with appropriate State agencies regarding the least tern. If potential impacts are identified, the FAA would consult with the appropriate agencies to develop any mitigation measures that may be warranted.

In September of 2008, the FAA completed the *Environmental Assessment for Space Florida Launch Site Operator License at Launch Complex-46.* In this document, the FAA concluded that impacts to nesting terns would not be anticipated. The EA states: "Individual launches may disturb or startle a few individual scrub jays due to excessive noise and vibration levels. These impacts would be temporary (less than one minute), occur approximately twice per month, and would be limited to individual birds close to the launch site during launch activities. The behavior of scrub jays observed after Delta, Atlas, and Titan launches has been normal, which suggests limited noise-related effects. Impacts on scrub-jay habitat are not anticipated. Space Florida would conduct all activities in accordance with the Scrub jay Management Plan for CCAFS. Impacts on piping plovers and least terns would be similar." Section 4.3.2.3 has been revised to include a discussion of impacts to the least tern.

8-11
As explained in Chapter 5 of the PEIS, the FAA has not developed site-specific mitigation measures for the level of launch activity analyzed in this PEIS. However, launch operators would be expected to implement mitigation measures consistent with those employed by the eight launch facilities addressed in this PEIS, when launching from those sites. The FAA has added to the discussion of protected species and habitat for each launch site to indicate that if potential impacts are identified in subsequent environmental review, the FAA would consult with the appropriate agencies to develop any mitigation measures that may be warranted. Potential mitigation involving evaluating for the presence of Gopher tortoises would be considered in any environmental document that tiers from this PEIS.

8-12
As explained in the response to comment 8-11 above, potential site-specific mitigation (in this case-involving Indigo snake awareness training for personnel) would be considered in any environmental document that tiers from this PEIS.

8-13
See response to comment 8-10 above. Section 4.8.2.3 has been revised to include a discussion of impacts to the least tern.

8-14
As explained in the response to comment 8-11 above, potential site-specific mitigation (in this case-involving southeastern beach mouse awareness training for personnel) would be considered in any environmental document that tiers from this PEIS.

8-15
See response to comment 8-11 above.

8-16
The FAA has amended the environmental checklist in Appendix A to add the specific launch site names.

Comment Letter: 9

NEW MEXICO
ENVIRONMENT DEPARTMENT

Office of the Secretary

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RON CURRY
Secretary
Jon Goldstein
Deputy Secretary

May 13, 2009

Michael McElligott
Manager, Space Systems Development Division
US Department of Transportation
Federal Aviation Administration
800 Independence Ave., SW
Washington, DC 20591

RE: Draft Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications

Dear Mr. McElligott:

Your letter regarding the above named project was received in the New Mexico Environment Department (NMED) and was sent to various Bureaus for review and comment. Comments were provided by the Air Quality and Surface Water Quality Bureaus and are as follows.

Air Quality Bureau
The Draft Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications was reviewed by Bureau staff. This Environmental Impact Statement addresses proposed infrastructure components and operations in multiple states and, therefore, comments in this environmental assessment will address only those occurring in New Mexico.

1 Sierra County, the future location of Spaceport America, is currently considered to be in attainment with all New Mexico and National Ambient Air Quality Standards (NAAQS). During the construction of Spaceport America, the potential exists for temporary increases in dust and emissions from vehicular use and combustion-related equipment associated with construction and earth-moving activities. However, the increases should not result in non-attainment of air quality standards. Dust control measures should be taken to minimize the release of particulates due to vehicular traffic. If activities result in significant ground disturbance, the project area should be reclaimed to avoid long-term problems with erosion and fugitive dust.

In reference to air quality information presented in the section 3.9.1, Affected Environment, the nearest non-attainment area is the community of Anthony located in Doña Ana. Doña Ana County is currently considered to be in attainment with the National Ambient Air Quality Standards (NAAQS). However, the New Mexico Air Quality Bureau has recorded exceedances of the standard for particulate matter (PM_{10}) in the Anthony area. In response to the recorded exceedances of the standard for PM_{10}, a Natural Events Action Plan (NEAP) for Doña Ana County has been prepared and submitted to the U.S. Environmental Protection Agency. As part of the NEAP, a dust control ordinance (Ordinance # 194-2000) was adopted by Doña Ana County. In accordance with this ordinance, appropriate dust control measures will need to be outlined and approved for any soil disturbing activities and should also be addressed in the environmental documentation.

2 Support engine use associated with infrastructure developments and/or operations, such as emergency or stand-by generators at launch sites within Spaceport America, may be subject to air quality permitting and modeling requirements in 20.2.72 NMAC. The Federal Aviation Administration (FAA) is the regulatory authority responsible for the assessment of the permitting and regulatory requirements of air quality impacts associated with the operation and deployment of reusable suborbital rockets.

Surface Water Quality Bureau

The Draft Programmatic Environmental Impact Statement (PEIS) for Streamlining the Processing of Experimental Permit Applications, in Exhibit ES-4 for the Spaceport America, New Mexico site in Sierra County, under water quality states:

> Surface water is limited to storm water runoff. No impacts to these ephemeral surface waters would be expected. The accidental release of hazardous materials, including fuels, from operations activities or an accident could affect water resources by contaminating groundwater. However, impacts would be expected to be minimized through adherence to all site-specific spill prevention and control requirements at each site.

3 The State of New Mexico has adopted surface water quality standards under authority of the New Mexico Water Quality Act [Chapter 74, Article 6 NMSA] pursuant to federal Clean Water Act § 303 [33 U.S.C. 1313 - Water Quality Standards and Implementation Plans], which are codified as *Standards for Interstate and Intrastate Surface Waters, 20.6.4 NMAC* (August 1, 2007) (WQS). WQS at 20.6.4.7.DDD defines "surface water(s) of the state" as:

> ...all surface waters situated wholly or partly within or bordering upon the state, including lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, reservoirs or natural ponds. Surface waters of the state also means all tributaries of such waters, including adjacent wetlands, any manmade bodies of water that were originally created in surface waters of the state or resulted in the impoundment of surface waters of the state, and any "waters of the United States" as defined under the Clean Water Act that are not included in the preceding description. Surface waters of the state does not include private waters that do not combine with other surface or subsurface water or any water under tribal regulatory jurisdiction pursuant to Section 518 of the Clean Water Act. Waste

2

> treatment systems, including treatment ponds or lagoons designed and actively used to meet requirements of the Clean Water Act (other than cooling ponds as defined in 40 CFR Part 423.11(m) that also meet the criteria of this definition), are not surface waters of the state, unless they were originally created in surface waters of the state or resulted in the impoundment of surface waters of the state.

There are numerous ephemeral or intermittent drainages located at the Spaceport America site and surrounding areas that meet the definition of "surface waters of the state." Although the PEIS is unclear whether discharges will actually reach a "surface water of the state" such as an arroyo or other surface watercourse, given the nature and extent of the activities addressed in the document, it is likely that they may in some cases. All surface waters of the state have designated uses and associated surface water quality criteria. These criteria are listed in the WQS at 20.6.4.13 (general criteria) and 20.6.4.900 (numeric criteria). Designated uses of ephemeral waters include livestock watering, wildlife habitat, limited aquatic life and secondary contact. 20.6.4.900 NMAC lists numeric criteria applicable to these designated uses, many of which are in addition to, and some of which are significantly more stringent than, other regulations, including the ground water quality standards, at 20.6.2 NMAC.

State surface water quality standards must be met at all times. Since the PEIS anticipates the discharge of hazardous materials, including rocket and other fuels, these materials will likely, at a minimum, contain various toxic materials, possibly in toxic amounts. State surface water quality standards prohibit the discharge of toxic pollutants in toxic amounts to surface waters of the state. 20.6.4.13.F (1) states:

> Except as provided in 20.6.4.16 NMAC, surface waters of the state shall be free of toxic pollutants from other than natural causes in amounts, concentrations or combinations which affect the propagation of fish or which are toxic to humans, livestock or other animals, fish or other aquatic organisms, wildlife using aquatic environments for habitation or aquatic organisms for food, or which will or can reasonably be expected to bioaccumulate in tissues of fish, shellfish and other aquatic organisms to levels which will impair the health of aquatic organisms or wildlife or results in unacceptable tastes, odors or health risks to human consumers of aquatic organisms.

In order to attempt to prevent violations of the WQS, the New Mexico Environment Department, Surface Water Quality Bureau (SWQB) suggests that you assess the potential to exceed any and all applicable water quality criteria in all possible receiving streams. SWQB also suggests that you incorporate any additional controls to be implemented, based on this assessment, for all pollutants or pollutant parameters which are determined will, or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard.

The NM Ground and Surface Water Protection Regulations [20.6.2 NMAC] and the Standards for Interstate and Intrastate Surface Waters [20.6.4 NMAC] are available on the internet at http://www.nmcpr.state.nm.us/nmac/.

3

I hope this information is helpful to you.

Sincerely,

Georgia Cleverley

Georgia Cleverley
Environmental Impact Review Coordinator
NMED File #2844

Response to Comment Letter 9:

9-01
The Proposed Action does not involve any construction or soil disturbance activities that would lead to dust emissions at Spaceport America. This PEIS addresses the environmental consequences of issuing experimental permits for rocket launches at Spaceport America with the assumption that no new construction would occur. As such, the focus of our analysis is on the environmental consequences of launch operations and assumes all facilities and infrastructure at Spaceport America would be fully constructed. In the future, if a permit application is received that would require construction or soil disturbance activities; additional NEPA documentation (either an EA or EIS) would be required (see Section 1.5.3 and Appendix A of the PEIS). Future NEPA documents would tier from this PEIS and would focus on the resource area(s) and impact(s) that are not addressed in this PEIS. As part of any future NEPA process, consultation with all relevant agencies would be conducted.

9-02
The air quality analysis for this PEIS focuses on emissions associated with reusable suborbital rocket launches, powered landings, and ground testing of reusable suborbital rocket motors. Emissions associated with launch site operations for trucks and other vehicle traffic, generators, fueling activities, boilers, or other activities that would result in emissions are presented in the *Final EIS for the Spaceport America Commercial Launch Site, Sierra County, New Mexico.*

9-03
As there is no perennial surface water in the vicinity of Spaceport America, all of the surface water resources considered in this PEIS are those related to ephemeral surface waters (such as arroyos, draws, and other drainages that contain water only during and after precipitation events). The FAA has amended Section 3.9.12.1 in order to clarify the surface waters that were evaluated in this PEIS.

The FAA does not anticipate any discharge of hazardous material, including rocket fuel. As stated in Section 4.7.1.2 of the *Final EIS for the Spaceport America Commercial Launch Site, Sierra County, New Mexico,* "Oxygen, nitrous oxide, hydrogen, and methane gases would quickly evaporate into the atmosphere (none is an air pollutant) and liquid hydrocarbons would be stored so that spills would be contained in catchments. Even in the event of a catastrophic accidental release of the entire on-site capacity of all propellant components, these propellants would not create a pollution hazard for the underlying aquifer, nor would they create pollution hazards that could migrate to the Rio Grande through stormwater runoff." In addition, the New Mexico Spaceport Authority would be required to obtain and abide by all Federal, state, and local water quality permits.

Comment Letter: 10

COMMONWEALTH of VIRGINIA

DEPARTMENT OF ENVIRONMENTAL QUALITY
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David K. Paylor
Director

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May 14, 2009

Ms. Stacey M. Zee
FAA Experimental Permits PEIS
c/o ICF International
9300 Lee Highway
Fairfax, VA 22031

RE: Draft Programmatic Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications (DEQ #09-065F).

Dear Ms. Zee:

The Commonwealth of Virginia has completed its review of the above-referenced draft programmatic environmental impact statement (PEIS). The Department of Environmental Quality (DEQ) is responsible for coordinating Virginia's review of federal environmental documents prepared pursuant to the National Environmental Policy Act (NEPA) and responding to appropriate federal officials on behalf of the Commonwealth. The following agencies and locality joined in this review:

- Department of Game and Inland Fisheries
- Department of Agriculture and Consumer Services
- Department of Conservation and Recreation
- Department of Health
- Department of Environmental Quality
- Department of Historic Resources
- Department of Mines, Minerals and Energy
- Department of Transportation
- Marine Resources Commission
- Accomack County
- Department of Aviation

The Virginia Institute of Marine Science, Department of Forestry and the Accomack-Northampton Planning District Commission also were invited to comment.

PROPOSED FEDERAL ACTION

The Federal Aviation Administration (FAA) has submitted a draft PEIS on a change in the process of issuing experimental permits for the launch and reentry of reusable suborbital rockets. One of the locations evaluated in the PEIS is the Mid-Atlantic Regional Spaceport (MARS) on Wallops Island in Accomack County. The FAA has prepared this PEIS in cooperation with the National Aeronautics and Space Administration (NASA) and the U.S. Air Force. The PEIS examines environmental impacts through an alternative approach for complying with NEPA when reviewing applications for these permits. The intent of this PEIS is to facilitate the preparation of environmental documents for the issuance of these permits to individual launch operators. This PEIS provides information and analyses common to all reusable suborbital rockets. If this PEIS is approved, an operator applying for an experimental permit would consult with the FAA to determine the type of environmental document to prepare. The FAA would then complete a NEPA checklist to examine the permit application in relation to this PEIS. If the proposed activities are covered in the PEIS, the FAA would document it in the checklist. If not, then the appropriate NEPA document would be prepared. This document would summarize the information in this PEIS and would concentrate on the issues specific to the proposed action. This effort, as described above, is considered the proposed action. A no action alternative also is considered.

An experimental permit would authorize the operation of a reusable suborbital rocket and the activities directly associated with its operation, including activities related to pre-flight, takeoff, flight (including reentry), landing and post flight. A permit would be valid for one year. The FAA estimates that a maximum of 1,000 launch and reentry events could occur annually at any one location from 2009 to 2014. Although the draft PEIS considers the potential environmental impact at specific sites in the United States, its intent is to also cover any possible site in the United States or abroad. The scope of the draft PEIS does not include construction activities and assumes the use of the existing launch support infrastructure; however, temporary structures (a launch stand or reentry pad, for example) may be used. In addition, the PEIS evaluates the environmental impacts of normal launch and reentry conditions, and accidents.

SUMMARY

The Commonwealth has no objection to the proposed action, and it should not have a significant, negative impact to the Commonwealth's natural resources provided all applicable state, federal and local laws and regulations are followed. Reviewers did not
1 identify any adverse impacts that could not be mitigated. However, they identified deficiencies in the draft PEIS, especially the sections describing wildlife resources and accidents, and provided recommendations for incorporation in the final PEIS. DEQ encourages the FAA to consider and include the Commonwealth's recommendations in the final document to ensure maximum consideration and protection of natural resources in Virginia.

Draft PEIS
Streamlining the Processing of Experimental Permit Applications
DEQ #09-065F

ENVIRONMENTAL IMPACTS AND MITIGATION

The Commonwealth's comments focus on potential environmental impacts from launches from MARS on Wallops Island at NASA Wallops Flight Facility and accidents, and technical aspects of the draft PEIS.

1. Water Quality and Wetlands. The PEIS (page 4-45) states that local adverse impacts to wetlands from the deposition of rocket engine emissions would not be significant. The proposed action would not result in the filling or draining of wetlands.

The PEIS (page 4-45) states that the accidental release of hazardous materials, including fuels, from operational activities or an accident could contaminate groundwater or surface waters. The PEIS (page 4-21) also states any hydrogen chloride (HCl) deposition from the burning of solid propellants could create short-term acidification impacts, including fish kills.

Even though the PEIS states that impacts may be minimized through adherence to all site-specific spill prevention and control requirements (page ES-15), it does not include notification requirements regarding pollution incidents.

2 ***1(a) Agency Jurisdiction.*** The State Water Control Board promulgates Virginia's water regulations, covering a variety of permits to include the Virginia Pollutant Discharge Elimination System Permit, Virginia Pollution Abatement Permit, Surface and Groundwater Withdrawal Permit, and the Virginia Water Protection (VWP) Permit. The VWP Permit is a state permit which governs wetlands, surface water and surface water withdrawals/impoundments. It also serves as § 401 certification of the federal Clean Water Act § 404 permits for dredge and fill activities in waters of the United States. The VWP Permit Program is under the Office of Wetlands and Water Protection and Compliance within the DEQ Division of Water Quality Programs. In addition to central office staff who review and issue VWP Permits for transportation and water withdrawal projects, the six DEQ regional offices perform permit application reviews and issue permits for the covered activities.

1(b) Wetlands. The DEQ Tidewater Regional Office (TRO) states that the report indicates that no filling or draining of wetlands will occur "because no new permanent infrastructure would be constructed at MARS and all temporary structures (e.g., a launch stand or reentry pad) would be removed after a launch or reentry event." Project proponents should be aware that temporary impacts to wetlands may require authorization from DEQ as well. Provided that all necessary permits are obtained and complied with, this project will be consistent with the requirements of the Virginia Water Protection Program.

1(c) Point Source Discharges. The DEQ TRO states that there does not appear to be any impact on permit activities within the Virginia Pollutant Discharge Elimination System (VPDES) category as a result of the activity described. However, there appears to be uncertainty regarding the level of impact. As there is no definition of the terms

3

minor or significant, it is difficult to assess the actual level of environmental impact from the information presented in the document. The difficulty in determining the actual impact may be the reality. However, even if there is a determination that there is a measureable impact to surface waters, it does not appear that the impact is associated with point source discharges. NASA Wallops Flight Facility has a VPDES permit, which sets the requirements for a release resulting from an accident. NASA would call the Pollution Response Program telephone line and follow up with a five-day letter.

1(d) Agency Recommendations.

- If temporary or permanent impacts to wetlands are proposed, contact Bert Parolari, VWP Manager with TRO, at *bwparolari@deq.virginia.gov* or (757) 518-2166 for a permitting determination.

- If a release occurs and reporting requirements in the NASA VPDES permit are met, then the DEQ Pollution Response Program should be contacted at (757) 518-2000 and other permit requirements should be followed.

- If an accident or associated spill occurs and there is contamination of natural resources, the responsible party should report the incident to the National Response Center at 800-424-8802 and the Virginia Emergency Operations Center at 800-468-8892.

2. Subaqueous Lands. If an accident were to occur, some material may enter surface waters (page 4-21).

2(a) Agency Jurisdiction. The Virginia Marine Resources Commission (VMRC) regulates encroachments in, on or over state-owned subaqueous beds as well as tidal wetlands pursuant to § 28.2-1200 through 1400 of the *Code of Virginia.*

The VMRC serves as the clearinghouse for the Joint Permit Application (JPA) used by the:

3

- U.S. Army Corps of Engineers (Corps) for issuing permits pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act;
- DEQ for issuance of a VWP permit;
- VMRC for encroachments on or over state-owned subaqueous beds as well as tidal wetlands; and
- local wetlands board for impacts to wetlands.

The VMRC will distribute the completed JPA to the appropriate agencies. Each agency will conduct its review and respond.

2(b) Agency Comments. The VMRC requires a permit for any activities that encroach upon or over, or take use of materials from the beds of the bays, oceans, rivers and streams, or creeks which are property of the Commonwealth. It would appear that the proposed action as described in the PEIS will not be under the jurisdiction of the VMRC. However, if any portion of the reusable suborbital rockets or trash from the launch falls in the Atlantic Ocean within three miles of the coast of Virginia, a permit may be required.

2(c) Agency Recommendations. If any portion of the reusable suborbital rockets or trash from a launch falls in the Atlantic Ocean within three miles of the coast of Virginia, contact George H. Badger with the VMRC at (757) 414-0710 for a permitting determination.

3. Waste and Debris Management. The draft PEIS (page 4-43) states that under the proposed action, the amount of hazardous materials, hazardous waste and solid waste would increase. Activities would comply with pollution prevention requirements and procedures in place at the flight facility. If an accident were to occur, most, if not all, material falling onto the ground or in surface waters would be collected and disposed of as hazardous waste in compliance with federal, state and local requirements (page 4-21).

3(a) Agency Jurisdiction. Solid and hazardous wastes in Virginia are regulated by DEQ, the Virginia Waste Management Board and EPA. They administer programs created by the federal Resource Conservation and Recovery Act, Comprehensive Environmental Response Compensation and Liability Act, commonly called Superfund, and the Virginia Waste Management Act. DEQ administers regulations established by the Virginia Waste Management Board and reviews permit applications for completeness and conformance with facility standards and financial assurance
4 requirements. All Virginia localities are required, under the Solid Waste Management Planning Regulations, to identify the strategies they will follow on the management of their solid wastes to include items such as facility siting, long-term (20-year) use, and alternative programs such as materials recycling and composting.

3(b) Agency Comments. The DEQ Waste Division states that this is a multi-state project, and the scope is extensive. For each area in Virginia where any work is to take place, the applicant needs to conduct an environmental investigation on and near the property to identify any solid or hazardous waste sites or issues before work can commence. This investigation should include a search of waste-related databases (detailed comments attached).

One such area in Virginia is MARS at Wallops Flight Facility. For this facility, there is one hazardous waste site and a formerly used defense site (FUDS) located within the same zip code (23337):

Hazardous Waste

- NASA Goddard Space Flight Facility/Wallops Flight Facility (VA8800010763 LQG, active; VA7800020888 LQG, active; treatment, storage or disposal)

FUDS

- Wallops Island (C03VA0301, VA9799F1697)

The DEQ TRO states that existing hazardous waste management procedures as required by the Virginia Hazardous Waste Management Regulations include contingency plans for spills and accidents. In addition, as required by these regulations, Wallops could obtain, in the future, an emergency permit as required for the onsite treatment/stabilization of hazardous waste that is too unstable to be transported from the facility. Specific guidance on the requirements and procedures for obtaining an emergency hazardous waste treatment permit is on the DEQ website at *www.deq.virginia.gov.*

The DEQ TRO also states that an appropriate solid and hazardous waste management system is in place at NASA Wallops to manage the projected increase in waste generated by the proposed activity.

3(c) Federal Facilities Program. The DEQ Federal Facilities Program states that in addition to the no action alternative, the document presents one action alternative that may be impacted by NASA Wallops Flight Facility (referred to as MARS) or Wallops FUDS. Given the vague nature of the document, it is difficult to determine whether the action alternative will result in temporary impacts or exposures to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) or FUDS activities at Wallops Flight Facility.

3(d) Agency Recommendations.

- DEQ encourages all construction projects and facilities to implement pollution prevention principles, including:
  - the reduction, reuse and recycling of all solid wastes generated; and
  - the minimization and proper handling of generated hazardous wastes.

- Any soil that is suspected of contamination or wastes that are generated during construction-related activities must be tested and disposed of in accordance with applicable federal, state and local laws and regulations.

- For each area in Virginia where any work is to take place, the applicant needs to conduct an environmental investigation on and near the property to identify any solid or hazardous waste sites or issues before work can commence.

- Prior to initiating any construction or demolition activities on Wallops property where soil, groundwater, surface water or sediment will be disturbed, the responsible party should contact T.J. Meyer, NASA Wallops Manager of Environmental Restoration, at (757) 824-1987 for information concerning any CERCLA obligations at or near areas adjacent to NASA Wallops CERCLA sites and Sher Zaman, U.S. Army Corps of Engineers Remediation Project Manager for Wallops FUDS, at (410) 962-3134 for information concerning CERCLA obligations at or near Wallops FUDS sites.

- Include the contact information in the final PEIS for Leslie Romanchik, DEQ Director of the Office of Hazardous Waste, (804-698-4129 or *laromanchik@deq.virginia.gov*) and indicate that she should be contacted for specific guidance on the requirements and procedures for obtaining an emergency hazardous waste treatment permit.

- The final PEIS should include information on the emergency permits that may be necessary regarding the cleanup of an accident and all appropriate notification requirements (see item 1(d) above).

4. Air Quality. The draft PEIS (page 4-40) states that emissions from the launch and reentry of reusable suborbital rockets would have a short duration and would rapidly disperse. An accident on or near the launch pad could produce air emissions that may include toxic combustions products (page 4-21).

4(a) Agency Jurisdiction. The DEQ Air Division, on behalf of the State Air Pollution Control Board, is responsible for developing regulations that become Virginia's Air Pollution Control Law. DEQ is charged with carrying out mandates of the state law and related regulations as well as Virginia's federal obligations under the Clean Air Act as amended in 1990. The objective is to protect and enhance public health and quality of life through control and mitigation of air pollution. The division ensures the safety and quality of air in Virginia by monitoring and analyzing air quality data, regulating sources of air pollution, and working with local, state and federal agencies to plan and implement strategies to protect Virginia's air quality. The appropriate regional office is directly responsible for the issuance of necessary permits to construct and operate all stationary sources in the region as well as monitoring emissions from these sources for
5 compliance. In the case of certain projects, additional evaluation and demonstration must be made under the general conformity provisions of state and federal law.

4(b) Ozone Attainment Area. According to the DEQ Air Division, the project site is located in an ozone attainment area.

4(c) Open Burning. If the construction of temporary structures includes the burning of vegetative debris and construction or demolition material, this activity must meet the requirements under 9 VAC 5-40-5600 *et seq*. of the regulations for open burning, and it may require a permit. The regulations provide for, but do not require, the local adoption of a model ordinance concerning open burning. The responsible party should contact officials with Accomack County to determine what local requirements, if any, exist.

4(d) Fugitive Dust. During the implementation of the project, fugitive dust must be kept to a minimum by using control methods outlined in 9 VAC 5-50-60 *et seq*. of the

Regulations for the Control and Abatement of Air Pollution. These precautions include, but are not limited to, the following:

- Use, where possible, of water or chemicals for dust control;
- Installation and use of hoods, fans and fabric filters to enclose and vent the handling of dusty materials;
- Covering of open equipment for conveying materials; and
- Prompt removal of spilled or tracked dirt or other materials from paved streets and removal of dried sediments resulting from soil erosion.

4(e) Agency Comments. The DEQ TRO states that representatives from NASA Wallops met with DEQ on March 26, 2009, to discuss permitting this project under Article 6 of the DEQ Air Regulations. It appears that minor New Source Review (NSR) permitting is triggered. The facility is currently drafting an application for an air permit (Form 7), which as of April 13, 2009, has not been received. The DEQ TRO also states that a general statement, which is in all air permits, includes reporting requirements to DEQ if there is a malfunction of the permitted facility or related air pollution control equipment (detailed comments attached).

4(f) Recommendations. The final PEIS should include information about the NSR permit, along with reporting requirements, in the air quality section. For additional information, contact Jane Workman, DEQ TRO Air Permit Manager, at (757) 518-2112.

5. Natural Heritage Resources. The draft PEIS (page 4-41) states that there are nesting areas for piping plover and Wilson's plover on Wallops Island, and a peregrine falcon nest has been recorded on the island. There is also habitat available for the upland sandpiper, gulled-billed tern and sea turtles.

5(a) Agency Jurisdiction. The mission of the Department of Conservation and Recreation (DCR) is to conserve Virginia's natural and recreational resources. The DCR Division of Natural Heritage's (DNH) mission is conserving Virginia's biodiversity through inventory, protection and stewardship. The Virginia Natural Area Preserves Act, 10.1-209 through 217 of the Code of Virginia, was passed in 1989 and codified DCR's
6 powers and duties related to statewide biological inventory: maintaining a statewide database for conservation planning and project review, land protection for the conservation of biodiversity, and the protection and ecological management of natural heritage resources (the habitats of rare, threatened and endangered species, significant natural communities, geologic sites, and other natural features).

5(b) Agency Findings. The DCR DNH has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

Draft PEIS
Streamlining the Processing of Experimental Permit Applications
DEQ #09-065F

Biotics documents the presence of natural heritage resources in the project area. However, due to the scope of the activity and the distance to the resources, DCR does not anticipate that this project will adversely affect these natural heritage resources.

5(c) Threatened and Endangered Plant and Insect Species. The Endangered Plant and Insect Species Act of 1979, Chapter 39, §3.1-102- through 1030 of the Code of Virginia, as amended, authorizes the Virginia Department of Agriculture and Consumer Service (VDACS) to conserve, protect and manage endangered species of plants and insects. VDACS Virginia Endangered Plant and Insect Species Program personnel cooperates with the U.S. Fish and Wildlife Service (FWS), DCR DNH and other agencies and organizations on the recovery, protection or conservation of listed threatened or endangered species and designated plant and insect species that are rare throughout their worldwide ranges. In those instances where recovery plans, developed by the U.S. FWS, are available, adherence to the order and tasks outlines in the plans are followed to the extent possible.

VDACS has regulatory authority to conserve rare and endangered plant and insect species through the Virginia Endangered Plant and Insect Species Act. Under a Memorandum of Agreement established between VDACS and DCR, DCR has the authority to report for VDACS on state-listed plant and insect species.

- DNH found that the current activity will not affect any documented state-listed plant and insect species.
- VDACS states that information in this document concerning endangered species were reviewed and compared to available information. No additional comments are necessary in reference to endangered plant and insect species.

5(d) Natural Area Preserves. DCR found that there are no State Natural Area Preserves under its jurisdiction in the project vicinity.

5(e) Agency Recommendations. Since new and updated information is continually added to the Biotics Data System, contact the DCR DNH at (804) 786-7951 for an update on this natural heritage information if a significant amount of time passes before it is utilized.

6. Chesapeake Bay Preservation Areas.

7 ***6(a) Agency Jurisdiction.*** The DCR Division of Chesapeake Bay Local Assistance (DCBLA) administers the Chesapeake Bay Preservation Act (Virginia Code §10.1-2100-10.1-2114) and Chesapeake Bay Preservation Area Designation and Management Regulations (9 VAC 10-20 *et seq.*).

6(b) Agency Comments. The DCR DCBLA states that the proposal to streamline experimental permits for private spaceflights at the Wallops Island facility in Accomack County includes no additional infrastructure development or land-disturbing activities.

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As long as the proposed activity will not include any land impacts, there are no requirements under the Chesapeake Bay Preservation Act program.

7. Wildlife Resources. The draft PEIS (page 4-40) states that terrestrial mammals and migratory birds may have startle responses due to launches. Significant impacts to marine animals are not expected. The report (page 4-41) states that should the FAA receive an application for an experimental permit to launch from the MARS site, the FAA will coordinate with NASA to determine if there is a need to consult with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service. The following protected species may be affected by the launches: piping plovers, Wilson's plovers, peregrine falcons, gulled-billed terns and upland sandpipers.

7(a) Agency Jurisdiction. The Department of Game and Inland Fisheries (DGIF), as the Commonwealth's wildlife and freshwater fish management agency, exercises enforcement and regulatory jurisdiction over wildlife and freshwater fish, including state- or federally-listed endangered or threatened species, but excluding listed insects (Virginia Code Title 29.1). DGIF is a consulting agency under the U.S. Fish and Wildlife Coordination Act (16 U.S.C. sections 661 *et seq.*) and provides environmental analysis of projects or permit applications coordinated through DEQ and several other state and federal agencies. DGIF determines likely impacts upon fish and wildlife resources and habitat, and recommends appropriate measures to avoid, reduce or compensate for those impacts.

7(b) Agency Comments.

8 *Section 4.5: Mid-Atlantic Regional Spaceport*

- DGIF is concerned that section 4.5 does not adequately characterize possible impacts upon wildlife and the resources that support them resulting from rocket launches. The draft PEIS acknowledges that animals (although it's limited to terrestrial mammals) will demonstrate a startle response. This is particularly significant in the case of nearby nesting birds. If birds are scared off their nesting sites, this may result in nest abandonment, leading to unsuccessful breeding or brooding, depending on the time of year of the launch. Over time and depending on the number of launches during the breeding season (for most species in the area, not including bald eagle, this is April 1 through August 15 of any year), this could result in significant impacts upon these populations. Rocket launches also may be detrimental to migrating species.

Section 4.5.7: Land Use

- In this section, it is stated that the proposed action will not preclude any land uses in and around MARS on Wallops Island, including those of Chincoteague National Wildlife Refuge (CNWR). DGIF is not sure that this is accurate. To DGIF's knowledge, rocket launches at this site have precluded staffs at CNWR from accessing Assawoman Island for the purposes of monitoring beach nesting

Draft PEIS
Streamlining the Processing of Experimental Permit Applications
DEQ #09-065F

birds, including piping plovers. This is significant in light of the fact that there may be adverse impacts upon these birds during launches and that the number of launches per year may increase. In this case, monitoring of these nesting birds is all the more important and should be accommodated by the FAA.

DGIF has reviewed the draft PEIS and does not object to a change in process allowing the FAA to tier future environmental documents from this PEIS (once final) to focus on environmental impacts specific to an applicant's proposed operations under an experimental permit.

7(c) Agency Recommendations. DGIF recommends that the final PEIS, and subsequent versions, include the following information and/or make the following changes and additions:

Exhibit 3-14: Virginia and Federally Listed Protected Species Possibly Present on Wallops Island

- This table currently has "NL" (not listed) in the column named "Virginia Status" for the sea turtles known to occur in the waters nearby Wallops Island. These species should not be labeled NL for Virginia. This column should be revised as follows:
  - State-listed endangered leatherback sea turtle
  - State-listed endangered hawksbill sea turtle
  - State-listed endangered Kemp's Ridley sea turtle
  - State-listed threatened loggerhead sea turtle
  - State-listed threatened Atlantic green sea turtle

- In addition, this table should include the following listed species also known from the vicinity of Wallops Island. The PEIS, and subsequent EISs, should fully evaluate these additional species for impacts associated with the launch and reentry of rockets from MARS on Wallops Island.
  - State-listed threatened bald eagle
  - Federally-listed endangered and state-listed endangered sperm whale
  - Federally-listed endangered and state-listed endangered fin whale
  - Federally-listed endangered and state-listed endangered humpback whale
  - Federally-listed endangered and state-listed endangered northern right whale
  - Federally-listed endangered and state-listed endangered sei whale
  - Federally-listed endangered and state-listed endangered blue whale
  - Federally-listed endangered and state-listed endangered Florida manatee (subspecies of the West Indian manatee)

11

Draft PEIS
Streamlining the Processing of Experimental Permit Applications
DEQ #09-065F

- This table should include red knot, a federally-listed candidate species and a species listed in Tier IV (Moderate Conservation Need) of Virginia's Wildlife Action Plan's list of Species of Greatest Conservation Need.

Section 3.5.7: Land Use

- This section should include documentation of The Nature Conservancy's role as a neighbor to MARS as it owns Metompkin Island, which is located immediately adjacent to Wallops/Assawoman Island.

Section 4.5: Mid-Atlantic Regional Spaceport

- The PEIS, and subsequent documents, should address the issue of the characterization of possible impacts to wildlife resources and the resources that support them (resulting from rocket launches) and provide alternatives for operations at MARS that may avoid, minimize or mitigate such impacts. This may include options such as a reduced number of launches during the breeding season.

- The PEIS and subsequent documents should detail the number of planned launches from MARS and the effect that an increase in the number of launches, if proposed, may have on nearby wildlife resources. This should include a detailed discussion about cumulative impacts.

Section 4.5.7: Land Use

- The final PEIS should include a process of accommodating CNWR for the monitoring of nesting birds on Assawoman Island's beaches and acknowledge that the access to the island has been an issue due to launch activities.

8. Underground and Aboveground Storage Tanks.

8(a) Agency Comments. The DEQ TRO states that 23 petroleum releases, one of which is a currently active case, have been reported at the Wallops Flight Facility in Accomack County. This active case (PC# 1990-0039) was discussed in the groundwater quality section of the PEIS (3.5.12.2). Petroleum contaminated soils or groundwater generated during implementation of this project must be properly
9 characterized and disposed of properly.

8(b) Agency Recommendations.

- If evidence of a petroleum release is discovered during implementation of this project, it must be reported to Lynne Smith at (757) 518-2055 or Gene Siudyla at (757) 518-2117 with DEQ TRO.

12

Draft PEIS
Streamlining the Processing of Experimental Permit Applications
DEQ #09-065F

- The removal, closure or relocation of regulated petroleum storage tanks at NASA Wallops during the implementation of this project should be reported to the DEQ TRO at (757) 518-2115.

9. Water Supply.

10 ***9(a) Agency Jurisdiction.*** The Virginia Department of Health (VDH) Office of Drinking Water reviews projects for the potential to impact public drinking water sources (groundwater wells, springs and surface water intakes).

9(b) Agency Comments. The VDH states that the Office of Drinking Water has no comment on the proposal, since the only facility listed in the proposal is Wallops Island, no public groundwater wells are within a mile of the launch pad, and no drinking water surface intakes are located within approximately 70 miles of the site.

11 **10. Mineral Resources.**

10(a) Agency Jurisdiction. The Virginia Department of Mines, Minerals and Energy (DMME), through its six divisions, regulates the mineral industry, provides mineral research and offers advice on wise use of resources. The Department's mission is to enhance the development and conservation of energy and mineral resources in a safe and environmentally sound manner in order to support a more productive economy in Virginia. The DMME Division of Geology and Mineral Resources (DGMR), serving as Virginia's geological survey, generates, collects, compiles and evaluates geologic data, creates and publishes geologic maps and reports, works cooperatively with other state and federal agencies, and is the primary source of information on geology, mineral and energy resources, and geologic hazards for both the mineral and energy industries and the general public. DMME DGMR also provides the necessary geologic support for those divisions of DMME that regulate the permitting of new mineral and fuel extraction sites, miner safety and land reclamation. The Division of Energy works to advance sustainable energy practices and behaviors by increasing the use of proven energy conservation practices in Virginia; fostering growth of emerging and sustainable energy industries and infrastructure; and identifying applications of new and innovative energy technologies in Virginia among other efforts.

10(b) Agency Comments. Based on the described process and scope of activities, DMME does not anticipate a significant impact on mineral resources as a result of this project.

11. Energy. The draft PEIS (page 4-43) states that the proposed action would not result in notable changes in energy demands.

12 ***11(a) Agency Jurisdiction.*** The DMME Division of Energy works to advance sustainable energy practices and behaviors by increasing the use of proven energy conservation practices in Virginia; fostering growth of emerging and sustainable energy

13

Draft PEIS
Streamlining the Processing of Experimental Permit Applications
DEQ #09-065F

industries and infrastructure; and identifying applications of new and innovative energy technologies in Virginia among other efforts.

11(b) Agency Comments. Based on the described process and scope of activities, DMME does not anticipate a significant impact to energy resources as a result of this project.

12. Historic Architectural Resources. The draft PEIS (page 4-42) states that the proposed action would not result in any new ground disturbances. There are two historic sites on Wallops Island.

12(a) Agency Jurisdiction. The Department of Historic Resources (DHR) conducts
reviews of projects to determine their effect on historic structures or cultural resources
under its jurisdiction. DHR, as the designated State's Historic Preservation Office,
ensures that federal actions comply with Section 106 of the National Historic
13 Preservation Act of 1966, as amended, and its implementing regulation at 36 CFR Part
800. The preservation act requires federal agencies to consider the effects of federal
projects on properties that are listed or eligible for listing on the National Register of
Historic Places. Section 106 also applies if there are any federal involvements, such as
licenses, permits, approvals or funding. DHR also provides comments to DEQ through
the state environmental impact report review process.

12(b) Agency Comments. DHR does not believe that the proposed action has the potential to affect historic properties listed in or eligible for the National Register of Historic Places.

13. Transportation Impacts.

13(a) Agency Jurisdiction. The Virginia Department of Transportation (VDOT) provides comments pertaining to potential impacts to existing and future transportation systems.

13(b) Agency Comments. The VDOT Hampton Roads District Planning Section
reviewed the draft PEIS. There is one transportation improvement project in the vicinity
14 of the MARS spaceport, located at Wallops Island, in the Fiscal Year 10-15 Six Year
Improvement Program or the Secondary Six Year Program. This project is the
replacement of the Route 175 Chincoteague Bridge (UPC #1896). VDOT has no
objections to the proposed action and concludes that additional traffic or traffic
disruptions are negligible.

13(c) Agency Finding. Based upon a preliminary review, the draft PEIS does not suggest any negative impacts to the transportation system at this time as a result of the project.

13(d) Agency Recommendation. If permanent or temporary facilities are proposed to affect VDOT right-of-ways, then the responsible party should coordinate with VDOT's Accomac Residency Office at (757) 787-1550.

14. Aviation Impacts.

14(a) Agency Jurisdiction. The Virginia Department of Aviation (DOAv) is a state agency that plans for the development of the state aviation system; promotes aviation; grants aircraft and airports licenses; and provides financial and technical assistance to
15 cities, towns, counties and other governmental subdivisions for the planning, development, construction and operation of airports, and other aviation facilities.

14(b) Agency Comments. DOAv reviewed the document and does not have any comments concerning the proposed action at this time. Adverse impacts are not anticipated.

15. Local and Regional Comments.

15(a) Local Comments. Accomack County does not have any comments on the proposed action.

15(b) Regional Comments. The Hampton Roads Planning District Commission did not respond to DEQ's request for comments.

REGULATORY AND COORDINATION NEEDS

1. Water Quality.

- If temporary or permanent impacts to wetlands are proposed, contact Bert Parolari, VWP Manager with TRO, at *bwparolari@deq.virginia.gov* or (757) 518-2166 for a permitting determination.

- If a release occurs and reporting requirements in the NASA VPDES permit are met, then the DEQ Pollution Response Program should be contacted at (757) 518-2000 and other permit requirements should be followed.

- If an accident or associated spill occurs and there is contamination of natural resources, the responsible party should report the incident to the National Response Center at 800-424-8802 and the Virginia Emergency Operations Center at 800-468-8892.

2. Subaqueous Lands. If any portion of the reusable suborbital rockets or trash from a launch falls in the Atlantic Ocean within three miles of the coast of Virginia, contact George H. Badger with the VMRC at (757) 414-0710 for a permitting determination.

3. Air Quality Regulation. According to the DEQ Air Division, the following regulations may apply:

- 9 VAC 5-50-60 *et seq.* of the regulations governing fugitive dust.
- 9 VAC 5-40-5600 *et seq.* of the regulations governing open burning.

For information on local requirements pertaining to open burning, contact Accomack County, if applicable.

3. Solid Waste and Hazardous Substances. Prior to initiating any construction or demolition activities on Wallops property where soil, groundwater, surface water or sediment will be disturbed, T.J. Meyer, NASA Wallops Manager of Environmental Restoration, at (757) 824-1987 for information concerning any CERCLA obligations at or near areas adjacent to NASA Wallops CERCLA sites and Sher Zaman, U.S. Army Corps of Engineers Remediation Project Manager for Wallops FUDS, at (410) 962-3134 for information concerning CERCLA obligations at or near Wallops FUDS sites.

Any soil that is suspected of contamination or wastes that are generated during construction-related activities must be tested and disposed of in accordance with applicable federal, state and local laws and regulations.

Applicable state regulations may include:

- Virginia Waste Management Act, Code of Virginia Section 10.1-1400 *et seq.*;
- Virginia Hazardous Waste Management Regulations (VHWMR) (9 VAC 20-60);
- Virginia Solid Waste Management Regulations (VSWMR) (9 VAC 20-80); and
- Virginia Regulations for the Transportation of Hazardous Materials (9 VAC 20-110).

Applicable federal regulations may include:

- the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. Section 6901 *et seq.*, and the applicable regulations contained in Title 40 of the Code of Federal Regulations; and
- the U.S. Department of Transportation Rules for Transportation of Hazardous Materials, 49 CFR Parts 107, 171.1-172.558.

4. Natural Heritage Resources. Contact the DCR DNH at (804) 786-7951 for an update on this natural heritage information if a significant amount of time passes before it is utilized.

5. Storage Tanks.

- If evidence of a petroleum release is discovered during implementation of this project, it must be reported to Lynne Smith at (757) 518-2055 or Gene Siudyla at (757) 518-2117 with DEQ TRO.

Draft PEIS
Streamlining the Processing of Experimental Permit Applications
DEQ #09-065F

- The removal, closure or relocation of regulated petroleum storage tanks at NASA Wallops during the implementation of this project should be reported to the DEQ TRO at (757) 518-2115.

6. Transportation Impacts. If permanent or temporary facilities are proposed to affect VDOT right-of-ways, then the responsible party should coordinate with VDOT's Accomac Residency Office at (757) 787-1550.

7. Federal Consistency Determination. Prior to the implementation of any activities at
the MARS site on Wallops Island, a federal consistency determination should be
submitted to the DEQ Office of Environmental Impact Review (P.O. Box 1105,
Richmond, Virginia 23218). Pursuant to the Coastal Zone Management Act of 1972, as
16 amended, federal actions that can have reasonably foreseeable effects on Virginia's
coastal uses or resources must be conducted in a manner which is consistent, to the
maximum extent practicable, with the Virginia Coastal Resources Management
Program (VCP). DEQ coordinates the review of federal consistency determinations with
agencies administering the enforceable and advisory policies of the VCP.

Thank you for the opportunity to review the draft PEIS. Detailed comments of reviewing agencies are attached for your review. Please contact me at (804) 698-4325 or Julia Wellman at (804) 698-4326 for clarification of these comments.

Sincerely,

Ellie L. Irons, Manager
Office of Environmental Impact Review

Enclosures

cc: Amy Ewing, DGIF
Keith Tignor, VDACS
Barry Matthews, VDH
Michelle Hollis, DEQ TRO
Melanie Allen, VDOT
George Badger, VMRC
Roger, Kirchen, DHR
Matt Heller, DMME
Pam Mason, VIMS
Todd Groh, DOF
Steven Miner, Accomack County
Elaine Meil, Accomack-Northampton PDC
Rusty Harrington, VDOAv

17

DEPARTMENT OF ENVIRONMENTAL QUALITY
TIDEWATER REGIONAL OFFICE
ENVIRONMENTAL IMPACT REVIEW COMMENTS

April 29, 2009

PROJECT NUMBER: **09-065F**

PROJECT TITLE: Streamlining the Processing of Experimental Permit Applications
As Requested, TRO staff has reviewed the supplied information and has the following comments:

Petroleum Storage Tank Cleanups:
Twenty three petroleum releases have been reported at the Wallops Flight Facility in Accomack County, one of which is a currently active case. This active case, PC# 1990-0039, was discussed in the groundwater quality section of the EIS (3.5.12.2). If evidence of a petroleum release is discovered during the implementation of this project, it must be reported to DEQ. Contact Ms. Lynne Smith at (757) 518-2055 or Mr. Gene Siudyla at (757) 518-2117. Petroleum contaminated soils or ground water generated during implementation of this project must be properly characterized and disposed of properly.

Petroleum Storage Tank Compliance/Inspections:
The removal, closure or relocation of regulated petroleum storage tanks at the NASA Wallops facility during this project should be reported to the DEQ Tidewater Regional Office (757) 518-2115.

Virginia Water Protection Permit Program (VWPP):
This report indicates that no filling or draining of wetlands will occur "because no new permanent infrastructure would be constructed at MARS and all temporary structures (e.g., a launch stand or reentry pad) would be removed after a launch or reentry event." Project proponents should be aware that temporary impacts to wetlands may require authorization from DEQ as well. Provided that all necessary permits are obtained and complied with, This project will be consistent with the requirements of the VWPP.

Air Permit Program :
Representatives from NASA Wallops met with DEQ on 3/26/09 to discuss permitting this project under Article 6 of the DEQ Air Regulations. It appears that minor New Source Review (NSR) permitting is triggered. The facility is currently drafting an application for an air permit (Form 7) which has not been received to date (4/13/09).

Water Permit Program :
GW – No Comments

VPDES – There does not appear to be any impact on permit activities within the VPDES category as a result of the activity described. However, there appears to be uncertainty regarding the level of impact. As there is no definition of the terms minor or significant, it is difficult to assess the actual level of environmental impact from the information presented in the document. The difficulty in determining the actual impact may be the reality. However, even if there is a determination that there is a measureable impact to surface waters, it does not appear that the impact is associated with point source discharges.

1 of 2

04/16/09 THU 08:33 FAX 757 414 0559 DEQ VMRC E SHORE 001

COMMONWEALTH *of* VIRGINIA

L. Preston Bryant, Jr.
Secretary of Natural Resources

Marine Resources Commission
2600 Washington Avenue
Third Floor
Newport News, Virginia 23607

Steven G. Bowman
Commissioner

April 16, 2009

Ms. Julia H. Wellman
c/o Department. Of Environmental Quality
Office of the Environmental Impact Review
629 East Main Street, Sixth Floor
Richmond, Virginia 23219

Re: 09-065F
Re: Experimental Permits

Dear Ms. Wellman:

You have inquired regarding streamlining the processing of experimental permit applications for the launch and/or reentry of reusable suborbital rockets from the Mid-Atlantic Regional Spaceport (MARS) on Wallops Island, Virginia. The Marine Resources Commission requires a permit for any activities that encroach upon or over, or take use of materials from the beds of the bays, ocean, rivers and streams, or creeks which are the property of the Commonwealth.

Based upon my review of the "Draft Programmatic Environmental Impact Statement for Streamlining the Processing of the Experimental Permit Applications", it would appear that your project will not be in the Commission's jurisdiction, therefore, no authorization would be required from the Marine Resources Commission. If, however, any portion of the reusable suborbital rockets or trash from the launch fall in the Atlantic Ocean within three miles of the coast of Virginia a permit may be required.

If I may be of further assistance, please do not hesitate to contact me at (757) 414-0710.

Sincerely,

George H. Badger, III
Environmental Engineer

An Agency of the Natural Resources Secretariat
Web Address: www.mrc.virginia.gov
Telephone (757) 247-2200 (757) 247-2292 V/TDD Information and Emergency Hotline 1-800-541-4646 V/TDD

Wellman,Julia

From: Hollis,Michelle
Sent: Monday, May 11, 2009 4:02 PM
To: Wellman,Julia
Subject: FW: questions regarding accidents/09-065F

Julia,

Jane Workman's response to your question is below.

Thank You,

Michelle Hollis
Environmental Specialist
5636 Southern Blvd.
VA Beach, Virginia 23462
Phone: (757) 518-2146
My Internet Address: mrhollis@deq.virginia.gov
DEQ Website Address: http://www.deq.virginia.gov

From: Workman,Jane
Sent: Monday, May 11, 2009 1:45 PM
To: Hollis,Michelle
Subject: RE: questions regarding accidents/09-065F

The following general condition is included in all air permits and deals with malfunctions:

Notification for Facility or Control Equipment Malfunction - The permittee shall furnish notification to the Director, Tidewater Regional Office of malfunctions of the affected facility or related air pollution control equipment that may cause excess emissions for more than one hour, by facsimile transmission, telephone or telegraph. Such notification shall be made as soon as practicable but no later than four daytime business hours after the malfunction is discovered. The permittee shall provide a written statement giving all pertinent facts, including the estimated duration of the breakdown, within two weeks of discovery of the malfunction. When the condition causing the failure or malfunction has been corrected and the equipment is again in operation, the permittee shall notify the Director, Tidewater Regional Office.
(9 VAC 5-20-180 C and 9 VAC 5-80-1180)

From: Hollis,Michelle
Sent: Thursday, May 07, 2009 3:18 PM
To: McConathy,James; Johnston,Milton; Parolari,Bert; Ghittino,Hank; Workman,Jane; Madigan,Thomas; Siudyla,Eugene
Subject: FW: questions regarding accidents/09-065F

5/12/2009

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

MEMORANDUM

TO: Julia Wellman, Environmental Program Planner

FROM: Paul Kohler, Waste Division Environmental Review Coordinator

DATE: May 8, 2009

COPIES: Sanjay Thirunagari, Waste Division Environmental Review Manager; file

SUBJECT: Environmental Impact Report; Streamlining the Processing of Experimental Permit Applications; DEQ Project Code 09-065F

The Waste Division has completed its review of the Consistency Determination report for the project "Streamlining the Processing of Experimental Permit Applications." We have the following comments concerning the waste issues associated with this project:

This is a multi-state project and the scope is extensive. For each area in Virginia where any work is to take place, the applicant needs to conduct an environmental investigation on and near the property to identify any solid or hazardous waste sites or issues before work can commence. This investigation should include a search of waste-related databases. Please see the attached page regarding this database search. One such area in Virginia is the Mid-Atlantic Regional Spaceport at Wallops Flight Facility. For this facility, there is one hazardous waste site and a formerly used defense site (FUDS) located within the same zip code. These are as follows.

HW (Zip 23337)
NASA GSFC WALLOPS FLIGHT FACILITY, VA8800010763 LQG (ACTIVE)
VA7800020888 LQG (ACTIVE) & TSD

FUDS
C03VA0301, VA9799F1697, WALLOPS ISL

Paul Herman of DEQ's Federal Facilities Program was contacted for his review of this project and will reply in a separate memo if he has any comments.

Any soil that is suspected of contamination or wastes that are generated must be tested and disposed of in accordance with applicable Federal, State, and local laws and regulations. Some of the applicable state laws and regulations are: Virginia Waste Management Act, Code of Virginia Section 10.1-1400 *et seq.*; Virginia Hazardous Waste Management Regulations (VHWMR) (9VAC 20-60); Virginia Solid Waste Management Regulations (VSWMR) (9VAC 20-80); Virginia Regulations for the Transportation of Hazardous Materials (9VAC 20-110).

Waste Information

There are four Waste Division databases that are to be used to complete this review. These are the Solid Waste Database, CERCLA Facilities, Voluntary Remediation Program, and Hazardous Waste Facilities databases.

The Solid Waste Database
A list of active solid waste facilities in Virginia.

CERCLA Facilities Database
A list of active and archived CERCLA (EPA Superfund Program) sites.

Hazardous Waste Facilities Database
A list of hazardous waste generators, hazardous waste transporters, and hazardous waste storage and disposal facilities. Data for the CERCLA Facilities and Hazardous Waste Facilities databases are periodically downloaded by the Waste Division from U.S. EPA's website.

Accessing the DEQ Databases:
The report author should access this information on the DEQ website at http://www.deq.state.va.us/waste/waste.html . Scroll down to the databases which are listed under Real Estate Search Information heading.

The ***solid waste information*** can be accessed by clicking on the Solid Waste Database tab and opening the file. Type the county or city name and the word County or City, and click the Preview tab. All active solid waste facilities in that locality will be listed.

The ***Superfund information*** will be listed by clicking on the Search EPA's CERCLIS database tab and opening the file. Click on the locality box, click on sort, then click on Datasheet View. Scroll to the locality of interest.

The ***hazardous waste*** information can be accessed by clicking on the Hazardous Waste Facility tab. Go to the Geography Search section and fill in the name of the city or county and VA in the state block, and hit enter. The hazardous waste facilities in the locality will be listed.

The ***Voluntary Remediation Program*** GPS database can be accessed by clicking on "Voluntary Remediation," then "What's in my backyard" in the center shaded area, and then under "Mapping Applications," click on "What's in my backyard" again.

This database search will include most waste-related site information for each locality. In many cases, especially when the project is located in an urban area, the database output for that locality will be extensive.

Wellman,Julia

From: Hollis,Michelle
Sent: Friday, May 08, 2009 7:53 AM
To: Wellman,Julia
Subject: RE: questions regarding accidents/09-065F

Julia,

I have asked the managers to respond to your question. Below you will find their responses.

NASA Wallops has a VPDES permit which sent the requirements for a release resulting form an accident. Yes they would call the PreP line and follow up with a five day letter.

The existing HW management procedures as required by the Virginia Hazardous Waste Management Regulations include a contingency plans for spills and accidents. In addition, as required by the VHWMR, Wallops has obtained in the past and could obtain in the future an emergency permit as required for the onsite treatment/stabilization of hazardous waste that is too unstable to be transported from the facility. Specific guidance on the requirements and procedures for obtaining an emergency hazardous waste treatment permit are on our website or they may contact Leslie Romanchik, Director Office of Hazardous Waste for more information.

To be clear they do not have to have a permit in advance of the actual spill or accident.

Thank You,

Michelle Hollis
Environmental Specialist
5636 Southern Blvd.
VA Beach, Virginia 23462
Phone: (757) 518-2146
My Internet Address: mrhollis@deq.virginia.gov
DEQ Website Address: http://www.deq.virginia.gov

DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
XP Ver.1a
August 2004

5/8/2009

L. Preston Bryant, Jr.
Secretary of Natural Resources

Joseph H. Maroon
Director

COMMONWEALTH of VIRGINIA

DEPARTMENT OF CONSERVATION AND RECREATION

203 Governor Street
Richmond, Virginia 23219-2010
(804) 786-6124

MEMORANDUM

DATE: May 5, 2009

TO: Julia Wellman, DEQ

FROM: Robert S. Munson, Planning Bureau Manager, DCR-DPRR Robert S. Munson

SUBJECT: DEQ 09-065F, FAA/USDOT – Streamlining Experimental Permits for Private Spaceflights – Accomack CO

Division of Natural Heritage

The Department of Conservation and Recreation's Division of Natural Heritage (DCR) has searched its Biotics Data System for occurrences of natural heritage resources from the area outlined on the submitted map. Natural heritage resources are defined as the habitat of rare, threatened, or endangered plant and animal species, unique or exemplary natural communities, and significant geologic formations.

Biotics documents the presence of natural heritage resources in the project area. However, due to the scope of the activity and the distance to the resources, we do not anticipate that this project will adversely impact these natural heritage resources.

In addition, our files do not indicate the presence of any State Natural Area Preserves under DCR's jurisdiction in the project vicinity.

Under a Memorandum of Agreement established between the Virginia Department of Agriculture and Consumer Services (VDACS) and the Virginia Department of Conservation and Recreation (DCR), DCR represents VDACS in comments regarding potential impacts on state-listed th reatened and endangered plant and insect species. The current activity will not affect any documented state-listed plants or insects.

New and updated information is continually added to Biotics. Please contact DCR for an update on this natural heritage information if a significant amount of time passes before it is utilized.

The Virginia Department of Game and Inland Fisheries maintains a database of wildlife locations, including threatened and endangered species, trout streams, and anadromous fish waters that may contain information not documented in this letter. Their database may be accessed from http://vafwis.org/fwis/ or contact Shirl Dressler at (804) 367-6913.

State Parks • Soil and Water Conservation • Natural Heritage • Outdoor Recreation Planning
Chesapeake Bay Local Assistance • Dam Safety and Floodplain Management • Land Conservation

If you cannot meet the deadline, please notify JULIA H. WELLMAN at 804/698-4326 prior to the date given. Arrangements will be made to extend the date for your review if possible. An agency will not be considered to have reviewed a document if no comments are received (or contact is made) within the period specified.

REVIEW INSTRUCTIONS:

A. Please review the document carefully. If the proposal has been reviewed earlier (i.e. if the document is a federal Final EIS or a state supplement), please consider whether your earlier comments have been adequately addressed.

B. Prepare your agency's comments in a form which would be acceptable for responding directly to a project proponent agency.

C. Use your agency stationery or the space below for your comments. **IF YOU USE THE SPACE BELOW, THE FORM MUST BE SIGNED AND DATED.**

Please return your comments to:

MS. JULIA H. WELLMAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF ENVIRONMENTAL IMPACT REVIEW
629 EAST MAIN STREET, SIXTH FLOOR
RICHMOND, VA 23219
FAX #804/698-4319
jhwellman@deq.virginia.gov

RECEIVED

MAY 11 2009

DEQ-Office of Environmental Impact Review

Julia H. Wellman

JULIA H. WELLMAN
ENVIRONMENTAL PROGRAM PLANNER

COMMENTS

Statements in the project document concerning endangered species were reviewed and compared to available information. No additional comments are necessary in reference to endangered plant and insect species regarding this project.

(Keith R. Tignor) May 4, 2009

(signed) Endangered Species Coordinator (date)

(title) VDACS, Office of Plant and Pest Service

(agency)

PROJECT #09-065F **6/08**

April 1 through August 15 of any year), this could result in significant impacts upon these populations. Rocket launches also may be detrimental to migrating species. We recommend that the PEIS, and subsequent documents, address this issue and provide alternatives for operations at Mid-Atlantic Regional Spaceport that may avoid, minimize or mitigate such impacts. This may include options such as a reduced number of launches during the breeding season. We further recommend that the PEIS and subsequent documents detail the number of planned launches from Mid-Atlantic Regional Spaceport and the affect that an increase in the number of launches, if proposed, may have on nearby wildlife resources. This should include a detailed discussion about cumulative impacts.

4. Section 4.5.7 Land Use
In this section, it is stated that will not preclude any land uses in and around Mid-Atlantic Regional Spaceport on Wallops Island, including those of Chincoteague National Wildlife Refuge (CNWR). We are unsure if this is accurate. To our knowledge, rocket launches at this site have precluded staffs at CNWR from accessing Assawoman Island for the purposes of monitoring beach nesting birds, including piping plovers. This is significant in light of the fact that there may be adverse impacts upon these birds during launches and that the number of launches per year may increase. In this case, monitoring of these nesting birds is all the more important and should be accommodated by the FAA.

Thank you for the opportunity to provide comments on the subject PEIS. Please contact me if you need further assistance or have any questions. Thanks, Amy

Amy M. Ewing
Environmental Services Biologist
Virginia Dept. of Game and Inland Fisheries
4010 West Broad Street
Richmond, VA 23230
804-367-2211
amy.ewing@dgif.virginia.gov

5/11/2009

If you cannot meet the deadline, please notify JULIA H. WELLMAN at 804/698-4326 prior to the date given. Arrangements will be made to extend the date for your review if possible. An agency will not be considered to have reviewed a document if no comments are received (or contact is made) within the period specified.

REVIEW INSTRUCTIONS:

A. Please review the document carefully. If the proposal has been reviewed earlier (i.e. if the document is a federal Final EIS or a state supplement), please consider whether your earlier comments have been adequately addressed.

B. Prepare your agency's comments in a form which would be acceptable for responding directly to a project proponent agency.

C. Use your agency stationery or the space below for your comments. **IF YOU USE THE SPACE BELOW, THE FORM MUST BE SIGNED AND DATED.**

Please return your comments to:

MS. JULIA H. WELLMAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF ENVIRONMENTAL IMPACT REVIEW
629 EAST MAIN STREET, SIXTH FLOOR
RICHMOND, VA 23219
FAX #804/698-4319
jhwellman@deq.virginia.gov

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MAY 08 2009
DEQ-Office of Environmental Impact Review

Julia H. Wellman

JULIA H. WELLMAN
ENVIRONMENTAL PROGRAM PLANNER

COMMENTS

Based on the described process + scope of activities covered by this program, I do not anticipate an impact to energy or mineral resources.

(signed) [signature] (date) 5/7/09

(title) Geologist Mgr

(agency) DMME

PROJECT #09-065F **6/08**

COMMONWEALTH of VIRGINIA

DEPARTMENT OF TRANSPORTATION
1700 North Main Street
SUFFOLK, VIRGINIA 23434

DAVID S. EKERN, P.E.
COMMISSIONER

April 29, 2009

To: Melanie L. Allen
Environmental Program Planner
Virginia Department of Transportation

From: Tony Gibson
Transportation Planning Engineer
VDOT Hampton Roads District

Subject: EIS Review
Streamlining the Processing of Experimental Permit Applications
Accomack County, Virginia

The Hampton Roads District Planning Section has reviewed the above referenced process for impacts to the existing and future transportation system. Our preliminary review does not indicate any negative impacts to the transportation system at this time.

There is one transportation improvement project in the vicinity of the Mid-Atlantic Regional Spaceport located at Wallops Island in the FY 10-15 Six Year Improvement Program or the Secondary Six Year Program. That project is UPC #1896- Route 175- Chincoteague Bridge Replacement.

We can only conclude any additional traffic or traffic disruptions regarding this process being considered are negligible.

This improvement to the permit application process should note coordination with VDOT's Accomac Residency is required if permanent or temporary facilities impact VDOT right of way. Otherwise, this office has no objections to the proposed improvements.

If further assistance is needed, please advise.

Cc: Eric Stringfield

VirginiaDOT.org
WE KEEP VIRGINA MOVING

If you cannot meet the deadline, please notify JULIA H. WELLMAN at 804/698-4326 prior to the date given. Arrangements will be made to extend the date for your review if possible. An agency will not be considered to have reviewed a document if no comments are received (or contact is made) within the period specified.

REVIEW INSTRUCTIONS:

A. Please review the document carefully. If the proposal has been reviewed earlier (i.e. if the document is a federal Final EIS or a state supplement), please consider whether your earlier comments have been adequately addressed.

B. Prepare your agency's comments in a form which would be acceptable for responding directly to a project proponent agency.

C. Use your agency stationery or the space below for your comments. **IF YOU USE THE SPACE BELOW, THE FORM MUST BE SIGNED AND DATED.**

Please return your comments to:

MS. JULIA H. WELLMAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
OFFICE OF ENVIRONMENTAL IMPACT REVIEW
629 EAST MAIN STREET, SIXTH FLOOR
RICHMOND, VA 23219
FAX #804/698-4319
jhwellman@deq.virginia.gov

RECEIVED
MAY 01 2009
DEQ-Office of Environmental Impact Review

Julia H. Wellman
JULIA H. WELLMAN
ENVIRONMENTAL PROGRAM PLANNER

COMMENTS

None

(signed) ______________________ (date) April 29, 2009

(title) County Administrator

(agency) County of Accomack

PROJECT #09-065F **6/08**

Response to Comment Letter 10:

10-01
Thank you for your comment. As indicated in the responses below, the FAA has addressed the Commonwealth's recommendations.

10-02
As the PEIS indicates, the Mid-Atlantic Regional Spaceport (MARS) is an FAA-licensed commercial launch site within the NASA Goddard Space Flight Center's Wallops Flight Facility. Therefore, during review of future applications and before issuing an experimental launch and reentry permit, The FAA would coordinate with NASA to ensure acquisition and compliance with necessary water quality or wetland permits, if any.

10-03
As the PEIS indicates, MARS is an FAA-licensed commercial launch site within the NASA Goddard Space Flight Center's Wallops Flight Facility. Therefore, during review of future applications and before issuing an experimental launch and reentry permit, the FAA would coordinate with NASA to ensure acquisition and compliance with necessary permits, if any.

10-04
The Proposed Action does not include construction. Additionally, as the PEIS indicates and the Virginia Department of Environment Quality (VDEQ) acknowledges, any hazardous waste generated from the launch and reentry of suborbital rockets at MARS would be collected and disposed of as hazardous waste in compliance with Federal, state, and local requirements. During review of future applications and before issuing an experimental launch and reentry permit, the FAA would coordinate with NASA to ensure acquisition and compliance with an emergency hazardous waste treatment permit, if needed.

10-05
The FAA is aware of the proposed activities and site modifications described in NASA's *Draft Environmental Assessment for the Expansion of the Wallops Flight Facility Launch Range* published in April 2009. Should the FAA receive an application for an experimental permit that proposes to launch from MARS, the FAA would coordinate with NASA to ensure that all Federal, state, and local permit requirements were met.

10-06
Thank you for your comment. As stated in Section 1.5.3 of this PEIS, future experimental permit applications will be reviewed in relation to the content addressed in the PEIS. If new information has been added to the Biotics Data System since the publication of this PEIS, and if the issuance of an experimental permit is found to potentially have an adverse effect on a newly-added natural heritage resource, the FAA would prepare an EA or EIS, which would tier from this PEIS and focus on analyzing potential impacts to the natural heritage resource.

10-07
Thank you for your comment.

10-08
Section 3.5.2

Exhibit 3-14 in Section 3.5.2 of the PEIS has been revised to include all potential state and federally listed species that may be present on or within the vicinity of Wallops Island and their current listing status. Accordingly, a discussion of potential impacts to the added species has been inserted into Section 4.5.2.3 of the PEIS.

Section 3.5.7

Section 3.5.7 of the PEIS has been revised to include documentation of The Nature Conservancy's (TNC's) role as a neighbor to MARS, as TNC owns Metompkin Island, which is located immediately south of Assawoman Island.

Section 4.5

As the PEIS indicates, rocket launches could cause piping and Wilson's plovers to flee their nesting sites for a short period during and after a launch. However, monitoring and the continued presence and breeding of piping plovers and Wilson's plover on Wallops Island demonstrates that years of rocket launches on the island have had a limited impact on the species.

Additionally, previous studies have shown that impacts can be expected within a 3,000-foot radius of the launch pad, with a principal impact radius of approximately 660 to 980 feet, and the impacts could last from 2 to 10 minutes. The closest piping plover and Wilson's plover critical habitat to Launch Pads 0-A and 0-B is approximately 4,000 feet to the southeast. At this distance, the habitat area would be subject to a brief increase in noise, but otherwise would not be adversely affected by launch operations.

Regarding impacts to migrating birds, Wallops Island is along the Atlantic Flyway Route and is an important stop for migratory birds. It is possible that birds in the immediate area of a reusable suborbital rocket launch would be startled and flee the site for some period. However, on Wallops Island, the continued presence and breeding of sea and shore birds demonstrates that rocket launches over the years have had little effect on these species.

Although the proposed action would not result in any immediate increase in experimental permit launches at MARS, subsequent NEPA documents for any experimental permit applications would address the potential impacts to wildlife resources from the proposed activities, as well as cumulative impacts, in the manner outlined in Section 1.5.3 of the PEIS. Additionally, as indicated in Section 4.5.2.3 of the PEIS that covers future impacts to protected species and habitats from proposed experimental launches at MARS, the

FAA would coordinate with NASA regarding any need to further consult with the Virginia Department of Game and Inland Fisheries (DGIF) regarding any applicable requirements for state-listed protected species and habitat. If potential impacts are identified, the FAA would further consult to develop any mitigation measures that may be warranted, as described in Chapter 5 of the PEIS.

Section 4.5.7

Section 4.5.7 has been revised to include DGIF's observation that rocket launches at the site have precluded staff at the Chincoteague National Wildlife Refuge (CNWR) from accessing Assawoman Island for the purpose of monitoring beach nesting birds, including piping plovers. Although the proposed action would not result in any immediate increase in experimental permit launches at the MARS site, should FAA receive any future permit applications at MARS, FAA would coordinate with NASA in order to determine (1) the current status of any consultations with the U.S. Fish and Wildlife Service and CNWR staff concerning both impacts to nesting birds as well as the monitoring program, and (2) the need for any further mitigation measures as a result of any proposed launches under an experimental permit. The results of this coordination would be reflected in FAA's NEPA document for the permit application(s).

10-09
As the PEIS indicates, MARS is an FAA-licensed commercial launch site within the NASA Goddard Space Flight Center's Wallops Flight Facility. If during the implementation of any future experimental permits, FAA or its permittee became aware of a petroleum release, notification and coordination would occur with NASA. As the property owner, NASA would be responsible for reporting the release to VDEQ's Tidewater Regional Office.

10-10
Thank you for your comment.

10-11
Thank you for your comment.

10-12
Thank you for your comment.

10-13
Thank you for your comment.

10-14
Thank you for your comment.

10-15
Thank you for your comment.

10-16
Part of the proposed action identified in the *Draft Environmental Assessment for the Expansion of the Wallops Flight Facility Launch Range* published by NASA in April 2009 includes launching orbital and suborbital rockets, which is similar to the Proposed Action of this PEIS. In that Draft EA, NASA determined that the proposed action is consistent with the enforceable policies of the Coastal Zone Management Program. In a letter dated April 23, 2009, NASA submitted its federal consistency determination to VDEQ when publishing the Draft EA. NASA is currently awaiting VDEQ's response.

Comment Letter: 11

May 20, 2009
P.O. Box 2303
Kodiak, Alaska 99615
cheitman@acsalaska.net

TO: Ms. Stacey M. Zee
FAA Environmental Specialist
FAA Experimental Permits PEIS
C/o ICF International
9300 Lee Highway
Fairfax, VA 22031

Ms. Zee,
Enclosed are my comments on the 'Draft Programmatic Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications'. Please send email confirmation when this is received. Thank you.

The FAA should adhere to the 'No Action Alternative'—the present method of analyzing environmental consequences case by case, without tiering from a programmatic document. Each launch site has its own environmental concerns and should have a 'site-specific' EIS for any new launch programs and/or launch vehicles. FAA regulations should be made tougher in obtaining permits, not more lack to the convenience of any private or state agency requesting a launch permit. Also, FAA should change its regulations to give launch permits to launch sites located on *federal* or *government-owned* property only, not property designated 'public'.

1

NASA and the Department of Defense have long-time U.S. designated launch sites without creating further national and international test sites under the pretext of 'spaceports' in order to test experimental space programs (reusable launch vehicles e.g.). Funding for new programs has to be obtained in some manner and it is a waste of taxpayers' dollars to create or duplicate test sites all over the U.S. and abroad when the current launch sites are suffice for any new NASA and Department of Defense testing. The various agencies can cooperate with one another for launch dates/times at White Sands Missile Range, Vandenberg AFB, Kwajalein and Cape Canaveral and new launch pads can be constructed at these locations for the reusable launch vehicles program, rather than purporting to cause further environmental pollution in numerous states.

2 The FAA's DPEIS is nothing more than a pretense for the *resurrection* of the 'Single Stage-to Orbit' (SSTO) program which had its funding cut. The goal of that program was to build spaceships that would take off straight up and would operate from spaceports located in any state— basically what is discussed in the FAA DPEIS.

1

3 It is interesting that NASA and the Air Force are cooperating agencies with the FAA, as those entities will benefit the most by being issued new experimental permits under the DPEIS proposed method, since NASA is currently working on developing new reusable launch vehicles to replace the space shuttle and the Air Force was involved with the previous SSTO program.

Coincidently, there are people who presently have, or had NASA and Air Force connections or employment who will most probably personally benefit financially from recreating the SSTO program and 'Spaceports' if the FAA can be convinced into changing its experimental permit process.

Since I live in Kodiak, Alaska, I can speak only on the Kodiak Launch Complex (KLC) listed in the PEIS as one of the launch sites for the proposed Reusable Launch Vehicles Program.

4 The KLC is located in Narrow Cape on Alaska state 'public' land and the Alaska Aerospace Development Corporation (AADC) is leasing land from the Department of Natural Resources (DNR). Already there are enough annual military launches from the KLC, which cuts off Narrow Cape public access before launches and any future experimental testing of reusable launch vehicles/spacecraft would further impact Kodiak residents from having access to Narrow Cape and Fossil Beach *public* land, especially if up to 1,000 annual launches could take place from any one launch site as stated in the DPEIS.

According to Alaska statues, public lands are to be used to most benefit the public as a whole, rather than private agencies with their own agendas. Public recreational areas on Kodiak Island are very limited due to the fact that the road system is only 45-50 miles long, and the majority of any potential recreational areas are inaccessible due to the cliffs along the road system or private land ownership. Also, 75% of the land on Kodiak Island is federally owned and road less.

5 Currently there are approximately 2-3 dozen privately owned cabins and at least one large home located at Pasagshak, which is only a few miles from the KLC, but yet close enough for toxic rocket plume exhaust to reach the area depending on the wind direction on launch days. Pasagshak is used for numerous recreational activities most every day in the summer time and some local residents use their cabins/homes year-around, especially since the paved road to the KLC is maintained all year.

6 Based on the 2000 U.S. Census Bureau, Kodiak's population was 13,913 (not 6,000 as stated in the PEIS) and the 2008 estimate was 13,049. Over 35% of Kodiak's population is under the age of 18 years old (U.S. Census Bureau).

7 **Section 3.4.11.3—Children's Environmental Health and Safety** states that because the KLC is not near schools, daycare facilities, playgrounds, or other places where children are concentrated, no further consideration of the protection of children from environmental health and safety risks is required. However, during the summer months

2

there are large numbers of children recreating at Pasagshak, and no scientific research has been done in Kodiak to determine whether or not any children's respiratory systems have been affected by breathing in the drifting, toxic rocket exhaust after launches (depending on wind direction). Nor have any studies been done on adults. So, for the PEIS to state there would be no adverse affects on children, it has not been scientifically proven that children would not be affected from rocket/missile toxins.

Recent news reports have stated that scientific research has discovered missile/rocket residue toxins in cows milk that children are drinking in the state of California due to accumulative launches from Vandenberg AFB and the cows eating contaminated grass and feed. The assumption must be made that the same toxic missile/rocket exhaust by-products can be found in Kodiak's Narrow Cape vegetation being eaten by the local buffalo. The buffalo meat is sold for human consumption. Only blood test research would show what current toxins are in the buffalos bodies or meat from accumulative rocket/missile launches over past years.

The KLC has always been a controversial issue with a large number of local residents feeling the KLC is of no national or local benefit as determined in a local poll in the Kodiak Daily Mirror. As stated in the DPEIS, the reusable launch vehicle program "will have no notable change in the health of the local economy because of the small launch staff." However, as also stated in the PEIS, there will be detrimental effects on Narrow Cape vegetation from launches and reentries (scorching, e.g.).

8 The DPEIS makes assumptions there would be no environmental impacts from launches and reentry of reusable launch vehicles. However, PEIS **Section 3.4.1---- Air Quality** states Kodiak Island Borough is considered unclassifiable for state standards for reduced sulfur compounds and other chemicals and no ambient air quality data are available for the vicinity of KLC since the nearest monitoring station is 130 miles north (USAF). Since KLC data is lacking and no reusable launch vehicles have been tested at the KLC, how was the conclusion reached that there would be no environmental impacts from reusable launch vehicles if 300 to 1,000 launches and reentries could take place annually from one location?

9 **Section 4.10.2.3---Kodiak Launch Complex,** states the emissions from the KLC would contribute to cumulative air quality impacts in the area. Refer back to **Section 3.4.11.4—Children's Environmental Health and Safety.**

10 As stated in the 1996 KLC EA, an earthquake fault runs through the land tip of Narrow Cape and below the KLC. According to the United States Geological Survey, Kodiak Island experienced 30 separate seismic events last week, between May 14, 2009 and May 16, 2009. The largest was a magnitude of 4.9. Another quake hit this week on May 18, 2009 (Kodiak Daily Mirror—May 18, 2009). Considering frequent earthquake activity around Kodiak Island and the large amounts of liquid/solid fuel propellants that would be needed and stored at the KLC for the Reusable Launch Vehicle Program—not including fuel for military launches, it would be irresponsible for the FAA to continue giving permits for any new, experimental programs at the KLC. The Kodiak Launch Complex

3

should be excluded from the sites being proposed for the Reusable Launch Vehicle program.

Section D.2.2—Site-Specific Cumulative Emissions

11 The Minotaur IV is mentioned in this section but it does not specifically state where the Minotaur IV would be launched or if it is being included as part of the PEIS, but there is a September 2009 Minotaur IV launch scheduled to launch from the Kodiak Launch Complex. If the FAA has already given a permit for this launch, it has not been made public. The FAA must be aware that launching the Minotaur IV from the Kodiak Launch Complex would be in violation of the START treaty, unless Russia and the United States come to a new agreement before the year's end. More explanation is needed regarding the Minotaur IV and proposed launch sites, as it is not a 'reusable' launch vehicle, and I am not quite sure why it was referred to at all in the DPEIS.

12 Finally, the April 10, 2009 FAA DPEIS Federal Register Notice was *not* published in the Kodiak Daily Mirror so that local people were aware of its existence and could send in comments. I happened to see the notice online. I would like to ask for an extension for the comment deadline and request that the FAA personally publish the notice in the Kodiak Daily Mirror to give other Kodiak residents the option to send in comments.

Carolyn Heitman
cheitman@acsalaska.net

4

Response to Comment Letter 11:

11-01
Thank you for your comments. The FAA will make a decision on either the Proposed Action or the No Action Alternative no earlier than 30 days after publication of this Final PEIS. The FAA will make its decision based on the entire environmental record including the PEIS, scoping comments, and public comments on the Draft PEIS. The PEIS analyzes the potential environmental impacts of launches under experimental permits at seven FAA-licensed launch sites and one Federal range. A site-specific analysis is provided for each site. Additional environmental review may be required once the FAA receives an application for an experimental permit.

11-02
As stated in Section 1.1, the FAA prepared this PEIS with cooperation from the National Aeronautics and Space Administration (NASA) and the U.S. Air Force (USAF) to examine the environmental impacts of an alternative approach for complying with NEPA when reviewing applications for reusable suborbital rockets operating under experimental permits. The intent of this PEIS is to facilitate the preparation of environmental documents for the issuance of experimental permits to individual launch operators.

11-03
NASA and the USAF are cooperating agencies in the development of this PEIS. However, experimental permits are intended to promote commercial space flight. NASA and the USAF are not eligible for experimental permits.

11-04
The establishment of the Alaska Aerospace Development Corporation and the ownership of land at KLC are outside the scope of this PEIS. The expected level of military launch activity and other launches are covered in the cumulative impacts analysis in Section 4.10.2.3 of this PEIS. Impacts to public access and the potential closure of public lands are covered in Section 4.4.7 of the PEIS. The PEIS states that the potential need to close recreational areas is not known at this time and would be based on an applicant's proposed rocket type and size, and defined operating area. The PEIS analyzes a maximum of 600 annual launches under experimental permits at KLC.

11-05
Pasagshak State Recreation Area is located approximately 6 miles northwest of KLC. Exhaust plume dispersion modeling for launches at KLC has previously shown that applicable air quality standards would not be expected to be exceeded at or beyond the KLC facility boundary under worst-case meteorological conditions (FAA, 1996). Emissions from the reusable suborbital rockets expected to be launched under experimental permits were analyzed using concept vehicles for Vertical 1 that burn ethanol and LOX propellant, and for Vertical 2 that burn kerosene and LOX. Both of these propellants undergo almost complete oxidation to CO, CO_2, H_2O, and some NO_x. No particulates or chlorine are emitted in the exhaust plume. In addition, the prevailing winds at KLC are from the northwest, which would normally transport exhaust emissions

created during a launch towards the ocean and away from populated areas, including Pasagshak State Recreation Area (FAA, 1996).

11-06
Section 3.4.11.1 of the PEIS correctly states that the population of Kodiak according to the 2000 Census was 6,334. The 2000 Census shows the population of Kodiak Island Borough as 13,913. The FAA has added the Kodiak Island Borough population to Section 3.4.11.1.

11-07
As explained in the response to comment 11-05 above, exhaust emissions created during a launch at KLC would normally be blown towards the ocean and away from populated areas, including Pasagshak State Recreation Area.

Concerning the comment on recent news reports about rocket residue toxins in cows' milk, the FAA assumes the commenter is referring to a U.S. Centers for Disease Control and Prevention finding that 15 brands of powdered infant formula were contaminated with perchlorate. Perchlorate is a rocket fuel component that has been found in the drinking water in 28 states and territories. The finding indicates that the contamination reached the formula through reconstituting cows' milk with contaminated water. The finding does not indicate that rocket exhaust emissions and subsequent deposition of exhaust products caused the contamination. In addition, ammonium perchlorate is a component of solid propellants used in rockets. As explained in Section 2.1.1.2 of the PEIS, the FAA does not expect reusable suborbital launch vehicles operating at KLC under experimental permits to use solid propellants. Solid propellants are more typically used in boosters for expendable rockets.

11-08
Section 3.4.1 of the PEIS states that Kodiak Island Borough meets all Federal and state standards for criteria air pollutants and that no ambient air quality data are available for the vicinity of KLC. Monitoring sites are not located in the vicinity of KLC due to the lack of industrial activity and generally good air quality. State agencies generally focus air quality monitoring funds on areas with poorer air quality. The impacts analysis in the PEIS relies on emissions data from similar launch activities conducted at other sites. The analysis of air quality impacts for KLC is contained in Section 4.4.1 of the PEIS and additional information on likely air quality impacts is contained in Section 4.1.1.

11-09
Section 4.10.2.3 concludes that emissions from the Proposed Action at KLC would not significantly affect air quality in the troposphere. Any level of emissions from launches of reusable suborbital rockets at KLC, no matter how minor, would contribute to cumulative air quality impacts. The cumulative impacts of emissions from KLC would remain low when current and reasonably foreseeable future activities are added to the emissions from the Proposed Action.

11-10
Section 3.4.5 of the PEIS describes the handling and storage of fuel and hazardous materials at KLC. All storage and handling is conducted in accordance with applicable federal and State of Alaska regulations. KLC is an FAA-licensed commercial launch site and as such, is one of eight licensed sites that could be used for launches of reusable suborbital rockets under experimental permits.

11-11
The cumulative impacts analysis contained in Section 4.10 and referenced in Appendix D, Section D.2.2, evaluates the impacts of past, present, and reasonably foreseeable future actions in addition to the activities under the Proposed Action. For KLC, this includes the maximum annual launch activity of 600 launches under experimental permits, plus other estimated launch activity from other programs. Exhibit 4-17 shows the estimated launch activity per year from 2009 to 2014 for each of the eight sites analyzed in the PEIS. The Minotaur launch vehicle shown in Exhibit 4-17 is not part of the Proposed Action in this PEIS and would not be launched under an experimental permit. It is included in Exhibit 4-17 for the purpose of analyzing potential cumulative impacts to air quality.

11-12
For the following reasons, the FAA has decided that it is not necessary to extend the comment period for the Draft PEIS. The Proposed Action addressed in this PEIS is national in scope. It pertains to whether or not FAA should use the PEIS to facilitate the preparation of environmental documents for future applications for experimental permits. Consequently, implementation of the Proposed Action would not result in any localized impacts at this time. In the future, should the FAA receive an experimental permit application involving launches at the KLC, the FAA would prepare the appropriate NEPA document at that time and notify the affected public, through a notice in the newspaper of general circulation in Kodiak, of the opportunity to review and comment on any resulting draft EA or EIS. To date, the FAA has not approved any experimental permits that would use the KLC.

Comment Letter: 12

California Regional Water Quality Control Board
Lahontan Region

Linda S. Adams
Secretary for Environmental Protection

Victorville Office
14440 Civic Drive, Suite 200, Victorville, California 92392
(760) 241-6583 • Fax (760) 241-7308
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Arnold Schwarzenegger
Governor

May 21, 2009

File: Environmental Doc Review
Kern County

Stacey M. Zee
U.S. Federal Aviation Administration
800 Independence Avenue, SW
Washington, DC 20591
Fax: (703) 934-3951
PEIS-ExperimentalPermits@icfi.com

COMMENTS ON THE DRAFT PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT FOR STREAMLINING THE PROCESSING OF EXPERIMENTAL PERMIT APPLICATIONS, MOJAVE AIR AND SPACE PORT, KERN COUNTY, STATE CLEARINGHOUSE NO. 2009044006

California Regional Water Quality Control Board, Lahontan Region (Water Board) staff received the Draft Programmatic Environmental Impact Statement (PEIS) for Streamlining the Processing of Experimental Permit Applications. The Draft PEIS, dated April 2009, was prepared by the U.S. Federal Aviation Administration (FAA) to examine an alternative approach to comply with the National Environmental Policy Act (NEPA) and expedite the preparation of environmental documents for the issuance of experimental permits to individual launch operators of reuseable suborbital rockets. The FAA contends that by providing general information common to all reusable suborbital rockets and analyzing the environmental impacts that may result from the launch and reentry of such rockets at specified facilities, site-specific environmental documents could be tiered from the PEIS as applications for experimental permits are received. Subsequent tiered environmental documents would then address project-specific environmental impacts and the potential for any cumulative impacts beyond what is addressed in the PEIS.

The FAA identified eight facilities, nationwide, that met the necessary infrastructure and safety requirements to support the operation of reusable suborbital rockets. The PEIS evaluated each of these sites with respect to rocket launch, reentry, and general maintenance and analyzed the potential impacts as a result of these activities on various environmental resources including hazardous materials, pollution prevention, solid waste generation, natural resources, water quality, and wetlands. Mojave Air and Space Port (Kern County), located in the Lahontan Region, is included as one of the eight facilities analyzed.

Water Board staff has reviewed the Draft PEIS with respect to the operation of suborbital rockets at the Mojave Air and Space Port (MASP) and the potential impacts to water quality that may result from these activities. We are submitting the following

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comments in compliance with NEPA Guidelines, which requires responsible agencies to specify the scope and content of the environmental information germane to their statutory responsibilities. The Water Board requests that the following comments be considered in the preparation of the final PEIS.

Basin Plan

The State Water Resources Control Board (SWRCB) and the Water Board regulate discharges in order to protect the water quality and, ultimately, the beneficial uses of waters of the State. The Water Quality Control Plan for the Lahontan Region (Basin Plan) provides guidance regarding water quality and how the Water Board may regulate activities that have the potential to affect water quality within the region. The Basin Plan
1 includes prohibitions, water quality standards, and policies for implementation of standards. The Basin Plan can be accessed via the Water Board's web site (http://www.waterboards.ca.gov/lahontan/water_issues/programs/basin_plan/references.shtml).

We request that the PEIS reference the Basin Plan in the water quality impact analysis for the MASP and require that tiered environmental documents prepared for projects within the Lahontan Region comply with all applicable water quality standards and prohibitions, including provisions of the Basin Plan.

Potential Impacts to Surface Waters

Surface waters include, but are not limited to, drainages, streams, washes, ponds, pools, or wetlands, and may be perennial or intermittent. Beneficial uses for any blue-line streams (potential waters of the U.S.) and other drainages (waters of the State) recognize additional characteristics of water bodies including their ability to provide groundwater recharge and protect water quality. Characteristics, which enable surface waters to protect water quality enhancement include, but are not limited to, riparian
2 vegetation and stream bank configuration. Natural drainage, including the use of vegetated buffer zones and rock swales, is the most effective means of filtering sediment and pollution and regulating the volume of runoff from land surfaces to adjacent streams, including washes.

The Draft PEIS states that there are "no bodies of surface water" at the MASP. While we recognize that there may not be perennial water flow or standing bodies of water within the vicinity of the MASP, published topographic maps indicate the presence of both marked (blue-line) and unmarked drainages located east and southwest of the MASP runways. The FAA is obligated to evaluate the potential impacts to these surface waters as a result of implementing the proposed action.

Groundwater Resources

3 The Antelope Valley groundwater basin is currently in a state of overdraft. The Draft PEIS did not identify the additional water resources needed for the proposed action, which may include the use of groundwater for fugitive dust control and/or soil compaction. We request that the FAA include in the PEIS recommendations to perform

Ms. Zee - 3 - May 21, 2009

water supply analyses for project-specific tiered environmental analyses that propose the use of groundwater resources at the MASP. Alternative water sources that would lessen the overdraft on the groundwater aquifer, but would not potentially impact water quality should be considered. As outlined in the State Water Resources Control Board policy on recycled water, approved February 3, 2009 (http://www.waterboards.ca.gov/water_issues/programs/water_recycling_policy/index.shtml), the Water Board encourages the use of recycled water in a manner consistent with state and federal water quality laws.

Closing

Thank you for the opportunity to comment on the Draft PEIS. We request that Water
4 Board staff be given the opportunity to review and comment on the final version of the PEIS and all subsequent tiered environmental documents prepared for projects located within the Lahontan Region. If you have any questions regarding this letter, please contact me at (760) 241-7376 (jzimmerman@waterboards.ca.gov) or Patrice Copeland, Senior Engineering Geologist, at (760) 241-7404 (pcopeland@waterboards.ca.gov).

Sincerely,

Jan M. Zimmerman, PG
Engineering Geologist

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California Environmental Protection Agency

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Response to Comment Letter 12:

12-01
The FAA has added a description of the Water Quality Control Plan for the Lahontan Region to Section 3.6.12.1 of the PEIS. All activities conducted under an experimental permit at the Mojave Air and Space Port would have to comply with applicable water quality standards.

12-02
The FAA has added a description of the surface water drainage channels to Section 3.6.12.1 of the PEIS and has addressed potential impacts to those surface waters in Section 4.6.12.1.

12-03
The FAA has added information on the status of the Antelope Valley groundwater basin to Section 3.6.12.2. As stated in Section 4.6.12.2, FAA expects that demands on groundwater to support launch operations would be negligible.

12-04
The California Regional Water Quality Control Board, Lahontan Region is on the distribution list for the PEIS and will receive notification of the publication of the Final PEIS and any subsequent tiered environmental documents.

Comment Letter: 13

STATE OF CALIFORNIA Arnold Schwarzenegger, Governor

NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-6251
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STATE CLEARING HOUSE

May 21, 2009

Ms. Stacey M Zee
UNITED STATES FEDERAL AVIATION ADMINISTRATION
800 Indepence Avenue, SW
Washington, D.C. 20591

Re: SCH#2009044006; NEPA Notice of Completion; draft Environmental Impact Statement (DEIS) for the Streamlling the Processing of Experimental Permit Applications; Kern County, California Location

Dear Ms. Zee:

The Native American Heritage Commission (NAHC) is the California state 'trustee agency' pursuant to Public Resources Code §21070 designated to protect California's Native American Cultural Resources. The NAHC is also a 'reviewing agency' for environmental documents prepared under the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq*) and that are subject to the Tribal and interested Native American consultation requirements of the National Historic Preservation Act, as amended (Section 106) (16 U.S.C. 470). The provisions of the Native American Graves Protection and Repatriation Act (NAGPRA) (25 U.S.C. 3001-3013) and its implementation (43 CFR Part 10.2) apply to this project if Native American human remains are inadvertently discovered.

The NAHC is of the opinion that the federal standards, pursuant to the above-referenced Acts and the Council on Environmental Quality (CSQ; 42 U.S.C. 4371 *et seq*) are similar to and in many cases more stringent with regard to the 'significance' of historic, including Native American items, and archaeological, including Native American items than the California Environmental Quality Act (CEQA.). In most cases, federal environmental policy require that any project that causes a substantial adverse change in the significance of an historical resource, that includes archaeological resources, is a 'significant effect' requiring the preparation of an Environmental Impact Statement (EIS). Both of the above-referenced projects contain known Native American cultural resources whose presence should be considered in the project planning of both.

Early consultation with Native American tribes in your area is the best way to avoid unanticipated discoveries once a project is underway. Enclosed are the names of the nearest tribes that may have knowledge of cultural resources in the project area. A list of Native American contacts is attached to assist you. It is advisable to contact the persons listed and seek to establish a 'trust' relationship with them; if they cannot supply you with specific information about the impact on cultural resources, they may be able to refer you to another tribe or person knowledgeable of the cultural resources in or near the affected project area.

Lack of surface evidence of archeological resources does not preclude the existence of
1 archeological resources. Lead agencies should consider avoidance, in the case of cultural resources that are discovered. A tribe or Native American individual may be the only source of information about a cultural resource.

NEPA regulations provide for provisions for accidentally discovered archeological resources during construction and mandate the processes to be followed in the event of an accidental discovery of any human remains in a project location other than a 'dedicated cemetery. Even though a discovery may be in federal property, California Government Code §27460 should be followed in the event of an accidental discovery of human remains during any ground-breaking activity; in such cases California Health & Safety Code §7050.5 may apply.

If you have any questions about this response to your request, please do not hesitate to contact me at (916) 653-6251.

Sincerely,

Dave Singleton, Program Analyst

Attachment: Native American Contacts list for Section 106 Consultation

Native American Contacts
Kern County
May 21, 2009

Santa Rosa Rancheria
Clarence Atwell, Chairperson
P.O. Box 8 — Tache
Lemoore , CA 93245 — Tachi
(559) 924-1278 — Yokut
(559) 924-3583 Fax

Tejon Indian Tribe
Kathy Morgan, Chairperson
2234 4th Street — Yowlumne
Wasco , CA 93280 — Kitanemuk

Tule River Indian Tribe
Ryan Garfield, Chairperson
P.O. Box 589 — Yokuts
Porterville , CA 93258
chairman@tulerivertribe-nsn.
(559) 781-4271
(559) 781-4610 FAX

Kern Valley Indian Council
Robert Robinson, Historic Preservtion Officer
P.O. Box 401 — Tubatulabal
Weldon , CA 93283 — Kawaiisu
brobinson@mchsi.com — Koso
(760) 378-4575 (Home) — Yokuts
(760) 549-2131 (Work)

Ron Wermuth
P.O. Box 168 — Tubatulabal
Kernville , CA 93238 — Kawaiisu
warmoose@earthlink.net — Koso
(760) 376-4240 - Home — Yokuts
(916) 717-1176 - Cell

Tubatulabals of Kern Valley
Donna Begay, Tribal Chairwoman
P.O. Box 226 — Tubatulabal
Lake Isabella , CA 93240
(760) 379-4590
(760) 379-4592 FAX

Kitanemuk & Yowlumne Tejon Indians
Delia Dominguez
981 N. Virginia — Yowlumne
Covina , CA 91722 — Kitanemuk
(626) 339-6785

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed SCH#2009044006; NEPA Notice of Completion; draft Environmental Impact Statement (DEIS) for the Streamlining the Processing of Experimental Permit Applications; Project location: Kern County, California

Response to Comment Letter 13:

13-01
The Proposed Action does not involve any construction or ground disturbance activities. Consequently, archaeological resources would not be affected. In the future, if an experimental permit application is received that would require construction or ground disturbance activities, additional NEPA documentation (either an EA or EIS) would be required (see Section 1.5.3 and Appendix A of this PEIS). That NEPA document would tier from this PEIS and would focus on the resource area(s) and impact(s) that were not addressed in this PEIS. As part of that NEPA process, consultation with all relevant agencies and Native American tribes would be conducted.

Comment Letter: 14

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

MAY 26 2009

Ms. Stacey M. Zee
FAA Environmental Specialist
FAA Experimental Permits PEIS
c/o ICF International
9300 Lee Highway
Fairfax, VA 22031

Dear Ms. Zee:

In accordance with National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the Environmental Protection Agency (EPA) has reviewed the Federal Aviation Administration's (FAA) draft Programmatic Environmental Impact Statement (EIS) for Streamlining the Processing of Experimental Permit Applications (CEQ #20090102).

Under the proposed action, FAA would issue experimental permits for the launch and reentry of reusable suborbital rockets from both FAA-licensed and non-licensed launch sites using this programmatic EIS as the basis for determining the potential environmental impacts of issuing experimental permits. FAA analyzed the potential impacts of issuing an experimental permit for the operation of reusable suborbital rockets from anywhere in the United States and abroad, and the potential site-specific impacts of permitted launches from seven FAA-licensed commercial launch sites and one Federal range. FAA can tier future environmental documents from this programmatic EIS to focus on environmental impacts specific to an applicant's proposed operations under an experimental permit.

1 EPA believes that this programmatic EIS provides an adequate discussion of the potential environmental impacts of issuing experimental permits. Therefore, EPA has no objection to the proposed action discussed in this draft EIS.

We appreciate the opportunity to review this draft EIS. The staff contact for this review is Ken Mittelholtz (202-564-7156).

Sincerely,

Susan E. Bromm

Susan Bromm
Director
Office of Federal Activities

Response to Comment Letter 14:

14-01
Thank you for your comment.

Comment Letter: 15

GOVERNOR
Bill Richardson

DIRECTOR AND SECRETARY
TO THE COMMISSION
Tod Stevenson

Robert S. Jenks, Deputy Director

STATE OF NEW MEXICO
DEPARTMENT OF GAME & FISH

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Hobbs, NM

May 26th, 2009

Ms. Stacey M. Zee,
FAA Environmental Specialist
Spaceport America EIS, ICF International
9300 Lee Highway
Fairfax, VA 22031

Re: Draft Programmatic Environmental Impact Statement for Streamlining the Process of Experimental Permit Applications. NMGF No. 12645

Dear Stacey Zee,

In response to your letter dated April 1st 2009, regarding the above referenced project, the Department of Game and
Fish (Department) has concerns that the PEIS fails to adequately address the cumulative and indirect impacts that
the Spaceport will have on wildlife. There is a lack of supporting documentation as to how the conclusion of no
1 significant impacts to Chihuahaun semi-desert grasslands was reached. Some of the significant impacts would be the
direct loss of Chihuahuan semi-desert grassland habitat, fragmentation of habitat, and displacement of wildlife onto
adjacent lesser quality habitats. Chihuahuan semi-desert grasslands are identified in the Comprehensive Wildlife
Conservation Strategy for New Mexico as a key terrestrial habitat type. This habitat type is very important to
grassland birds and has been identified for conservation by the World Wildlife Fund. The Department is also
concerned that launches from the vertical launch pad at Spaceport America NM will negatively impact a wildlife
water that is within 100 yards of the launch pad. Launch and prelaunch activity will most likely render this wildlife
2 water unsuitable for wildlife use due to its proximity to the launch pad and the human activity associated with the
pad. The department recommends that as a mitigation measure Spaceport America fund a replacement wildlife water
at a location far enough from the Spaceport that human activities will not impact its use by wildlife.

Thank you for the opportunity to review and comment on your project. If you have any questions, please contact Patrick Mathis, Southwest Area Habitat Specialist at (575) 532-2108 or patrick.mathis@state.nm.us.

Sincerely,

Michael Gustin
Assistant Chief-Lands, Conservation Services Division

MG/pm

xc: Wally Murphy, Ecological Services Field Supervisor, USFWS
Luis Rios, SW Area Operations Chief, NMDGF
Pat Mathis, SW Area Habitat Specialist, NMDGF

Response to Comment Letter 15:

15-01
Impacts such as direct loss of Chihuahuan semi-desert grassland habitat, habitat fragmentation and wildlife displacement would primarily result from construction of the Spaceport America facility. This PEIS addresses the environmental consequences of issuing experimental permits for rocket launches at Spaceport America. As such, the focus of our analysis is on the environmental consequences of launch operations and assumes that all facilities and infrastructure at Spaceport America would be fully constructed. An analysis of impacts to the Chihuahuan semi-desert grassland community resulting from facility construction is presented in the *Final EIS for the Spaceport America Commercial Launch Site, Sierra County, New Mexico.*

The PEIS does acknowledge that some minor, short-term impacts to wildlife may result from launch operations, including disturbance of wildlife through noise generated by launch activities (see Section 4.1.2.1 of the PEIS). In the Record of Decision for the *Final EIS for the Spaceport America Commercial Launch Site, Sierra County, New Mexico,* FAA agreed that the following mitigation measures would be considered, as deemed necessary and appropriate, in order to mitigate impacts to wildlife and the Chihuahuan semi-desert grassland habitat:

- Enhancement of off-site desert grassland habitats, primarily through mesquite/creosote brush control to increase herbaceous growth, to replace those grassland habitats made un-usable or inaccessible by Spaceport America construction and/or operation; and
- Monitoring of wildlife populations within and/or near the project area to examine for potential shifts in density and diversity.

15-02
Noise associated with launch activities could startle wildlife and temporarily disrupt their activities, including usage of the existing wildlife water catchment near the vertical launch area (for a more detailed discussion of impacts to wildlife, see Section 4.1.2.1 of the PEIS). In the Record of Decision for the *Final EIS for the Spaceport America Commercial Launch Site, Sierra County, New Mexico,* FAA agreed that the following mitigation measures would be considered, as deemed necessary and appropriate, in order to mitigate impacts to wildlife:

- Creation and/or refurbishment of off-site watering areas (drinkers and catchments) to replace those watering areas that may be impacted by Spaceport America construction and/or operation and to improve off-site habitats for wildlife.

Comment Letter: 16

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, DC 20240

TAKE PRIDE IN AMERICA

9043.1
PEP/NRM

ER 09/358

JUN 3 2009

Mr. Michael McElligott
Manager, Space Systems Development Division
Office of the Associate Administrator for
Commercial Space Transportation
Federal Aviation Administration
800 Independence Avenue, SW
Washington, DC 20591

Dear Mr. McElligott:

The Department of the Interior has reviewed the April 2009 Draft Programmatic Environmental Impact Statement (DPEIS) for **Streamlining the Processing of Experimental Permit Applications** and have the following comments.

Specific Comment

Section 3.2.12.2 Groundwater, page 3-37, second paragraph, second sentence

The concentration of dissolved solids is the sum of constituents including calcium, magnesium (major component of hardness), and chloride, among others (Hem, 1985, p.165). Therefore, it seems unlikely that the concentration of dissolved solids in the
1 groundwater could be less than the hardness or the concentration of chloride, as reported in this sentence.

Hem, J.D., 1985, Study and Interpretation of the Chemical Characteristics of Natural Water, 3rd edition, U.S. Geological Survey Water Supply Paper 2254, 263 p. Available on the Internet at: http://pubs.er.usgs.gov/usgspubs/wsp/wsp2254

Thank you for the opportunity to review and comment on the DPEIS. If you have any questions concerning our comment, please contact Lloyd Woosley, Chief of the USGS Environmental Affairs Program, at (703) 350-8797 or at lwoosley@usgs.gov.

Sincerely,

Willie R. Taylor
Director, Office of Environmental Policy
and Compliance

Response to Comment Letter 16:

16-01
The FAA has revised Section 3.2.12.2 of this PEIS to remove the dated information on groundwater contamination levels. The text has been replaced with a general discussion of groundwater contamination and the Installation Restoration Program in place at Vandenberg Air Force Base.