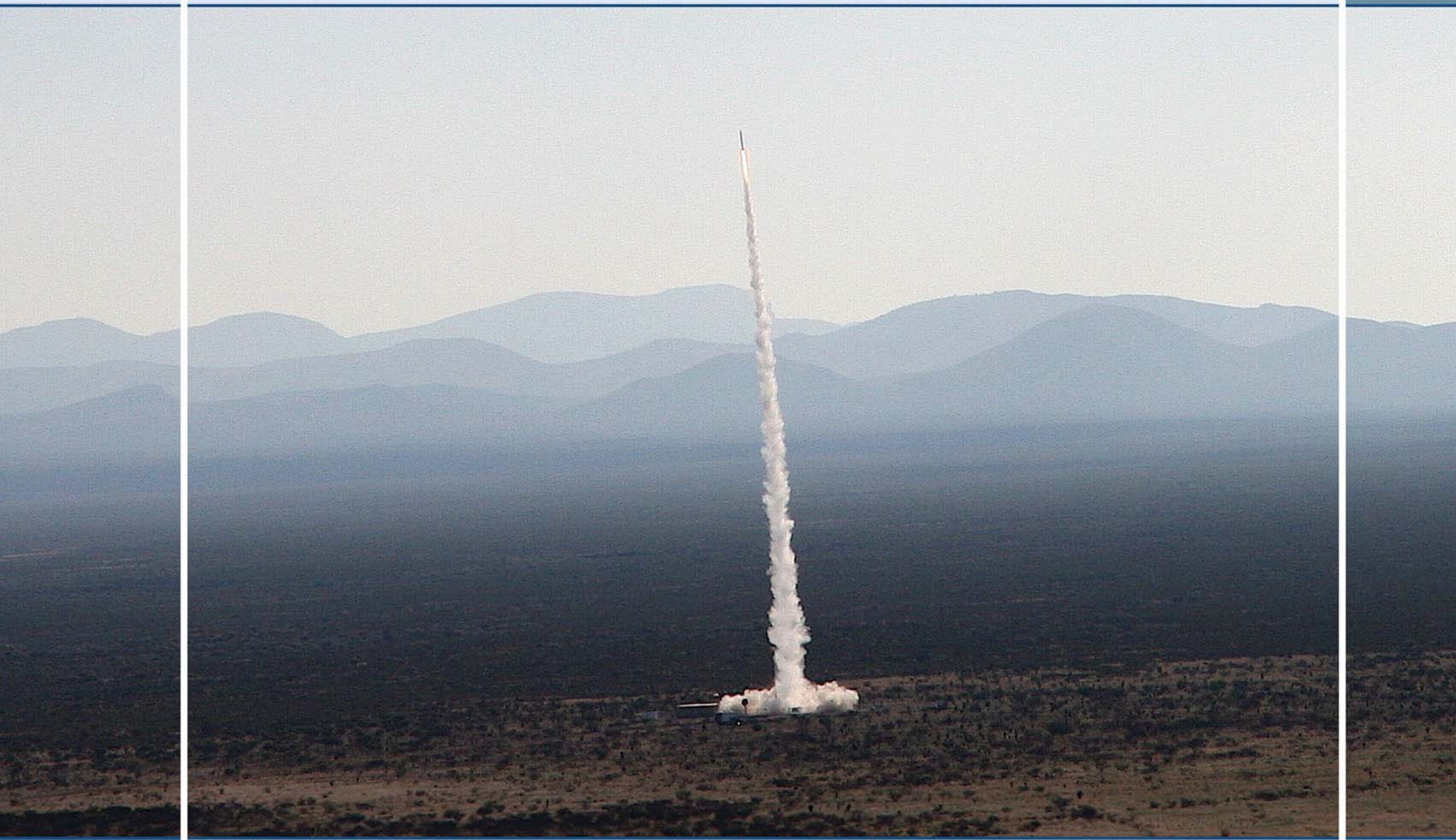
Federal Aviation Administration



Draft Environmental Impact Statement for the Spaceport America Commercial Launch Site, Sierra County, New Mexico

JUNE 2008

Draft Environmental Impact Statement
for the Spaceport America Commercial Launch Site,
Sierra County, New Mexico

AGENCIES: Federal Aviation Administration (FAA), lead agency; Bureau of Land Management, cooperating agency; National Aeronautics and Space Administration, cooperating agency; National Park Service, cooperating agency; White Sands Missile Range, cooperating agency

PUBLIC REVIEW PROCESS: This Draft Environmental Impact Statement (EIS) is submitted for review pursuant to 42 U.S.C. 4332(2)(c) (Section 102(2)(c) of the National Environmental Policy Act (NEPA)), 49 U.S.C. 303(c) (Section 4(f) of the Department of Transportation Act), and 16 U.S.C. 470 (the National Historic Preservation Act). In accordance with NEPA, the FAA has initiated a public review and comment period for the Draft EIS for the Spaceport America Commercial Launch Site, Sierra County, New Mexico. The Notice of Availability of the Draft EIS was announced in the Federal Register. This notice initiated the beginning of the Draft EIS public comment period, which will end on August 18, 2008. Public hearings on the Draft EIS will be held at the following places and times:

- August 5, 2008, 2:00 PM and 6:30 PM, Alamogordo City Hall (Commission Chambers), 1376 E. Ninth St., Alamogordo, NM
- August 6, 2008, 2:00 PM and 6:30 PM, Truth or Consequences Civic Center, 400 West Fourth St., TorC, NM
- August 7, 2008, 2:00 PM and 6:30 PM, Doña Ana County Government Center, 845 North Motel Blvd, Las Cruces, NM

The purpose of the hearings is to receive comments from the public on the Draft EIS. Comments received on the Draft EIS will be addressed and incorporated into the Final EIS as appropriate.

ABSTRACT: The Draft EIS for the Spaceport America Commercial Launch Site, Sierra County, New Mexico addresses the potential environmental impacts of the Proposed Action, where the FAA would issue a launch site operator license to the New Mexico Spaceport Authority (NMSA) to operate a launch site capable of accommodating both horizontal and vertical launch vehicles. The proposed site is located in Sierra County, approximately 30 miles southeast of Truth or Consequences and 45 miles north of Las Cruces, New Mexico. The Draft EIS also addresses the potential environmental impacts of issuing a launch site operator license for horizontal launches only (Alternative 1), vertical launches only (Alternative 2), and the No Action Alternative.

CONTACT INFORMATION: Comments regarding the Draft EIS can be addressed to Ms. Stacey M. Zee, FAA Environmental Specialist, Spaceport America EIS, c/o ICF International, 9300 Lee Highway, Fairfax, VA 22031; submitted by email to SpaceportAmericaEIS@icfi.com; or faxed to (703) 934-3951.

This Environmental Impact Statement becomes a Federal document when evaluated, signed, and dated by the responsible FAA official.

Responsible FAA Official:

Date: 6/19/08

Dr. George Nield
Associate Administrator for
Commercial Space Transportation

EXECUTIVE SUMMARY

Introduction

The State of New Mexico, New Mexico Economic Development Department (NMEDD) through the New Mexico Spaceport Authority (NMSA) proposes to develop and operate a commercial space launch site, called Spaceport America. The proposed site is in Sierra County near Upham, New Mexico (NM) at a location approximately 45 miles north of Las Cruces, New Mexico (NM) and 30 miles southeast of Truth or Consequences, NM (see Exhibit ES-1). NMSA proposes to operate this site for horizontal and vertical launches of suborbital launch vehicles (LVs). The vehicles may carry space flight participants, scientific experiments, or other payloads. Horizontal LVs would launch and land at the proposed Spaceport America airfield. Vertical LVs would launch from the proposed Spaceport America and would either land at Spaceport America or in the United States (U.S.) Army's White Sands Missile Range (WSMR), which is located approximately 9 miles east of the site.

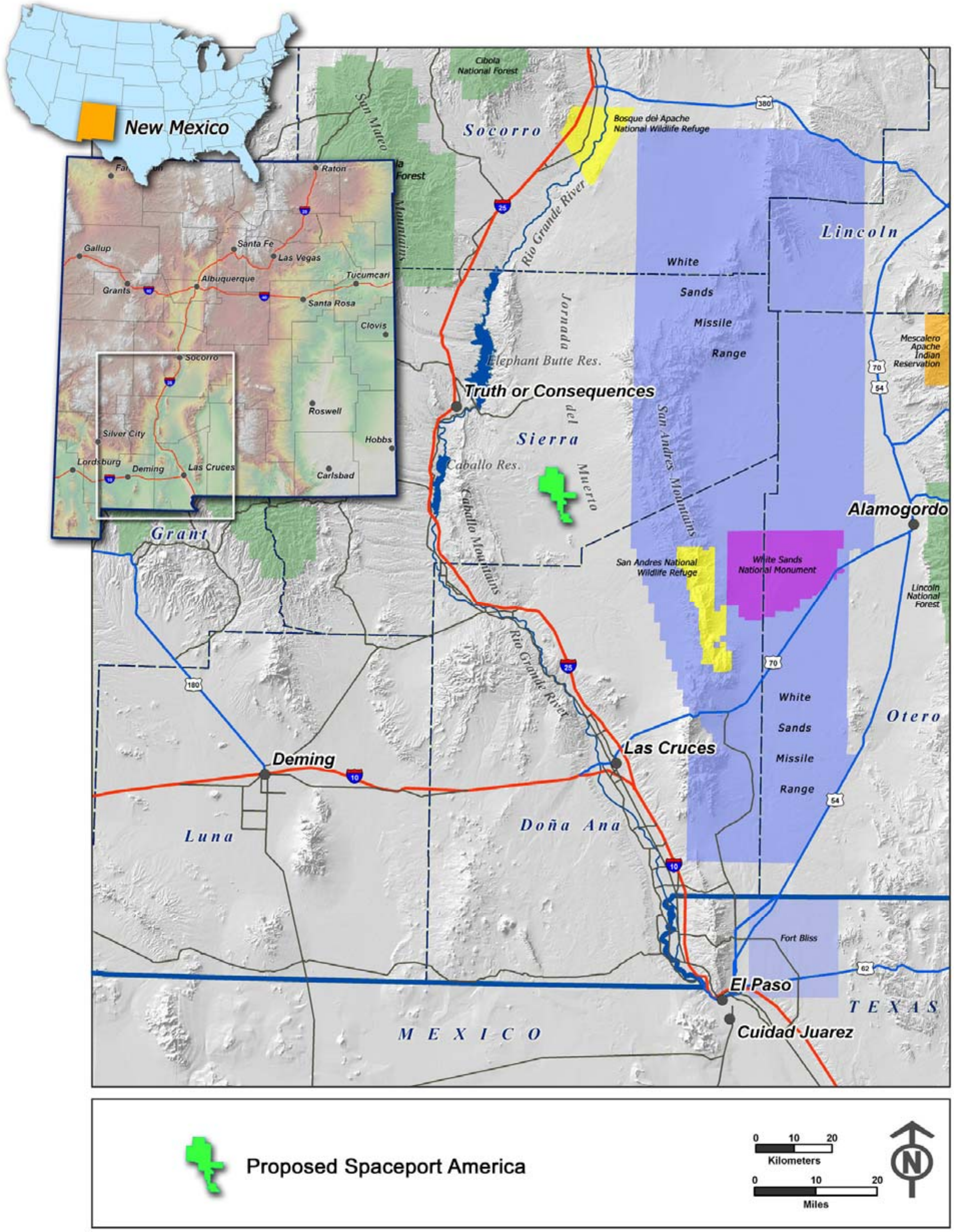
To operate a commercial launch site, the State must obtain a license from the Federal Aviation Administration (FAA), Office of Commercial Space Transportation. The proposed Federal action that is the subject of this Environmental Impact Statement (EIS) is for the FAA to issue a launch site operator license to the NMSA. The National Environmental Policy Act (NEPA) of 1969 as amended (42 USC 4321, et seq.), the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 CFR 1500-1508), and FAA Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures*, direct FAA lead agency officials to consider the environmental consequences when planning for, authorizing, or approving Federal actions. When the FAA issues a launch site operator license, it is considered a Federal action and is subject to review as required by NEPA.

The decision to license the operation of a commercial launch site by the FAA is considered a Federal action. The FAA is responsible for analyzing the environmental impacts associated with licensing proposed commercial launch sites. The FAA is the lead Federal agency responsible for the preparation of the EIS for the proposed Spaceport America. Cooperating agencies include the Bureau of Land Management (BLM), the National Park Service (NPS), the U.S. Army's WSMR, and the National Aeronautics and Space Administration (NASA).

Purpose and Need

The need for the project proposed by NMSA is to establish a long-term source of economic development in southern New Mexico that is based on high technology and can be used to develop educational opportunities. State-sponsored studies have shown great potential benefits to the State in terms of jobs, as well as direct and indirect economic impact. To be successful, the project must meet the expected needs of the commercial space transportation industry for both vertical and horizontal suborbital launch capacity. Several commercial space transportation providers have made commitments to the State contingent on the State's ability to provide the licensed launch facility in a timely way. They have done so because of the inherent advantages offered by the State's proposed site, which features a dry and sunny climate, 4,500-foot launch pad elevation, low population density, contiguous sections of available land, and access to the restricted airspace over nearby WSMR.

Exhibit ES-1. Location of the Proposed Spaceport America with Respect to Surrounding Areas



The purpose of the FAA action in connection with NMSA's request for licensure is to ensure compliance with international obligations of the U.S. and to protect the public health and safety, safety of property, and national security and foreign policy interest of the U.S. during commercial launch or reentry activities; to encourage, facilitate, and promote commercial space launches and reentries by the private sector; and to facilitate the strengthening and expansion of the U.S. space transportation infrastructure, in accordance with the requirements of the Commercial Space Launch Act of 1984 (CSLA), the Commercial Space Transportation Competition Act of 2000 (CSTCA) (49 USC 70101-70121), FAA's commercial space transportation regulations (14 CFR Parts 400-450), the National Space Transportation Policy, and the National Space Policy.

Public Involvement

Public participation in the NEPA process provides for and encourages open communication between the FAA and the public, and promotes better decision-making. Scoping for the development of the EIS began with the publication of the Notice of Intent (NOI) in the Federal Register on January 23, 2006 (71 FR 3915). During scoping, the FAA invited the participation of Federal, State, and local agencies, Native American tribes, environmental groups, citizens, and other interested parties to assist in determining the scope and significant issues to be evaluated in the EIS.

Two scoping meetings were held in February 2006 to request input from the public on concerns regarding the proposed activities as well as to gather information and knowledge of issues relevant to analyzing the environmental impacts associated with the Proposed Action. The scoping meetings were held on February 15 in Truth or Consequences, NM, and on February 16 in Las Cruces, NM. Copies of public notifications, available public meeting materials, and a summary of public scoping comments and other relevant documents are included in Appendix B of this document.

A 45-day public review and comment period will commence upon the publication of a notice in the Federal Register that the Draft EIS is available to the public. The FAA will host public hearings during this comment period during which members of the public, organizations, tribal groups, and government agencies can provide oral or written comments on the Draft EIS. The Final EIS will respond to all substantive comments and will include any changes or edits resulting from the comments received. The FAA will issue a Record of Decision (ROD) no sooner than 30 days after publication of the Final EIS in accordance with CEQ NEPA implementing regulations.

Description of Proposed Action

The Proposed Action is for the FAA to issue a Launch Site Operator License to NMSA that would allow the State to operate Spaceport America for both horizontal and vertical suborbital LV launches. Horizontal LVs would launch and land at the proposed Spaceport America airfield. Vertical LVs would launch from Spaceport America and either land at Spaceport America or at WSMR. Rocket-powered vertical landing vehicles would land on either the Spaceport America airfield or a vertical launch/landing pad. Vertical LVs with components that would return to Earth by parachute would have flight profiles such that these components (i.e., main rocket stages, payload sections, and crew/passenger modules) would land at WSMR. Landings at WSMR would be coordinated and approved in advance by WSMR. In addition, the Proposed Action includes construction of facilities needed to support the licensed launch activities at Spaceport America. The EIS addresses the environmental impacts of constructing and operating such a launch facility, including all related activities and uses that are reasonably foreseeable and any actions considered connected to the Proposed Action within the context of NEPA.

Infrastructure and Construction Activities

The proposed Spaceport America project would include construction of infrastructure to support the operation of the launch site that would be licensed under the Proposed Action. All construction, with the exception of improvements to some existing access roads and installation of a power transmission line and fiber optic cables to the project site, would take place on New Mexico State Trust Land. Off-site access roads, transmission line, and fiber optic cables would cross a mix of State Trust, BLM, and private lands. The construction of any future infrastructure beyond that discussed in this document is not considered reasonably foreseeable for purposes of this NEPA analysis. Any proposed future infrastructure dissimilar to, or beyond the scope of, that included in this analysis would be analyzed in subsequent NEPA analyses as appropriate. The construction proposed in this document is considered conservative, meaning that it represents an overestimate of the actual construction activities that would likely take place during the 5-year term of the Launch Site Operator License.

Development of Spaceport America infrastructure would occur in two phases. The total area of land disturbed by construction would be approximately 970 acres; the total area of the final facilities footprint would be approximately 145 acres. The proposed Spaceport America boundary would encompass approximately 26 square miles. This area currently contains both State and private land.

Operational Activities

As the phased construction activities related to the Proposed Action are completed, Spaceport America would begin operational activities in support of the Proposed Action. Access to the launch site would be controlled by the NMSA (per 14 CFR 420.53). Private-use areas, such as vehicle assembly areas, would be under the administrative control of individual Spaceport America launch operators. These operators would be responsible for adhering to NMSA policies and procedures as well as compliance with FAA regulations.

The operational activities that may have environmental consequences and would support, either directly or indirectly, licensed launches include:

- Transport of Launch Vehicles to the Assembly or Staging Areas
- Transport and Storage of Rocket Propellants and Other Fuels
- Launch, Landing and Recovery Activities for Horizontal Vehicles
- Launch, Landing and Recovery Activities for Vertical Vehicles
- Other Activities
  - Ground-Based Tests and Static Firings
  - Training
  - X Prize Cup Events

Description of Alternatives and No Action Alternative

The FAA identified two alternatives and the No Action Alternative to the Proposed Action, which are considered in this EIS.

Horizontal Launch Vehicles Only (Alternative 1)

Under Alternative 1, the FAA would consider issuing a Launch Site Operator License only for the operation of a launch site to support horizontal launches. In this alternative, the vertical launch complex would not be built; however, road and utility infrastructure would still be built to support amateur launches. Vertical commercial launches licensed or permitted by the FAA would not occur from Spaceport America and no vertical vehicles or components would land at WSMR. However, amateur vertical launches, which do not require a license or permit from the FAA, could still occur. This is considered a feasible alternative because a significant number of launches of horizontal LVs are projected, and most X Prize Cup activities would be located at the airfield.

Vertical Launch Vehicles Only (Alternative 2)

Under Alternative 2, the FAA would consider issuing a Launch Site Operator License only for the operation of a launch site to support vertical launches. In this alternative, the vertical launch complex would be built but the airfield facilities would be more limited than described under the Proposed Action. Many X Prize Cup activities would still be located at the airfield. Horizontal commercial and X Prize Cup launches would not occur from Spaceport America. This is considered a feasible alternative because a significant number of launches are projected to be of vertical LVs.

No Action Alternative

Under the No Action Alternative, the FAA would not issue a Launch Site Operator License to the NMSA. Because the NMSA would not be authorized to offer the site for commercial licensed launches, facilities to support commercial launches would not be constructed. The current land use in the proposed project areas would remain unchanged or the land would be put to some other use, as designated by the entities that have authority over the land, namely the NM State Land Office. The need to support commercial launches and host the X Prize Cup would not be met by the State of New Mexico.

Environmental Consequences of the Proposed Action and Alternatives

Analysis Methodology

Eleven resource areas were considered to provide a context for understanding and assessing the potential environmental effects of the Proposed Action, with attention focused on key issues. The resource areas considered included compatible land use; Section 4(f) properties and farmlands; noise; visual resources and light emissions; historical, architectural, archaeological, and cultural resources; air quality; water quality, wetlands, wild and scenic rivers, coastal resources, and floodplains; fish, wildlife, and plants; hazardous materials, pollution prevention, and solid waste; socioeconomics, environmental justice, and children's environmental health and safety risks, and energy supply and natural resources. For each resource area discussed in this EIS, the Region of Influence (ROI) was determined. The ROI describes a region for each resource area that comprises the area that could be affected by the Proposed Action or alternatives. The environmental consequences associated with the Proposed Action, Alternatives

1 and 2, and the No Action Alternative, were analyzed for the appropriate ROI for each resource area.

Environmental Consequences

Exhibit ES-2, Summary of Environmental Impacts from the Proposed Action and Alternatives, presents a summary of the impacts on the 11 resource areas.

Cumulative Impacts of the Proposed Action

Cumulative impacts are "the incremental impact of the actions 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). The cumulative impacts analysis for this EIS focuses on those past, present, and reasonably foreseeable future actions that have the potential to contribute to cumulative impacts. These past, current, and future projects and activities include the cumulative effect of the Proposed Action as it would occur over the 5-year term of the Launch Site Operator License; ranching operations; railroad and county road construction, maintenance, and use; transmission line construction and maintenance; construction and operation of the existing amateur launch site; BLM habitat restoration activities; designation of El Camino Real as a National Historic Trail (NHT); temporary and permanent improvements to County Road (CR) A013; potential expansion of Spaceport America facilities; increasing the frequency of launches; launching new types of vehicles; BLM leasing and development of oil and gas resources; and development of visitor facilities along El Camino Real NHT The Proposed Action has been evaluated for cumulative impacts on compatible land use; Section 4(f) properties and farmlands; noise; visual resources and light emissions; historical, architectural, archaeological, and cultural resources; air quality; water quality, wetlands, wild and scenic rivers, coastal resources, and floodplains; fish, wildlife, and plants; hazardous materials, pollution prevention, and solid waste; socioeconomics, environmental justice, and children's environmental health and safety risks; energy supply and natural resources; and construction impacts. The results of this evaluation are summarized below.

- **Compatible Land Use** - The Proposed Action would not have significant impacts on land use in the project vicinity. Past projects and activities have been supportive of maintaining the historic and current land use for ranching and have not resulted in land use impacts. Future projects could result in doubling the amount of acreage at Spaceport America removed from grazing use. However, because the vicinity of the project area includes large amounts of rangeland, the cumulative impact on land use from the Proposed Action would not be significant.
- **Section 4(f) Properties and Farmlands** - No impacts to Section 4(f) properties are expected from the Proposed Action. There are no prime or unique farmlands located within or near the proposed project site, so no impacts would occur to farmlands from the Proposed Action. Because there would be no impacts expected from the Proposed Action on these types of resources, there are no cumulative impacts anticipated either.

Exhibit ES-2. Summary of Environmental Impacts from the Proposed Action and Alternatives

Resource Area	Proposed Action	Alternative 1	Alternative 2	No Action Alternative
Compatible Land Use	Impacts on land use are not expected to be significant. Construction and operation would retain most current land uses, while permanently changing land use in a small portion of the total project area from rangeland to spaceport use and support facilities. Reduced levels of grazing beyond the directly disturbed areas may occur due to loss of base waters. Indirect impacts could come from increased noise, air emissions, vehicle use, visual effects, and induced growth in adjacent areas. Temporary indirect impacts would be greatest during construction and special events.	The amount of change in land use and disturbed acreage would be reduced, as compared to the Proposed Action. There would be fewer direct and indirect impacts from construction and operation.	There would be fewer direct and indirect impacts from construction and operation than under the Proposed Action due to fewer facilities and lower levels of launch and non-launch operations. However, construction impacts would only be marginally reduced as both airfield and vertical facilities would be constructed.	No new impacts would occur.
Section 4(f) Properties and Farmlands	No indirect or proximity impacts would meet the standard of constructive use or substantial impairment to potential Section 4(f) properties. No protected farmlands are present and no impacts are expected.	Impacts would the same as for the Proposed Action.	Impacts would be the same as for the Proposed Action.	No new impacts would occur.

Resource Area	Proposed Action	Alternative 1	Alternative 2	No Action Alternative
Noise	Noise impacts are not expected to be significant. Construction noise level would be at background or ambient levels at the nearest residence. Also, the Day-Night average sound level (DNL) noise levels from construction traffic at residences along the roadways would be at peak associated with a small town. Vertical launches would have the highest noise levels, but occur for short periods of time, periodically, and only during daylight hours. Persons within three miles of the launch site would experience loud, but not damaging sound levels. Test firing of rocket engines would be less frequent and less intense. Horizontal launches along with airport operations would generate noise that is more frequent than vertical launches, but noise peaks would be less. 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. The traffic noise of operations would be less than that of the peak of construction, except during the X Prize Cup event, when noise levels are estimated at about 50 dBA at 300 feet from the road, a level that EPA associates with a small town.	Noise impacts would be reduced as compared to the Proposed Action, due to the absence of vertical launches.	Alternative 2 would result in a significant reduction in noise impacts near the spaceport due to the absence of horizontal launches and reentries, and lower levels of flight operations at the airfield.	No new impacts would occur.

Resource Area	Proposed Action	Alternative 1	Alternative 2	No Action Alternative
Visual Resources and Light Emissions	The visual impacts and light emissions resulting from construction and operation would be less than significant. Visual Resource Management (VRM) Class II objectives for the NHT would be maintained in the five-mile visual buffer zone because of terrain, use of color schemes, distance, and camouflage for facility design. There would be weak contrast between the current setting and the proposed project facilities as viewed from the NHT. All new utility-infrastructure would be buried onsite. Road paving would be noticeable, but would not be a significant visual intrusion. The visual impacts of launches, landings, and aircraft operations would be low because of their distance from viewpoints. Effects of security and safety lighting would be insignificant by minimizing use and by following the standards of the International Dark-Sky Association. Visual impacts of roadway vehicles and fugitive dust would increase and have some minor impact on the NHT and the overall visual setting. In VRM Class IV areas the new construction would increase visual contrast, but would be consistent with the objectives for these areas.	Although the vertical launch facilities would be inconspicuous, not building these facilities would further reduce the visibility of infrastructure compared with developing the complete facility. Fewer launches and less vehicle traffic would further reduce visual impacts compared with developing the complete facility. Temporary construction impacts due to fugitive dust would be reduced.	Airfield facilities would be limited, traffic would be reduced, and fewer launches would take place, reducing visual impacts as compared to the Proposed Action. Although the airfield facilities in the Proposed Action would be inconspicuous, limiting the facilities would further reduce the visibility of infrastructure compared with developing the complete facility. A reduction in launches, operations and special event vehicle traffic would further reduce some visual impacts. Temporary construction impacts due to fugitive dust would be reduced.	No new impacts would occur.

Resource Area	Proposed Action	Alternative 1	Alternative 2	No Action Alternative
Historical, Architectural, Archaeological, and Cultural Resources	Impacts to historic properties, including physical damage, changes to setting, and visual and auditory effects, would occur. These impacts, without mitigation measures, would include minimal impacts to setting, moderate impacts to setting, and significant impacts to setting and physical resource integrity. The FAA would consult with the New Mexico State Historic Preservation offices (SHPO) prior to commencement of construction by NMSA to develop measures to avoid, minimize, or mitigate the adverse effects to historic properties. While the adverse effects to the resources would remain, the Memorandum of Agreement (MOA) and the measures contained within it would resolve these effects and reduce the impacts to a less than significant level.	Not building the facilities in the vertical launch area would result in fewer adverse effects to historic properties than under the Proposed Action. Direct physical impacts would be the same. Visual and noise impacts from traffic would be reduced, as fewer vertical launches would take place and fewer workers would be needed on-site. Impacts to the setting of the NHT and District would remain substantially the same as under the Proposed Action.	Limiting the facilities in the horizontal launch area would result in fewer adverse effects to historic properties than under the Proposed Action. Direct physical impacts could be reduced. Visual and noise effects from launches would be reduced more under Alternative 2 than Alternative 1. Impacts to the settings of the NHT and District would remain substantially the same as under the Proposed Action.	No new impacts would occur.
Air Quality	The criteria pollutant and hazardous air pollutant (HAP) emissions from construction and operation would have a negligible impact on air quality and would not impair visibility along El Camino Real NHT. The emissions of carbon dioxide (CO_2) and ozone depleting substances in the stratosphere would have a negligible impact on climate change and ozone depletion.	Impacts to the atmosphere, although not significant in the Proposed Action, would be reduced as compared to the Proposed Action.	Impacts to the atmosphere, although not significant in the Proposed Action, would be reduced as compared to the Proposed Action.	No new impacts would occur.

Resource Area	Proposed Action	Alternative 1	Alternative 2	No Action Alternative
Water Quality, Wetlands, Wild & Scenic Rivers, Coastal Resources, and Floodplains	Construction and operation would not result in significant impacts on water quality in the Spaceport America region. There could be small offsite water quantity (drawdown) effects in the immediate vicinity of the site, but no changes in offsite water use are anticipated. The Proposed Action would not result in a notable adverse impact on natural and beneficial floodplain values. No wetlands, wild & scenic rivers, or coastal resources are present and no impacts are expected.	Impacts on water resources would be somewhat less than that of the Proposed Action. Impacts on the floodplain would not be significantly different than those of the Proposed Action.	Impacts on water resources would be similar but slightly less than that of the Proposed Action. Impacts on the floodplain would not be significantly different than those of the Proposed Action.	No new impacts would occur.
Fish, Wildlife, and Plants	Impacts from construction and operation on regional plant and wildlife species would not be significant. Construction and operation would not jeopardize the continued existence of special status species of plants or wildlife, or result in the destruction or adverse modification of designated critical habitat. No fish are present and no impacts are expected.	Alternative 1 would result in slightly smaller impacts on local and regional biological resources as compared to the Proposed Action.	Alternative 2 would result in slightly smaller impacts on local and regional biological resources as compared to the Proposed Action.	No new impacts would occur.

Resource Area	Proposed Action	Alternative 1	Alternative 2	No Action Alternative
Hazardous Materials, Pollution Prevention, and Solid Waste	Onsite impacts stemming from the management of hazardous materials and hazardous and non-hazardous wastes are not anticipated 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.	Impacts would be slightly less than under the Proposed Action due to fewer launches, reduced amount of propellants, and from the construction and operation of fewer facilities.	Impacts would be slightly less than under the Proposed Action due to the reduced amount of propellants, fewer launches, and from the construction and operation of fewer facilities.	No new impacts would occur.
Socioeconomics, Environmental Justice, and Children's Environmental Health & Safety Risks	The Proposed Action would not have any significant negative impacts to socioeconomics. There are no disproportionate high and adverse impacts to minority or low-income populations expected from construction or operation. The potential environmental health impacts and safety risks from the construction and operation would not be expected to disproportionately affect children.	Socioeconomic impacts would be slightly reduced as compared to the Proposed Action. Environmental justice and children's health and safety risks would be the same as under the Proposed Action.	Socio economic impacts would be slightly reduced as compared to the Proposed Action. Environmental justice and children's health and safety risks would be the same as under the Proposed Action.	A withdrawal of recent investment in aerospace research in the region would be likely and could result in an adverse socioeconomic impact.

Resource Area	Proposed Action	Alternative 1	Alternative 2	No Action Alternative
Energy Supply and Natural Resources	There would be no impact to energy supplies or use as a result of implementation of the Proposed Action. Construction material supply and availability would not be impacted in the area.	Impacts would be the same as for the Proposed Action.	Impacts would be the same as for the Proposed Action.	No new impacts would occur.

- **Noise** - The Proposed Action would have minor temporary and minor short-term noise impacts. Past and current projects and activities would have minor short-term noise impacts. Future projects would have temporary noise impacts during construction activities. Use of the expanded facilities would result in different noise impact contours than those of the Proposed Action, and would see increased traffic noise. Increasing the number of vertical and horizontal LV launches could result in significant noise impacts from launches, aircraft using the airfield, and traffic. When the noise impacts from the Proposed Action are added to the likely noise impacts of the past, current, and future projects and activities, it is likely that the cumulative noise impacts would be significant.
- **Visual Resources and Light Emissions** - The visual impacts and light emissions resulting from construction and operation of Spaceport America would not be significant for the project area. Past and current projects and activities would have minor, sporadic, and short-term visual impacts. Future projects would have temporary visual impacts during construction activities. Construction and use of expanded Spaceport America facilities could likely result in significant visual impacts due to their location and orientation. Increasing the number of vertical and horizontal launches could result in significant visual impacts as well. When the visual impacts from the Proposed Action are added to the likely visual impacts from the past, current, and future projects and activities, it is likely that the cumulative visual impacts would be significant.
- **Historical, Architectural, Archaeological, and Cultural Resources** - Physical impacts to historic properties and impacts to the settings of historic properties would occur under the Proposed Action. However, the impacts would be mitigated to a level that is not significant. Past and current projects and activities have had significant impacts to historic properties in the vicinity of the project area. Future projects would have temporary impacts to the settings of historic properties during construction activities and permanent physical impacts to historic properties. Construction and use of expanded Spaceport America facilities could likely result in significant impacts to the settings of the NHT and Aleman Draw Historic District due to the location and orientation of the new facilities. Increasing the number of vertical and horizontal launches could result in significant impacts to setting as well.

  The impacts, both to physical integrity and historic property setting, would be mitigated. However, when the remaining impacts to the physical integrity and settings of historic properties from the Proposed Action are added to those of the past, current, and future projects, it is likely that the cumulative impacts to historic properties would be significant, particularly to the settings of the NHT and District.
- **Air Quality** - The impacts to air quality arising from the Proposed Action would be negligible. The project area is in attainment of Federal and New Mexico Ambient Air Quality Standards, thus past and current projects and activities have not impacted the air quality. Future projects would have temporary air quality impacts during construction activities. Paving of dirt roads would result in less fugitive dust. Construction and use of expanded Spaceport America facilities would likely result in impacts that are similar to those described for the Proposed Action, i.e., negligible. Increasing the number of vertical and horizontal launches would result in some level of air quality impacts, dependent on the magnitude of the increase. BLM leasing and development of oil and gas resources could have effects to air quality, but mitigation measures would mitigate them. When the air

quality impacts from the Proposed Action are added to the likely impacts from past, current, and future projects and activities, it is likely that the cumulative impact would not be significant.

- **Water Quality, Wetlands, Wild and Scenic Rivers, Coastal Resources, and Floodplains** - There are no wetlands, wild and scenic rivers, or coastal resources located within or near the proposed project site, so no impacts would occur to these resources from the Proposed Action. No impacts to floodplains or water quality are expected from the Proposed Action. Because there would be no impacts expected from the Proposed Action on these types of resources, there are no cumulative impacts anticipated either.

  The impacts to ground water quantity arising from the Proposed Action would not be significant. Past and current projects and activities have negligible impact on ground water. Future projects would have impacts that are similar to the Proposed Action and would not be significant. Based on the water usage and drawdown calculations of the Proposed Action, when the impacts of the past, current, and future projects and activities are added to the impacts of the Proposed Action, it is likely that the cumulative ground water quantity impacts would not be significant.

- **Fish, Wildlife, and Plants** - There are no fish located within or near the proposed project site, so no impacts would occur to this resource from the Proposed Action. Because there would be no impacts expected from the Proposed Action on fish, there are no cumulative impacts anticipated either.

  The impacts to wildlife and plants resulting from implementation of the Proposed Action would not be significant. Past and current projects and activities have had minor impacts. BLM restoration activities have had a beneficial impact on grassland habitats. Future projects would cause temporary disturbance impacts that would not be significant during construction activities and launch operations. When the impacts to wildlife and plants from the Proposed Action are added to the likely impacts from past, current, and future projects and activities, it is likely that the cumulative impacts would be additive, but would not be significant.

- **Hazardous Materials, Pollution Prevention, and Solid Waste** - No impacts stemming from the management of hazardous materials or hazardous and non-hazardous wastes are expected under the Proposed Action. Because there would be no impacts expected from the Proposed Action from these types of resources, no cumulative impacts are anticipated either.

  Offsite impacts from disposal of spaceport-generated waste would be negligible to minimal under the Proposed Action due to the small quantities of waste in comparison to waste disposal capacity available in the region. For the past, current, and future projects and activities, the quantities of waste generated would have negligible or minimal impacts on the waste disposal capacity in the region. When these impacts are added to the impacts of the Proposed Action, it is likely that the cumulative impacts to waste disposal capacity in the region would not be significant.

- **Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks** - There are no disproportionate high and adverse impacts to minority or low-income populations expected from construction or operations. The potential environmental health impacts and safety risks from construction and operation would not be expected to disproportionately affect children. Since there are no potential impacts expected from the Proposed Action in these two resource areas, no cumulative impacts are anticipated either.

Under the Proposed Action, impacts would be beneficial for population, economics, employment, housing, and tax revenues. Adverse impacts to community services would be small. Most of the past, current, and future projects and activities would result in the same types of beneficial and adverse impacts to socioeconomics as the Proposed Action. When these impacts are combined with the impacts of the Proposed Action, it is likely that the cumulative beneficial impact to socioeconomics would be significant.

- **Energy Supply and Natural Resources** - There are no expected impacts to energy supply and use or natural resources supply and availability from implementation of the Proposed Action. Since there are no potential impacts expected from the Proposed Action, there are no cumulative impacts anticipated either.
- **Construction Impacts** - All construction impacts from the Proposed Action, when considered together, would be either temporary and significant or long-term and would not be significant. The past, current, and future projects and activities would likely have the same types of impacts from construction as those under the Proposed Action. When the construction impacts from the Proposed Action are combined with the construction impacts from these cumulative projects, the cumulative impacts of the Proposed Action would remain the same – either temporary and significant (lasting only as long as the construction activities) or long-term and not significant due to implemented mitigation and avoidance measures.

Mitigation Measures

The only resource area for which the impact from the Proposed Action would exceed the applicable threshold of significance is Historical, Architectural, Archaeological, and Cultural Resources. Mitigation measures would be developed by the FAA, in consultation with the New Mexico SHPO and Section 106 consulting parties, to resolve these impacts and reduce them to a level that is not significant. Conceptual mitigation measures are presented below in Exhibit ES-3.

Exhibit ES-3. Mitigation Measures and Other Measures to Reduce Potential Impacts from the Proposed Action

Resource Area	Mitigation Measures and Other Measures
Visual Resources and Light Emissions	• Minimizing the use of security and safety lighting, and ensuring that all essential lighting would meet lighting standards consistent with the Outdoor Lighting Code Handbook published by the International Dark-Sky Association (IDA, 2002) and Night Sky Protection Act [74-12-1 to 74-12-10 New Mexico Statutes Annotated 1978];

Resource Area	Mitigation Measures and Other Measures
	• Providing busses for visitors and tourists, especially during the X Prize Cup event, and controlling vehicle use associated with Spaceport America activities and events within the limited developed land areas; and • Using earthen berms, vegetation, non-glare material, color, and height and distance measures to disguise facilities to the extent practicable to minimize impacts within areas visible from the NHT.
Historical, Architectural, Archaeological, and Cultural Resources	• Conducting data recovery excavations of archaeological sites; • Conducting in-depth background research and field investigations of historical resources; • Implementing standard Best Management Practices during construction and maintenance activities to control erosion and changes to erosion patterns;
	• Training Spaceport America construction, maintenance, operations, contractor, and tenant personnel to recognize when archaeological resources or human remains have been discovered or when inadvertent damage has occurred to a resource, to halt ground disturbing activities in the vicinity of the discovery, and to notify appropriate personnel;
	• Educating Spaceport America construction, maintenance, and operations personnel, as well as contractors and tenant organizations, on the importance of cultural resources, the need to stay within defined work zones, and the legal implications of vandalism and artifact collecting;
	• Educating visitors and the general public on the importance of cultural resources, the need to stay within defined access areas, and the legal implications of vandalism and artifact collecting;
	• Developing a state management plan for those portions of the NHT located on State Trust Land;
	• Developing a Cultural Resource Management Plan to ensure long-term protection of resources within the project boundaries;

Resource Area	Mitigation Measures and Other Measures
	• Establishing a Design Committee, with membership to include agency and public stakeholders, to develop ways to reduce the visibility of proposed facilities through use of specific color, texture, topography, orientation, materials, etc.; and • Developing joint marketing and education programs that benefit both Spaceport America and the NHT, such as: ⇨ Providing educational outreach to the public about the region's cultural heritage with programs and publications; ⇨ Developing public activities in coordination with El Camino Real International Heritage Center and the New Mexico Museum of Space History; and ⇨ Developing and maintaining road-side interpretive signs and foot trails to enhance the visitor experience.
Air Quality	• Applying water during construction to disturbed areas and dirt road surfaces for dust suppression; • Applying dust abatement to gravel roads for dust suppression during operations; and • Incorporating particulate control features at the cement batch plant, such as the enclosure of conveyors and elevators, filters on storage bin vents, and the use of water sprays.
Water Quality, Wetlands, Wild and Scenic Rivers, Coastal Resources, and Floodplains	• Incorporating water-efficient fixtures and appliance into facility design, such as dual flush toilets, waterless urinals, aerated faucets, and low flow showers; • Incorporating desert landscaping with water-efficient irrigation where needed; • Using wastewater effluent to meet a portion of the nonpotable water needs, such as for vehicle washing, toilet flushing, and landscaping; and • Collection of rain water and storm water runoff for nonpotable uses.

Resource Area	Mitigation Measures and Other Measures
Fish, Wildlife, and Plants	• Enhancement of off-site desert grassland habitats as per BLM (2007) to replace wildlife habitat potentially impacted by Spaceport construction and/or operation; • Creation and/or refurbishment of off-site watering areas to replace those potentially made un-usable by Spaceport America construction and/or operation; • Development of cattle fences in accordance with BLM guidelines to allow continued movement of wildlife; • Reconstruction and/or modification of existing on-site fences; and • Monitoring of wildlife populations within the project area to examine for potential shifts in density and diversity.
Energy Supply and Natural Resources	• Incorporating energy efficient building design for natural cooling, heating, and lighting; and • Developing alternate power sources such as geothermal and photovoltaic
Hazardous Materials, Pollution Prevention, and Solid Waste	• Taking advantage of all pollution prevention opportunities, including recycling and purchase of environmentally-friendly products whenever possible; • Having spill response materials (e.g., sorbents, drain covers, mops, brooms, shovels, drum repair materials and tools, warning signs and tapes, and personal protective equipment) readily available for use in storage areas, during fueling, and during transport in the event of an unplanned release; • Storing hazardous materials in protected and controlled areas with containment and impermeable ground cover; • Using spill containment berms during fueling operations; • Inspecting hazardous materials daily; and • Purchasing hazardous materials in appropriately size containers (e.g., if the material is used by the can, it would be purchased by the can rather than in bulk-sized containers) and in appropriate quantities.

Secondary (Induced) Impacts

Major developments sometimes have the potential to cause secondary or induced impacts on surrounding communities. The Council on Environmental Quality defines secondary impacts as those that are caused by an action and are later in time and/or farther removed in distance, but still foreseeable. FAA 1050.1E guidance requires assessment of the potential for and significance of such impacts. Potential secondary or induced impacts assessed for the proposed Spaceport America project include:

- Shifts in patterns of population movement or growth,
- Public service demands,
- Changes in local or regional business or economic activity, and
- Changes in regional land use.

Issuing a Launch Site Operator License to NMSA for Spaceport America would not result in substantial induced impacts. Although the Proposed Action would result in beneficial economic impacts to the region by supporting and facilitating limited growth, it would not induce growth. Operation of the spaceport would not support substantial numbers of workers. Construction would temporarily employ large numbers of workers during peak construction; however, these workers either would already live in the region or would be transient workers who would move away once the construction job was completed. Thus population movement would not be affected. Implementation of the Project would include development of all necessary infrastructure for water, wastewater, electricity, communications, and roads. Thus there would be no changes in demand for public services, no strain on existing public service infrastructure, and no induced expansion of existing infrastructure. There are no known specific future development activities that would be dependent on the Proposed Action. Spaceport America would be constructed in a rural area with very sparse population, and would co-exist with the local ranching economy. Economic activity and regional land use in the region would not change due to the implementation of the Proposed Action.

Therefore, no secondary or substantial induced impacts are expected to result from the Proposed Action or alternatives analyzed in this EIS.

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LIST OF EXHIBITS

ACRONYMS AND ABBREVIATIONS

ACEC	Areas of Critical Environmental Concern
ACHP	Advisory Council on Historic Preservation
AFB	Air Force Base
AGL	above ground level
AHPA	Archaeological and Historic Preservation Act
AIRFA	American Indian Religious Freedom Act
Al_2O_3	Aluminum oxide
APE	Area of Potential Effects
AQCR	Air Quality Control Region
Ar	argon
ARFF	attached grounds maintenance facility
ARPA	Archeological Resources Protection Act
ATF	Alcohol, Tobacco, and Firearms
BLM	Bureau of Land Management
BNSF	Burlington Northern and Santa Fe Railroad
CAA	Clean Air Act
CCC	Civilian Conservation Corps
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESQG	Conditionally Exempt Small Quantity Generator
CFC	Chlorofluorocarbons
CFR	Code of Federal Regulations
CH_4	methane
Cl_2	chlorine
CMP	Comprehensive Management Plan
CO	Carbon monoxide
CO_2	Carbon dioxide
CR	County Road
CSLA	Commercial Space Launch Act of 1984
CSTCA	Commercial Space Transportation Competition Act of 2000
dB	Decibels
dBA	"A" weighted decibels
dBC	C-weighted scale
DNL	Day-Night average sound level
DoD	Department of Defense
EA	environmental assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
ERPG-2	Level 2 Emergency Response Planning Guidelines
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration

FLPMA	Federal Land Policy and Management Act of 1976
FPPA	Farmland Protection Policy Act
GPS	Global Positioning System
H1-3	Horizontal launch concept 1, 2, or 3 vehicle
H_2O	water
H_2S	hydrogen sulfide
HAP	Hazardous air pollutant
HCl	Hydrogen chloride
HCl	hydrochloric acid
HPD	Historic Preservation Division
KOP	Key observation point
kV	Kilovolt
LA	Laboratory of Anthropology
LCDO	Cruces District Office
LH_2	Liquid hydrogen
LMC	Lockheed Martin Corporation
LOS	Level of Service
LOX	Liquid oxygen
LTO	Landing and takeoff
LV	Launch vehicle
MOA	Memorandum of Agreement
N_2	Molecular nitrogen
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NASA	National Aeronautics and Space Administration
NEAP	Natural Events Action Plan
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for hazardous air pollutants
NFIP	National Flood Insurance Program
NHPA	National Historic Preservation Act
NHT	National Historic Trail
NM	New Mexico
NMAC	New Mexico Administrative Code
NMDGF	New Mexico Department of Game and Fish
NMDOT	New Mexico Department of Transportation
NMED	New Mexico Environment Department
NMEDD	New Mexico Economic Development Department
NMEMNR	New Mexico Department of Energy, Minerals, and Natural Resources
NMOSE	New Mexico Office of the State Engineer
NMSA	New Mexico Spaceport Authority
NMSHPO	New Mexico State Historic Preservation Officer
NMSLO	New Mexico State Land Office
NMSU	New Mexico State University
NO_2	nitrogen dioxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent

NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSR	New Source Review
NHT	National Historic Trail
O_2	Molecular oxygen
O_3	Ozone
ODS	ozone-depleting substances
ORV	off-road vehicle
OSHA	Occupational Safety and Health Administration
Pb	Lead
PEIS	Programmatic Environmental Impact Statement
PEIS HL	PEIS for Horizontal Launch and Reentry of Reentry Vehicles (FAA, 2005)
PEIS LL	PEIS for Licensing Launches (FAA, 2001)
PM	Particulate matter
PM_{10}	PM diameter less than or equal to 10 micrometers
$PM_{2.5}$	PM diameter less than or equal to 2.5 micrometers
PSD	Prevention of Significant Deterioration
RCRA	Resource Conservation and Recovery Act
RFQ	Request for Qualifications
RLV	Reusable launch vehicle
RMP	resource management plan
ROD	Record of Decision
ROI	Region of Influence
RP-1	Rocket Propellant-1
SARA	Superfund Amendments and Reauthorization Act of 1986
SFHA	Special Flood Hazard Area
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_2	Sulfur dioxide
SRM	Solid rocket motor
SRS	Southwest Regional Spaceport
TCP	traditional cultural property
THF	terminal and hangar facility
TSP	total suspended particulate
U.S.C.	United States Code
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
UV	ultraviolet
V1	Vertical launch concept 1, 2, or 3 vehicle
VOC	Volatile organic compounds
VRM	Visual Resource Management
WSMR	White Sands Missile Range

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1. INTRODUCTION AND PURPOSE AND NEED

1.1 Introduction

The State of New Mexico, New Mexico Economic Development Department (NMEDD) through the New Mexico Spaceport Authority (NMSA) proposes to develop and operate a commercial space launch site, called Spaceport America. The proposed site is in Sierra County near Upham, New Mexico (NM) at a location approximately 45 miles north of Las Cruces, NM and 30 miles southeast of Truth or Consequences, NM. NMSA proposes to operate this site for horizontal and vertical launches of suborbital[1] launch vehicles (LVs). The vehicles may carry space flight participants,[2] scientific experiments, or other payloads.[3] Horizontal LVs would launch and land at the proposed Spaceport America airfield. Vertical LVs would launch from the proposed Spaceport America and would either land at Spaceport America or in the U.S. Army's White Sands Missile Range (WSMR)[4], which is located approximately 9miles east of the site. These landings would be coordinated with, and approved in advance by, WSMR.

To operate a commercial launch site, the State must obtain a license from the Federal Aviation Administration (FAA), Office of Commercial Space Transportation. The proposed Federal action that is the subject of this Environmental Impact Statement (EIS) is for the FAA to issue a Launch Site Operator License to the NMSA. The National Environmental Policy Act (NEPA) of 1969 as amended (42 United States Code [U.S.C.] 4321, et seq.), the Council on Environmental Quality (CEQ) Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations [CFR] 1500-1508), and FAA Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures*, direct the FAA lead agency officials to consider the environmental consequences when planning for, authorizing, or approving major Federal actions. When the FAA issues a Launch Site Operator License, it is considered a Federal action and is subject to review as required by NEPA.

1.2 Background

New Mexico has had a long and continuous relationship with the space industry. In 1929, Robert Goddard, the "Father of Modern Rocketry" relocated to Roswell, NM, from New England to build his experimental rockets. WSMR was established by the Department of Defense (DoD) in 1945, and became the "Birthplace of America's Missile and Space Activity" when the U.S. Army, with the assistance of Wernher von Braun, successfully launched the V-2 rocket from WSMR Launch Complex 33. In 1961, the first chimp to be launched into outer space was trained at Holloman Air Force Base (AFB), adjacent to WSMR. Space Shuttle astronaut training began at the Northrup Strip at WSMR in 1978; the Northrup Strip was declared a landing site for the Shuttle in 1979; and in 1982 the Space Shuttle Orbiter Columbia landed there.

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[1] A suborbital rocket is a vehicle, rocket-propelled in whole or in part, intended for flight on a suborbital trajectory, and the thrust of which is greater than its lift for the majority of the rocket-powered portion of its ascent. 49 U.S.C. 70102(19) Suborbital trajectory is the intentional flight path of a launch vehicle, reentry vehicle, or any portion thereof whose vacuum instantaneous impact point (IIP) does not leave the surface of the Earth.

[2] 'Space flight participant' means an individual who is not crew, carried within a launch vehicle or reentry vehicle. 49 U.S.C. 70102(17)

[3] Payload means an object that a person undertakes to place in outer space by means of a launch vehicle or reentry vehicle, including components of the vehicle specifically designed or adapted for that object. 49 U.S.C. 70102(10)

[4] Rocket-powered vertical landing vehicles would land on either Spaceport America airfield or a vertical launch/landing pad. Parachute landings of vertical vehicles or components would land in WSMR.

New Mexico's long-standing relationship with the space industry has resulted in the expansion of research and development in the State by the government and private sectors. The annual aerospace-related payroll in southern NM exceeds $300 million, with work being done by WSMR, National Aeronautics and Space Administration's (NASA) White Sands Test Facility, General Dynamics Corporation's SpacePlex, New Mexico State University's Physical Science Laboratory and Unmanned Aerial Vehicle Technical Analysis and Applications Center, Raytheon, and Boeing. Additional aerospace activity takes place at Holloman AFB, Kirtland AFB (including the Air Force Research Laboratory), the New Mexico Institute of Mining and Technology. New Mexico's aerospace and aviation industry is ranked 36th in the U.S. by employment with more than 8,000 jobs.

In 2004, New Mexico was selected by the X Prize Foundation to be the host of the X Prize Cup. The X Prize Foundation is a non-profit educational organization using competitions to create innovative technological breakthroughs and to change public perception of space flight, all for the benefit of mankind. The X Prize Cup will eventually develop into a 7-day event that is organized by the X Prize Foundation and held annually beginning in the fall of 2010. The Cup will feature competitions, demonstrations, and displays, all centered on space travel and exploration.

Over the past 10 years, the State has identified and screened potential sites for space launch activities and has worked with private entities to define the specific types of infrastructure needed to support their activities. The State, in consultation with industry experts at the Physical Science Laboratory at New Mexico State University, at WSMR, and at the FAA, conducted research on potential launch vehicles, safety studies, land use studies, airspace availability, topographic and preliminary environmental studies, and availability of regional infrastructure. They also consulted with land management agencies in the region, and with county and local municipal officials. After extensive analysis and evaluation, the proposed Spaceport America location was identified by the State as the preferred location for these commercial space vehicle operations, as well as the X Prize Cup event.

1.3 Federal Agency Involvement

The FAA is the lead Federal agency responsible for the preparation of the EIS for the proposed Spaceport America. Cooperating agencies include the Bureau of Land Management (BLM), the National Park Service (NPS), the U.S. Army's WSMR, and NASA.

1.3.1 Role of the FAA

The FAA has the responsibility, under 49 U.S.C. subtitle IX, ch. 701, to:

- Encourage private sector launches, reentries, and associated services and, only to the extent necessary, regulate those launches, reentries, and services to ensure compliance with international obligations of the U.S. and to protect the public health and safety, safety of property, and national security and foreign policy interests of the U.S.;
- Facilitate and promote commercial space launches and reentries by the private sector;
- Oversee and coordinate the conduct of commercial launch and reentry operations, issue and transfer commercial licenses authorizing those operations, and protect the public health and safety, safety of property, and national security and foreign policy interests of the U.S.;

- Facilitate the strengthening and expansion of the U.S. space transportation infrastructure, including the enhancement of U.S. launch sites and launch-site support facilities, and development of reentry sites, with Government, State, and private sector involvement, to support the full range of U.S. space-related activities; and
- Take actions to facilitate private sector involvement in commercial space transportation activity, and to promote public-private partnerships involving the U.S. Government, State governments, and the private sector to build, expand, modernize, or operate space launch and reentry infrastructure.

The decision to license a commercial launch or the operation of a commercial launch site by the FAA is considered a Federal action. The FAA is responsible for analyzing the environmental impacts associated with licensing proposed commercial launches and the operation of proposed commercial launch sites.

1.3.2 Role of the Cooperating Agencies

The U.S. Department of the Interior, BLM, Las Cruces District Office is responsible for managing portions of the land surrounding the proposed Spaceport America. Off-site infrastructure to support Spaceport America will require a BLM right-of-way permit and BLM will use this EIS as the NEPA documentation for the permit application. BLM is also a co-administrator of El Camino Real de Tierra Adentro National Historic Trail (NHT), which runs through the proposed Spaceport America site near the western edge. The U.S. Department of the Interior, NPS, Intermountain Region shares responsibility with BLM for the co-administration of El Camino Real de Tierra Adentro NHT. The U.S. DoD, U.S. Department of the Army, WSMR is responsible for administering the airspace in which operations from the proposed Spaceport America would occur. NASA provides special expertise with respect to potential environmental impacts from space launches and the operation of a launch site.

The FAA entered into Memoranda of Agreement (MOA) with each of these cooperating agencies. The cooperating agencies are responsible for developing and verifying information, including portions of the EIS for which the cooperating agency has special expertise. Information on the MOAs can be found in Appendix A, along with other interagency coordination.

1.4 Purpose and Need

The need for the Project proposed by NMSA is to establish a long-term source of economic development in southern New Mexico that is based on high technology and can be used to develop educational opportunities. State-sponsored studies (Futron Corporation, 2005; Arrowhead Center, n.d.) have shown great potential benefits to the State in terms of jobs, as well as direct and indirect economic impact. To be successful, the Project must meet the expected need of the commercial space transportation industry for both vertical and horizontal suborbital launch capacity. Several commercial space transportation providers have made commitments to the State contingent on the State's ability to provide the licensed launch facility in a timely way. They have done so because of the inherent advantages offered by the State's proposed site, which features a dry and sunny climate, 4,500-foot launch pad elevation, low population density, contiguous sections of available land, and access to the restricted airspace over nearby WSMR.

The purpose of the action proposed by NMSA is to:

- Develop and operate a safe, economically-viable spaceport in southern New Mexico;
- Expand the space launch industry in New Mexico by meeting the demand for launch site services;
- Expand into new space-related markets by licensing an inland spaceport with both horizontal and vertical suborbital launch capabilities;
- Provide a location for X Prize Cup and other scheduled events; and
- Provide a venue for expansion of opportunities for aerospace education in New Mexico.

These activities are consistent with the objectives of the FAA's mission to encourage, facilitate, and promote commercial launch and reentry activities by the private sector.

The need for the FAA action on NMSA's request for licensure is related to the purpose of facilitating the strengthening and expansion of the U.S. space transportation infrastructure, including the enhancement of U.S. launch sites and launch-site support facilities, and development of reentry sites to support the full range of U.S. space-related activities.

The purpose of the FAA action in connection with NMSA's request for licensure is to ensure compliance with international obligations of the U.S. and to protect the public health and safety, safety of property, and national security and foreign policy interest of the U.S. during commercial launch or reentry activities; to encourage, facilitate, and promote commercial space launches and reentries by the private sector; and to facilitate the strengthening and expansion of the U.S. space transportation infrastructure, in accordance with the requirements of the Commercial Space Launch Act of 1984 (CSLA), the Commercial Space Transportation Competition Act of 2000 (CSTCA) (49 U.S.C. 70101-70121), the FAA's commercial space transportation regulations (14 CFR Parts 400-450), the National Space Transportation Policy, and the National Space Policy.

The Secretary of Transportation has delegated responsibility for oversight of commercial space launch activities, including licensing the operation of launch and reentry sites, to the FAA Associate Administrator for Commercial Space Transportation.

1.5 FAA Licenses, Regulations, and Approvals

Operation of the proposed Spaceport America and launches by individual commercial launch operators would be governed by various licenses or permit requirements as specified by the FAA. These statutory and regulatory requirements pertaining to Spaceport America operations and to individual launch operators are described in 14 CFR Chapter III (Parts 400-450).

Under the Proposed Action, the FAA would issue a Launch Site Operator License to NMSA for the operation of the proposed launch site. A Launch Site Operator License "authorizes a licensee to operate a launch site in accordance with the representations contained in the licensee's application, with terms and conditions contained in any license order accompanying the license, and subject to the licensee's compliance with" applicable laws and regulations (14 CFR 420.41[a]). The Launch Site Operator License authorizes the licensee "to offer its launch site to a launch operator for each launch point for the type and any weight class of LV identified in the license application and upon which the licensing determination is based" (14 CFR 420.41[b]). The Launch Site Operator License "remains in effect for 5 years from the date of issuance unless surrendered, suspended, or revoked before the expiration of the term and is renewable upon application by the licensee" (14 CFR 420.43).

In addition, launch operators could submit an application to the FAA for use of Spaceport America for other missions, which would require the licenses listed below and described in further detail in the Glossary:

Reusable Launch Vehicle (RLV) Mission-Specific License – "authorizes a licensee to launch and reenter, or otherwise land, one model or type of RLV from a launch site approved for the mission to a reentry site or other location approved for the mission" (14 CFR 431.3[a]).

RLV Mission Operator License – "authorizes a licensee to launch and reenter, or otherwise land, any of a designated family of RLVs within authorized parameters" (14 CFR 431.3[b]).

Launch-Specific License – "authorizes a licensee to conduct one or more launches, having the same launch parameters, of one type of LV from one launch site" (14 CFR 415.3[a]).

Launch Operator License – "authorizes a licensee to conduct launches from one launch site, within a range of launch parameters, of LVs from the same family of vehicles transporting specified classes of payloads" (14 CFR 415.3[b]).

Experimental Permit – "authorizes launch or reentry of a reusable suborbital rocket" (14 CFR 437.7).

1.6 Other Permits and Approvals

Preparation of this EIS, public review and comment, and issuance of a Record of Decision will fulfill the FAA's requirements under NEPA. However, if the FAA decides to issue a launch site operator's license to NMSA, acquisition of other permits and approvals under other regulations would also be required prior to construction of the spaceport. The FAA has already obtained a finding under Section 404 of the Clean Water Act by the U.S. Army Corps of Engineers that the Project area is located within a closed basin and no jurisdictional waters would be affected by the proposed Project. 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 Project "is not likely to jeopardize" any listed species. Further permits or approvals that would be required include completion of consultation under Section 106 of the National Historic Preservation Act, and acquisition of a discharge permit from the U.S. Environmental Protection Agency under the Clean Water Act's National Pollution Discharge Elimination System.

1.7 Summary of the Public Involvement Process

Public participation in the NEPA process provides for and encourages open communication between the FAA and the public, and promotes better decision-making. Scoping for the development of the EIS began with the publication of the Notice of Intent (NOI) in the Federal Register on January 23, 2006 (71 FR 3915). During scoping, the FAA invited the participation of Federal, State, and local agencies, Native American tribes, environmental groups, citizens, and other interested parties to assist in determining the scope and significant issues to be evaluated in the EIS.

Two scoping meetings were held in February 2006 to request input from the public on concerns regarding the proposed activities as well as to gather information and knowledge of issues relevant to analyzing the environmental impacts associated with the Proposed Action. The scoping meetings were held on February 15 in Truth or Consequences, NM, and on February 16 in Las Cruces, NM. Copies of public notifications, available public meeting materials, and a summary of public scoping comments and other relevant documents are included in Appendix B of this document.

A 45-day public review and comment period will commence upon the publication of a notice in the Federal Register that the Draft EIS is available to the public. The FAA will host public hearings during this comment period during which members of the public, organizations, tribal groups, and government agencies can provide oral or written comments on the Draft EIS. The Final EIS will respond to all substantive comments and will include any changes or edits resulting from the comments received. The FAA will issue a Record of Decision no sooner than 30 days after publication of the Final EIS in accordance with CEQ NEPA implementing regulations.

1.8 Related Environmental Documentation

CEQ regulations for implementing NEPA (40 CFR 1502.20 and 1508.28) state that "[w]henever a broad environmental impact statement [such as a Programmatic Environmental Impact Statement (PEIS)] has been prepared (such as a program or policy statement) and a subsequent statement or environmental assessment (EA) is then prepared on an action included within the entire program or policy (such as a site specific action) the subsequent environmental analysis need only summarize the issues discussed in the broader statement and incorporate discussions from the broader statement by reference and shall concentrate on the issues specific to the subsequent action." The EIS for Spaceport America tiers from the following two PEISs prepared by the FAA:

- Final Programmatic Environmental Impact Statement for Licensing Launches (FAA, 2001), referred to in this document as the "Programmatic Environmental Impact Statement for Licensing Launches (FAA, 2001)" (PEIS LL), and
- Final Programmatic Environmental Impact Statement for Horizontal Launch and Reentry of Reentry Vehicles (FAA, 2005), referred to in this document as the Programmatic Environmental Impact Statement for Horizontal Launch and Reentry of Reentry Vehicles (FAA,2001) (PEIS HL).

These documents are available for download and viewing at the FAA's web site (http://www.faa.gov/about/office_org/headquarters_offices/ast). The PEIS LL focuses on potential environmental impacts of vertical launches; the PEIS HL focuses on potential environmental impacts of horizontal launches. The PEIS HL also considers reentry of orbital reentry vehicles, but they are not relevant to the Proposed Action in this document, which addresses the launch of suborbital vehicles only.

In addition to the PEISs, NEPA documents related to spaceports and licensed launches prepared by the FAA and other Federal agencies may also be cited. The FAA documents are available at the above web site. These other NEPA documents are:

- Environmental Assessment of the Kodiak Launch Complex, (FAA, 1996).
- Environmental Assessment for Launch of NASA Routine Payloads on Expendable Launch Vehicles from Cape Canaveral Air Force Station Florida and Vandenberg Air Force Base California (NASA, 2002) (http://spacescience.nasa.gov/admin/pubs/routine_EA/).

- Final Environmental Assessment for the East Kern Airport District Launch Site Operator License for the Mojave Airport (FAA, 2004).
- Final Environmental Assessment for the Oklahoma Spaceport (FAA, 2006).

The EIS makes use of and refers to documents and information prepared by or for the State of New Mexico. These documents and information are referenced in the EIS where appropriate.

1.9 EIS Document Structure

Chapter 2 describes the proposed Spaceport America Project, two alternatives to the Proposed Action, and the No Action Alternative. Chapter 3 presents the environmental baseline or existing environmental conditions for the environmental impact categories listed below. Chapter 4 discusses the analysis of potential environmental impacts that could occur to the resources as a result of the Proposed Action, the two alternatives, and the No Action Alternative. Chapter 5 describes the potential cumulative impacts that could arise from the proposed Project. Chapter 6 discusses mitigation measures and environmental commitments that would be undertaken by NMSA to address identified environmental impacts, should the FAA decide to issue a Launch Site Operator License. Chapter 7 lists the people who worked on the preparation of the EIS. Chapter 8 lists those agencies, organizations, and persons to who copies of this EIS were sent. Chapter 9 lists the references cited in the document. Chapter 10 presents a glossary of terms used in the EIS. Chapter 11 provides an index to the document.

The environmental parameters addressed in this EIS are consistent with the requirements of FAA Order 1050.1E and include analyses of the environmental impact categories listed below:

- Compatible Land Use,
- Section 4(f) Properties and Farmlands,
- Noise,
- Visual Resources and Light Emissions,
- Historical, Architectural, Archaeological, and Cultural Resources,
- Air Quality,
- Water Quality, Wetlands, Wild and Scenic Rivers, Coastal Resources, and Floodplains,
- Fish, Wildlife, and Plants,
- Hazardous Materials, Pollution Prevention, and Solid Waste,
- Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks,
- Energy Supply and Natural Resources,
- Construction Impacts, and
- Secondary (Induced) Impacts.

Additional environmental parameters were also considered. These include geology and soils, mineral resources, airspace, health and safety, and traffic and transportation. Analyses of these additional resource areas are contained within the appendices.

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2. DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This chapter describes the Proposed Action, Alternative 1, Alternative 2, the No Action Alternative, and alternatives not carried forward for further analysis.

2.1 Proposed Action

The Proposed Action, which is the Preferred Alternative, is for the FAA to issue a Launch Site Operator License to NMSA that would allow the State to operate Spaceport America for both horizontal and vertical suborbital LV launches. Horizontal LVs would launch and land at the proposed Spaceport America airfield. Vertical LVs would launch from Spaceport America and either land at Spaceport America or at WSMR. Rocket-powered vertical landing vehicles would land on either the Spaceport America airfield or a vertical launch/landing pad. Vertical LVs with components that would return to Earth by parachute would have flight profiles such that these components (i.e., main rocket stages, payload sections, and crew/passenger modules) would land at WSMR. Landings at WSMR would be coordinated and approved in advance by WSMR. In addition, the Proposed Action includes construction of facilities needed to support the licensed launch activities at Spaceport America. The EIS addresses the environmental impacts of constructing and operating such a launch facility, including all related activities and uses that are reasonably foreseeable and any actions considered connected to the Proposed Action within the context of NEPA.

The requirements for obtaining and possessing a license to operate a launch site are described in 14 CFR Part 420. The completion of the environmental review process does not guarantee that the FAA would issue a Launch Site Operator License to the NMSA to operate Spaceport America. The Proposed Action also must meet all of the FAA safety, risk, and indemnification requirements. In addition, a license to operate a launch site does not guarantee that a launch license or permit would be granted for a specific launch proposed from the site. All individual launch license and permit applications would be subject to separate review by the FAA.

2.1.1 Proposed Spaceport America Location

The proposed Spaceport America would be located in south-central New Mexico about 45 miles north of Las Cruces and 30 miles southeast of Truth or Consequences. Exhibit 2-1 shows the proximity of the proposed Spaceport America to WSMR, which is located east of the proposed Project site. The proposed Spaceport America site is situated in Sierra County, between 32-33° North latitude and 106-107° West longitude at an average elevation of 4,500 feet. This region is referred to as the Jornada del Muerto Basin. Exhibit 2-2 shows land ownership in the region. All proposed Spaceport America facilities would be located within the large State-owned block of land in the center of the map. WSMR is 9 miles east of this block of land, and Interstate 25 (I-25) is approximately 18 miles west of this block.

Exhibit 2-1. Location of the Proposed Spaceport America with Respect to Surrounding Areas

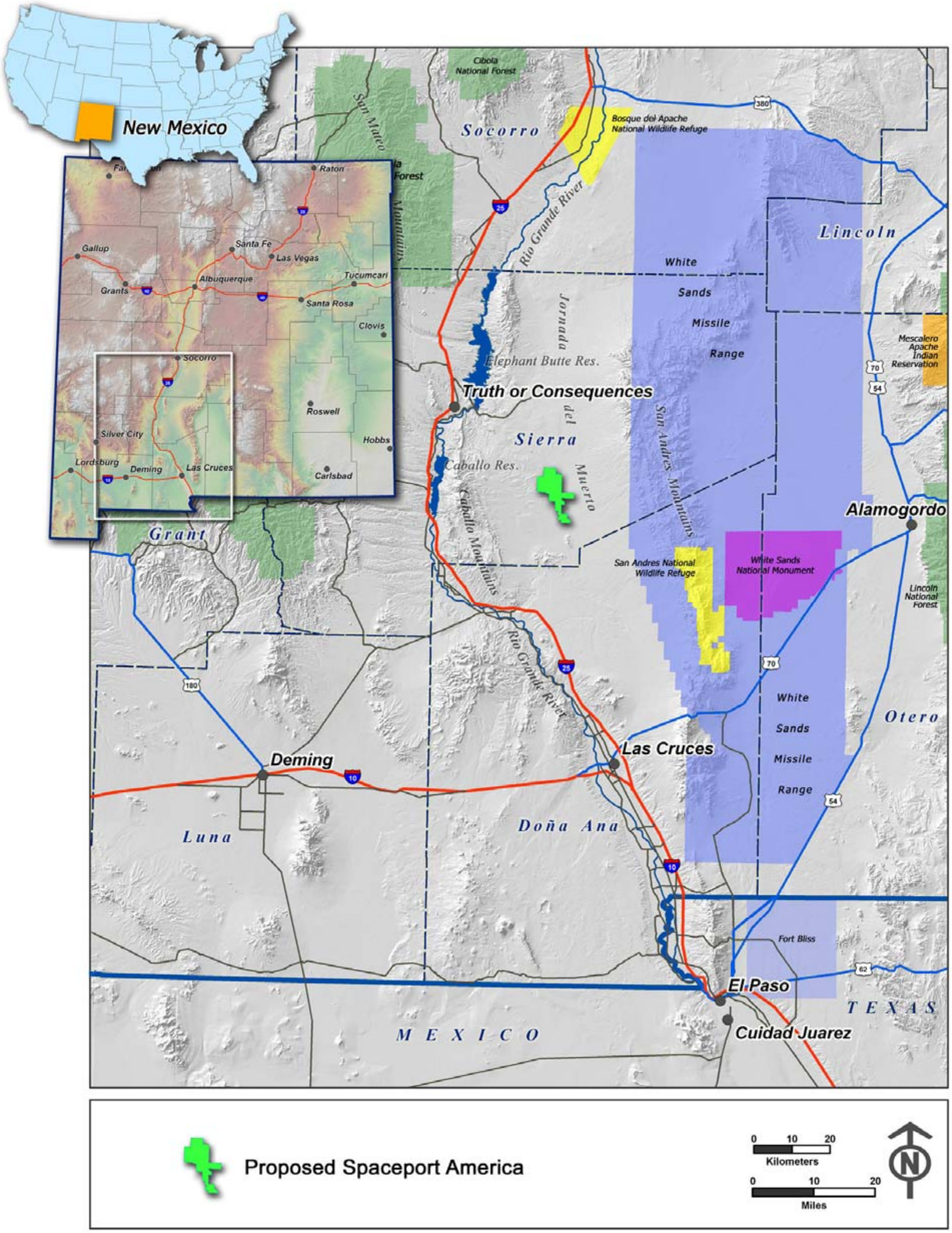
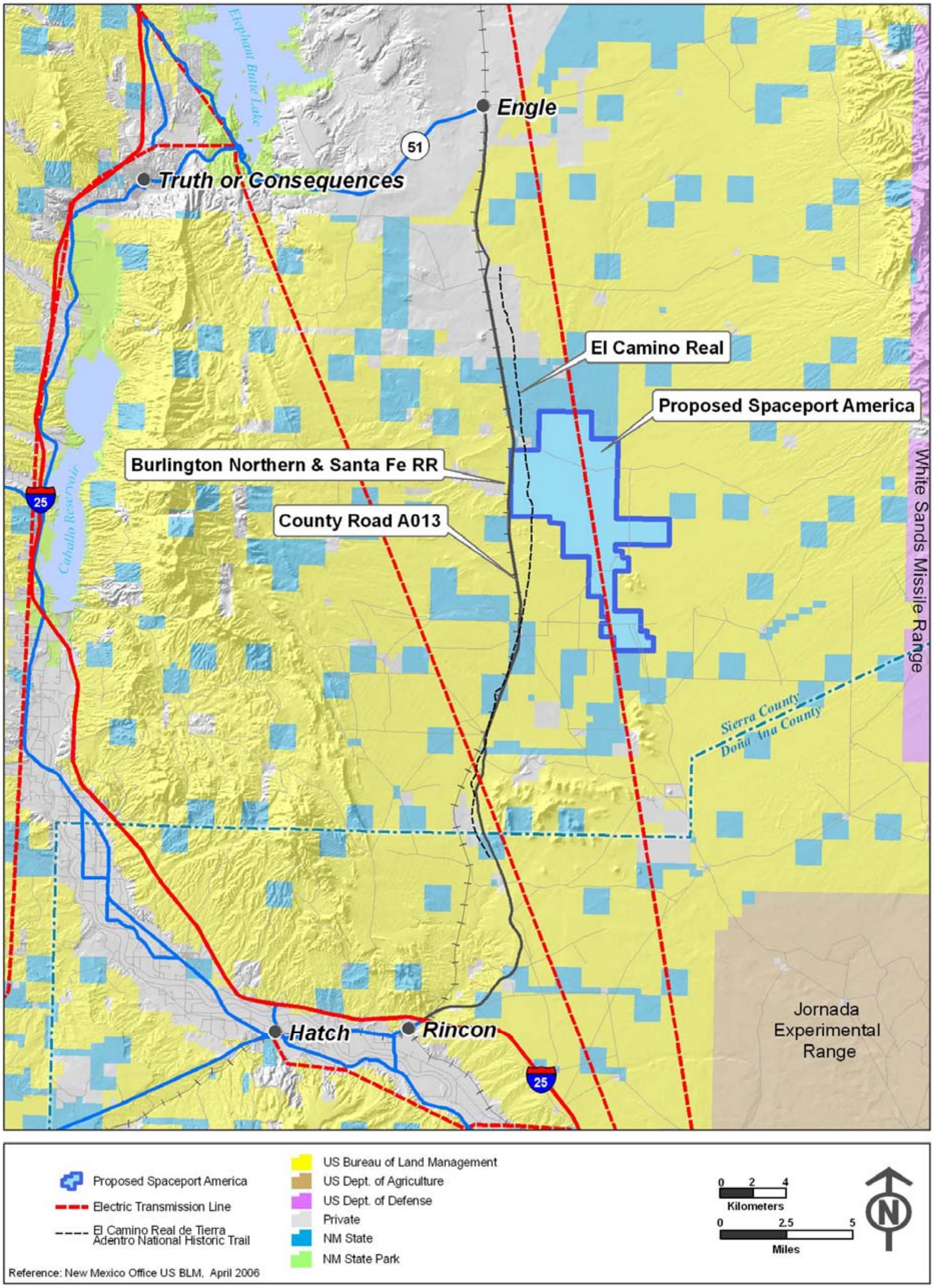


Exhibit 2-2. Land Ownership in Spaceport America Region



2.1.2 Proposed Spaceport America Phased Infrastructure and Construction Activities

The proposed Spaceport America Project would include construction of infrastructure to support the operation of the launch site that would be licensed under the Proposed Action. All construction, with the exception of improvements to some existing access roads and installation of a power transmission line and fiber optic cables to the Project site, would take place on New Mexico State Trust Land. Off-site access roads, transmission line, and fiber optic cables would cross a mix of State Trust, BLM, and private lands. The construction of any future infrastructure beyond that discussed in this document is not considered reasonably foreseeable for purposes of this NEPA analysis. Any proposed future infrastructure dissimilar to, or beyond the scope of, that included in this analysis would be analyzed in subsequent NEPA analyses as appropriate. The construction proposed in this document is considered conservative, meaning that it represents an overestimate of the actual construction activities that would likely take place during the 5-year term of the Launch Site Operator License.

Development of Spaceport America infrastructure would occur in two phases (see Exhibit 2-3). These phases do not include the existing 1-mile dirt road and amateur launch pad on State-owned land in the proposed vertical launch area. This facility was constructed in 2006 to support amateur rocket launches[1], which do not need an FAA launch license or a Launch Site Operator License and are not considered a major Federal action subject to NEPA analysis. The dates and goals of each construction phase, as analyzed in this EIS, are as follows:

Exhibit 2-3. Proposed Schedule for Spaceport America Development

Development Phase	Construction Dates		Construction Goals
	Start	End	
Phase 1 Operational Spaceport (17 months)	30 days after ROD[b]	18 months after ROD	Operational spaceport with both vertical and horizontal launch capabilities Support of some X Prize Cup activities
Phase 2 Long-Term Development (12 months)	18 months after ROD	30 months [a] after ROD	Additional vertical launch capabilities Full support of X Prize Cup activities

[a] This phase of construction would be conducted during 12 consecutive months, and would occur sometime between month 18 and the end of the 5-year term of the license (i.e., month 60 after the ROD). To enable a conservative, bounding analysis, this EIS assumes that Phase 2 would commence immediately following the end of Phase 1.
[b] ROD = Record of Decision

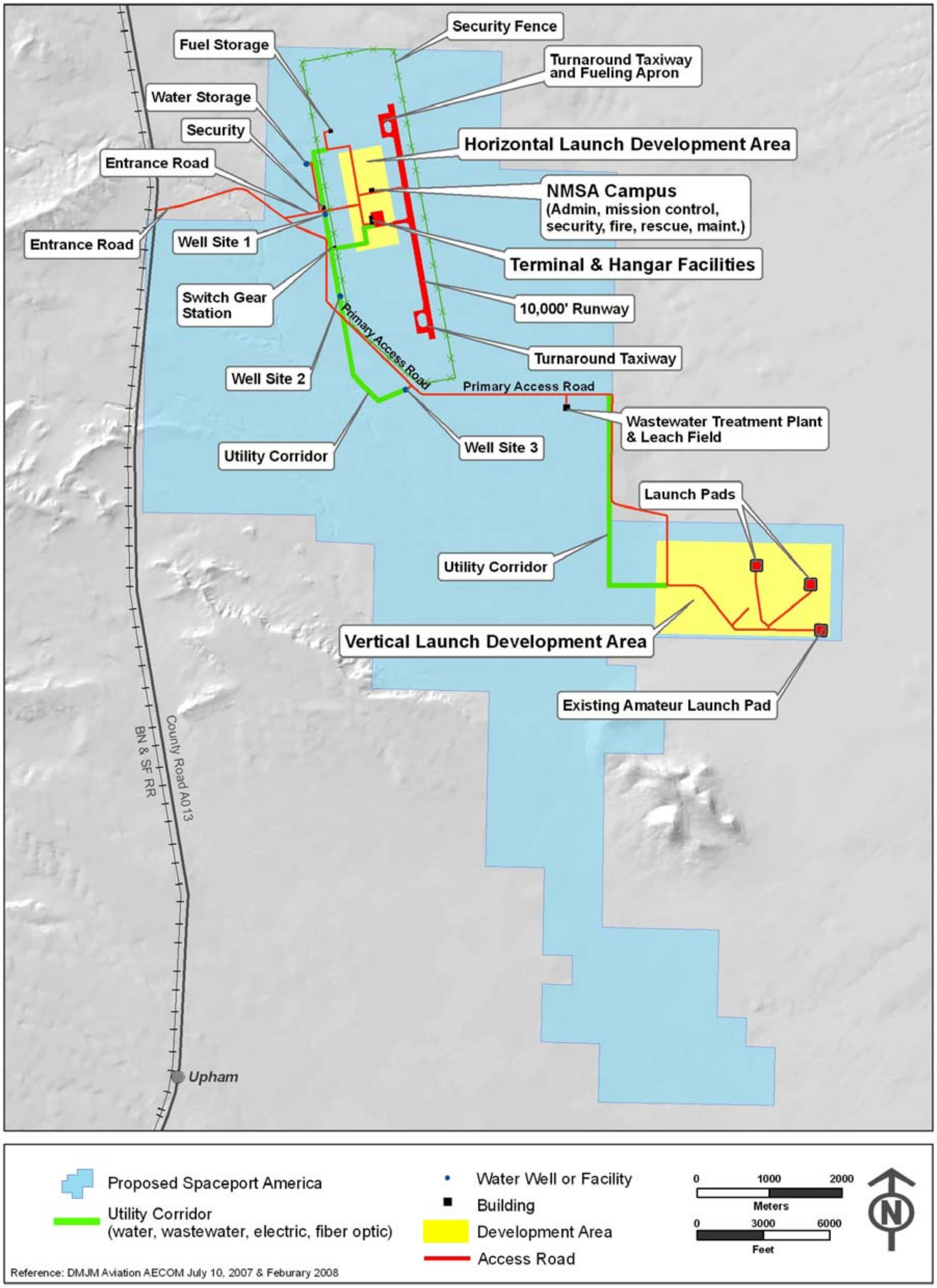
[1] Amateur rocket activities mean launch activities conducted at private sites involving rockets powered by a motor or motors having a total impulse of 200,000 pound-seconds or less and a total burning or operating time of less than 15 seconds, and a rocket having a ballistic coefficient, i.e., gross weight in pounds divided by frontal area of rocket vehicle, of less than 12 pounds per square inch (14 CFR Part 401.5).

The infrastructure to be constructed in each phase is listed in Exhibit 2-4. Exhibit 2-5 shows the proposed infrastructure components within the proposed Spaceport America area. Some facilities planned for construction in Phase 2 do not have specific known locations. These facilities would be constructed within the designated launch development areas. The total area of land disturbed by construction would be approximately 970 acres; the total area of the final facilities footprint would be approximately 145 acres. The proposed Spaceport America boundary would encompass approximately 26 square miles. This area currently contains both State and private land.

Exhibit 2-4. Infrastructure Components to Be Constructed by Phase

Phase	Off-site and Vertical Launch Area	Horizontal Launch Area and Airfield
Phase 1 Operational Spaceport (17 months) 30 days to 18 months after Record of Decision	Off-site power supply to Spaceport America entrance road Off-site fiber optic cable to Spaceport America entrance road Entrance road providing access to Spaceport America from County Road A013 Primary access road Vertical area secondary roads Vertical area power, water, and communications utilities Vertical area sewage collection and treatment systems	North-south runway Tarmac and airfield facilities area Turnaround taxiway and fueling apron Terminal and hangar facility NMSA Campus • Aircraft rescue and fire-fighting facility • Grounds maintenance facility Fuel storage facilities Secondary roads Power, water, and communications utilities Security fence Reroute existing 7.2 kilovolt (kV) power line Sewage collection system and wastewater treatment plant
Phase 2 Long-Term Development (12 months) 18 months to 30 months after Record of Decision	Two vertical launch pads Vertical area static rocket test stand Vertical area vehicle assembly building Vertical area launch control facility Vertical area propellant storage facilities Vertical area general purpose building Additional vertical area secondary roads	Two airfield hangars NMSA terminal/office building (at the NMSA campus) Airfield general purpose building General purpose hangar

Exhibit 2-5. Proposed Spaceport America Infrastructure Components and Locations



Responsibility for development of the specific erosion and sediment control plans and other Best Management Practices during construction would be placed on the general contractor hired by NMSA to construct the spaceport. The general contractor would be required to apply the current construction industry Best Management Practices in accordance with Federal requirements, NPDES General Permit requirements, and applicable regulations of the New Mexico Environment Department. NMSA would act in an oversight capacity to ensure that contractor performance meets these requirements.

2.1.2.1 Vertical Launch Area Facilities

The proposed vertical launch area currently contains amateur rocket launch facilities consisting of one launch pad with a rollaway structure, a propellant storage building, and two portable launch control trailers, all connected by a dirt road. A cattle fence (e.g., four-stringed barbed wire) already surrounds the vertical launch area, and no additional fencing is proposed. During Phase 1 of construction, utilities would be extended to and within the vertical launch area, including power, water, and communications, and a sewage collection and treatment system would be installed (see Section 2.1.2.3). A primary access road would be built from the entrance road to the vertical launch facilities area. Secondary roads within the launch area would also be constructed. During Phase 2 of construction, new facilities that would be constructed include two additional concrete launch pads, a static rocket test stand, a vehicle assembly building, a permanent launch control facility, propellant storage facilities, and a general-purpose building. All buildings would utilize low-profile design with non-reflective surfaces. Natural berms, vegetation, and color would be used to disguise facilities to the extent practicable. Additional secondary roads would be constructed within the launch area to access these new facilities. All of the facilities would be constructed on NM State Trust Land within the development area, shown in Exhibit 2-6.

2.1.2.2 Horizontal Launch Area and Airfield Facilities

No facilities currently exist in the proposed horizontal launch area. Phase 1 of construction would include most of the horizontal launch area facilities.

The airfield would include a 10,000 foot-long north-south runway, with associated taxiway and tarmac areas. The orientation of the runway would allow for sufficient wind coverage and the location would ensure that an existing 345 kV transmission line remains outside of the areas required to be free of obstructions. The orientation of the runway parallel with the existing natural contours would also aid in hiding it from view. The length of the runway would conform to the needs of potential users and would accommodate anticipated transient aircraft carrying Spaceport America visitors and customers or deliveries of equipment or materials. To be conservative in the design, the width of the runway, 200 feet, would conform with the criteria for the largest aircraft considered in the FAA Advisory Circular 150/5300-13, *Airport Design*.

Buildings and facilities would be constructed in a "campus" setting in a designated development area located at the northern end of the runway, on the west side (Exhibit 2-7). Phase 1 buildings would include a terminal and hangar facility (THF), an aircraft rescue and fire-fighting facility (ARFF), and attached grounds maintenance facility. The THF would use a sloped elevation and natural berms, vegetation, and colors to blend into the surroundings, as viewed from the south and west. Its orientation and berms would also hide activities occurring on the apron. The ARFF would use natural colors, berms, and vegetation to reduce visibility of the building. The

Exhibit 2-6. Proposed Vertical Launch Area Infrastructure Components

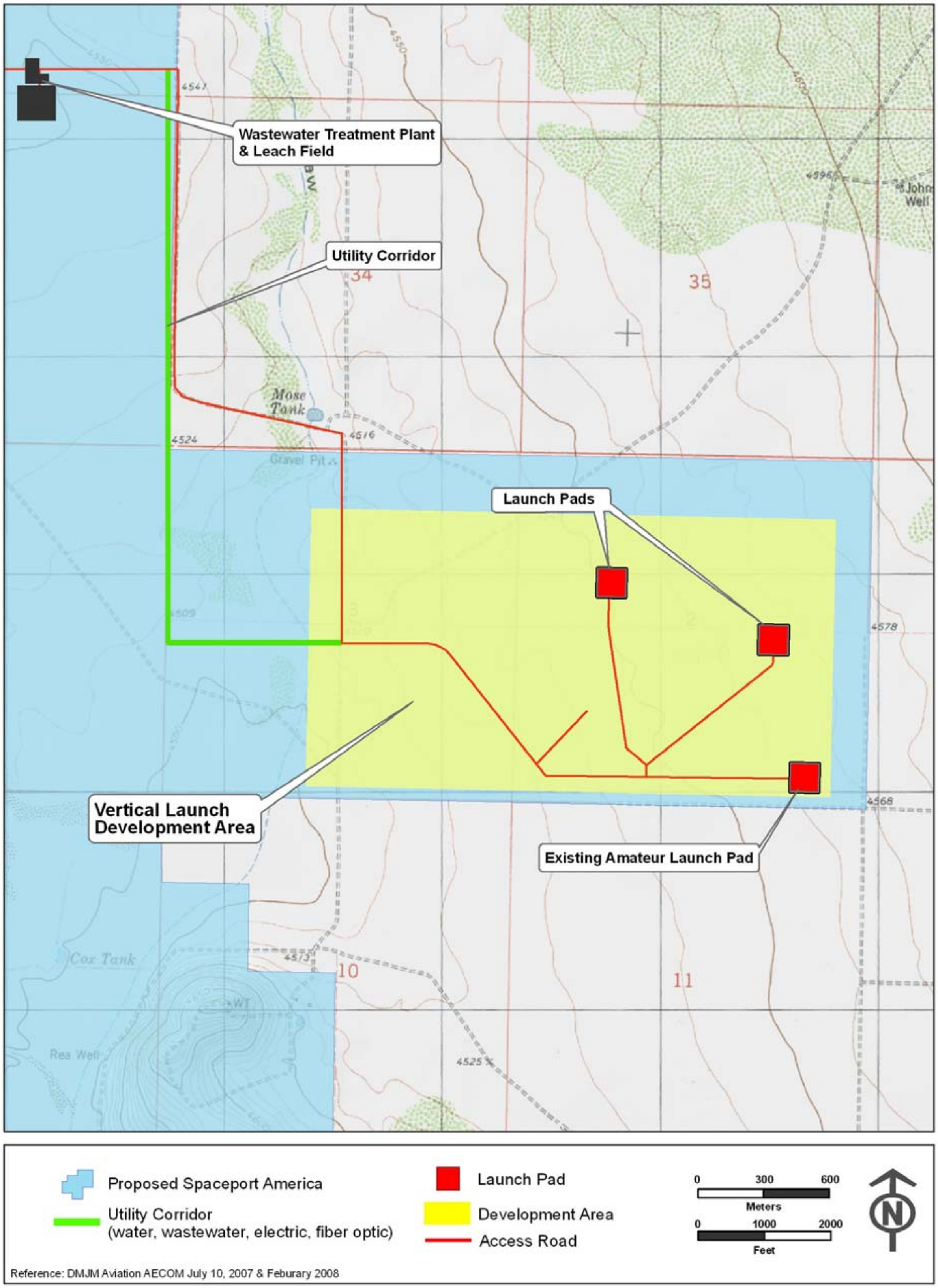
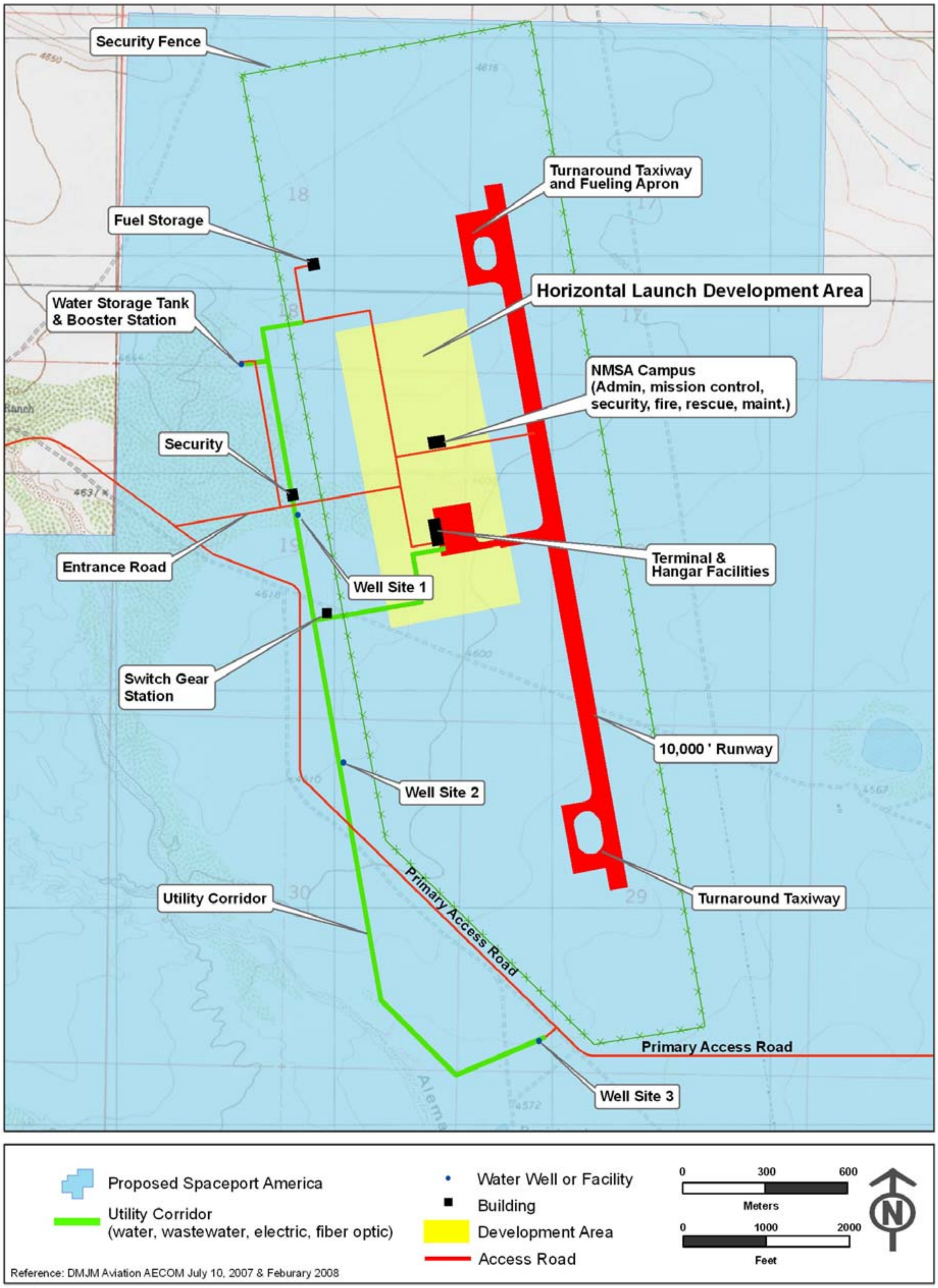


Exhibit 2-7. Proposed Horizontal Launch Area Infrastructure Components



ARFF is also partially hidden from view by the natural contours. Schematics of these two proposed facilities can be seen in Appendix L.

Propellant storage facilities would be constructed north of the campus, away from the other buildings. The facilities would include individual tanks in a defined area, separated by distance and earthen berms from one another. Federal regulations for separation distances between fuel tanks and between fuels and the public would be followed (14 CFR Parts 420.67 and 420.69). Berms would be constructed to contain liquid spills and maintain separation distances. The storage facilities would be partially hidden from view from the west by the natural landscape contours.

The runway and campus would be surrounded by an 8-foot tall perimeter fence to maintain personnel and visitor safety, facility security, and to keep cattle and wildlife off the runway and away from facilities. This fence would enclose approximately 1,400 acres. Most of the perimeter fencing would be game fence (steel wire with both vertical and horizontal strands), with the portion along the west side of the campus area where people would enter and exit constructed of chain link. Fencing would also be present around the propellant storage area and along the secondary road leading to it. Cattle fencing (e.g., four-string barbed wire) would be installed on both sides of the entrance road from County Road A013 to the perimeter fence.

Secondary roads connecting the facilities would be constructed within the designated development area. Utilities would be extended to and within the horizontal launch area including power, communications, water, and wastewater (see Section 2.1.2.3). A sewage collection system would be installed and extended to a wastewater treatment plant and leach field constructed southeast of the southern end of the runway.

Phase 2 of construction would include two airfield hangars, a general purpose hangar, an NMSA terminal/office building, and an airfield general purpose building, all located within the development area. All buildings would utilize low-profile design with non-reflective surfaces. Hangar glass and elevation would be oriented to the east. Natural berms, vegetation, and color would be used to disguise facilities to the extent practicable. All construction at the horizontal launch area and airfield would occur on NM State Trust Land.

Lighting would be minimal at the airfield due to its use almost exclusively during the day. An edge lighting system would be located on the runway, taxiway, or tarmac for use only during landings and takeoffs. Lighting would be located on the east side of the THF overlooking the adjacent apron. Low mast lighting would be present at road intersections and security lights would be located at entrances to buildings.

2.1.2.3 Utilities

Utilities necessary for Spaceport America operation would include electrical power, fiber optic communications, water supply, and sewage treatment.

Electrical Transmission

Electrical power would be supplied from an existing 115 kV transmission line located approximately 6 miles west of the intersection of County Road A013 and the spaceport entrance road. In Phase 1, Sierra Electric Cooperative, Inc. would construct a substation at the 115 kV line to deliver power to Spaceport America. Spaceport America would require redundant systems to ensure little or no interruption of power supply to the facilities. To meet this requirement, the substation would include one active transformer and an inter-connected transformer that is already installed on the system. Should the first transformer fail, the second would almost instantaneously become operational. A transmission line would be constructed from the substation to County Road A013 and deliver 24 kV of power to the Spaceport America site. The first 5.5 miles of the transmission line from the substation and heading east would be aboveground; the next 0.75 mile to County Road A013 would be underground. After crossing County Road A013, the transmission line would continue underground along the entrance road into the Project site (Exhibit 2-8). The off-site substation and transmission line would be constructed in Phase 1 and located on BLM-administered land.

The buried transmission line would follow the entrance road to an electrical switch gear station, then into the horizontal launch area, providing power to the airfield and associated facilities. The switch gear station would be comprised of a concrete pad with metal cabinets mounted on top. The transmission line would also run south from the horizontal launch area, first in a utility corridor past the southern end of the runway, and then east along the primary access road, past the waste water treatment plant (Exhibit 2-9). The line would then extend south in the utility corridor and then east into the vertical launch area, where it would run to the various facilities along the secondary roads. Key facilities would have individual backup generators for a redundant power supply. If water supply Scenario 2 were selected for implementation (see Water Supply in this section for a description of the three water-supply scenarios), additional transmission lines would be constructed, sharing the utility corridor with a pipeline to the three pump stations. The entire power distribution system on the Spaceport America Project site would be constructed during Phase 1, and would be located underground on NM State Trust Land.

Existing 7.2 kV transmission lines, which supply power to the both the Bar Cross Ranch and Lewis Cain Ranch headquarters and the section-hand house, cross the location proposed for the airfield runway. During Phase 1, these aboveground transmission lines would be removed from this area and re-routed along the primary access road from the west side of the campus area southeast to a location south of the runway. At this point it would join with the existing transmission line running southeast to the Lewis Cain Ranch headquarters, and also would continue east and north to a ranch foreman's house (Exhibit 2-10). These re-routed transmission lines would remain aboveground on NM State Trust Land.

Fiber Optic Communications

Fiber optic cable for voice and data communications is currently available along the Burlington Northern and Santa Fe Railroad right-of-way that parallels County Road A013. During Phase 1, Spaceport America would tie-in to the LamdaRail fiber optic system at a regeneration station located adjacent to County Road A013 approximately 6 miles north of the spaceport entrance road. To meet the need for redundant systems, another tie-in would occur at an existing splice point located adjacent to County Road A013 approximately 6 miles south of the entrance road. From each of these points, the fiber optic cable would be buried in the right-of-way of County Road A013 to the entrance road (Exhibit 2-11). These 12 miles of buried fiber optic cables would cross BLM, NM State Trust, and private lands.

Exhibit 2-8. Proposed Spaceport America Off-site Power Supply Infrastructure

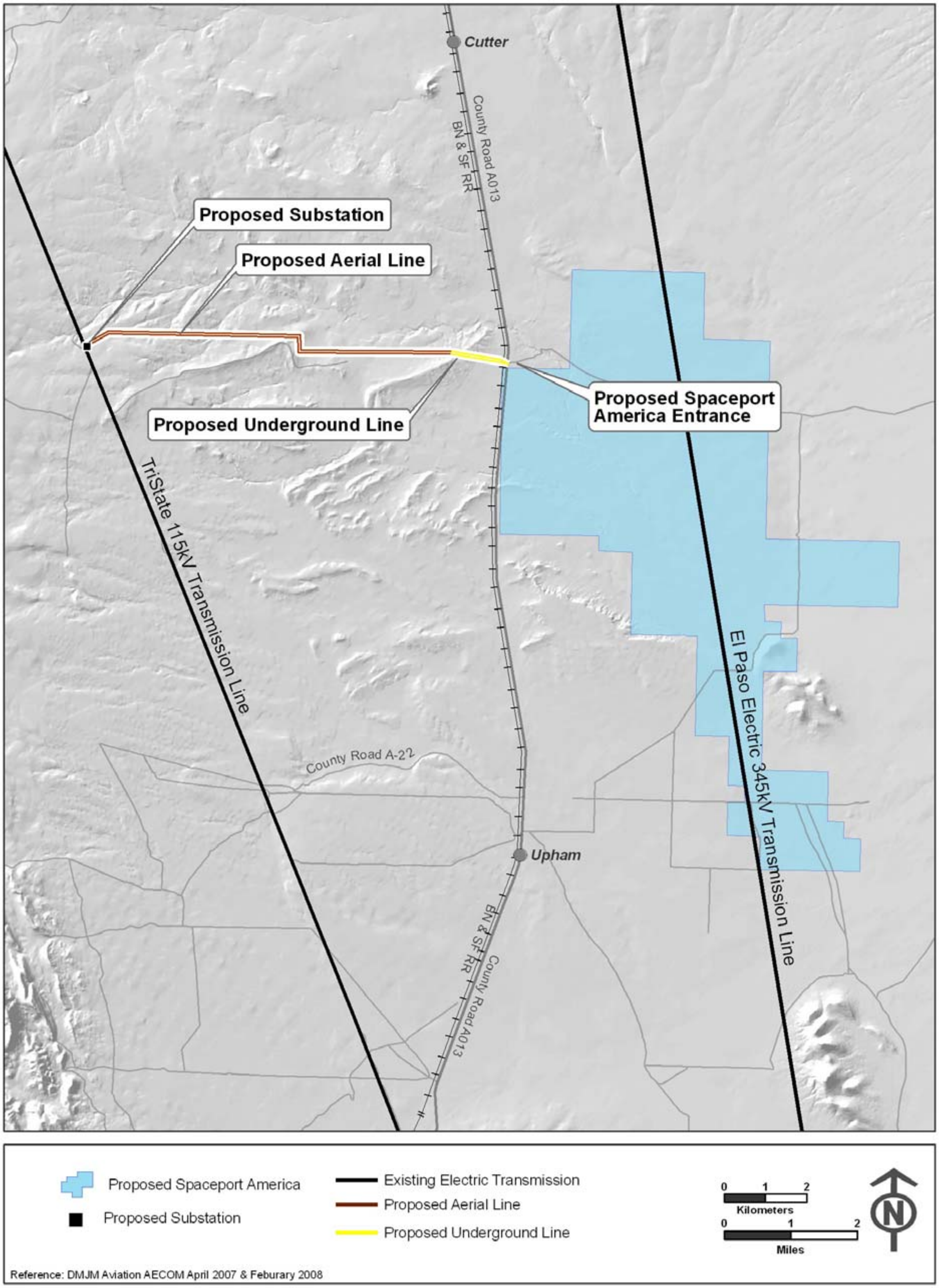


Exhibit 2-9. Proposed Spaceport America On-site, Underground Power Supply Infrastructure

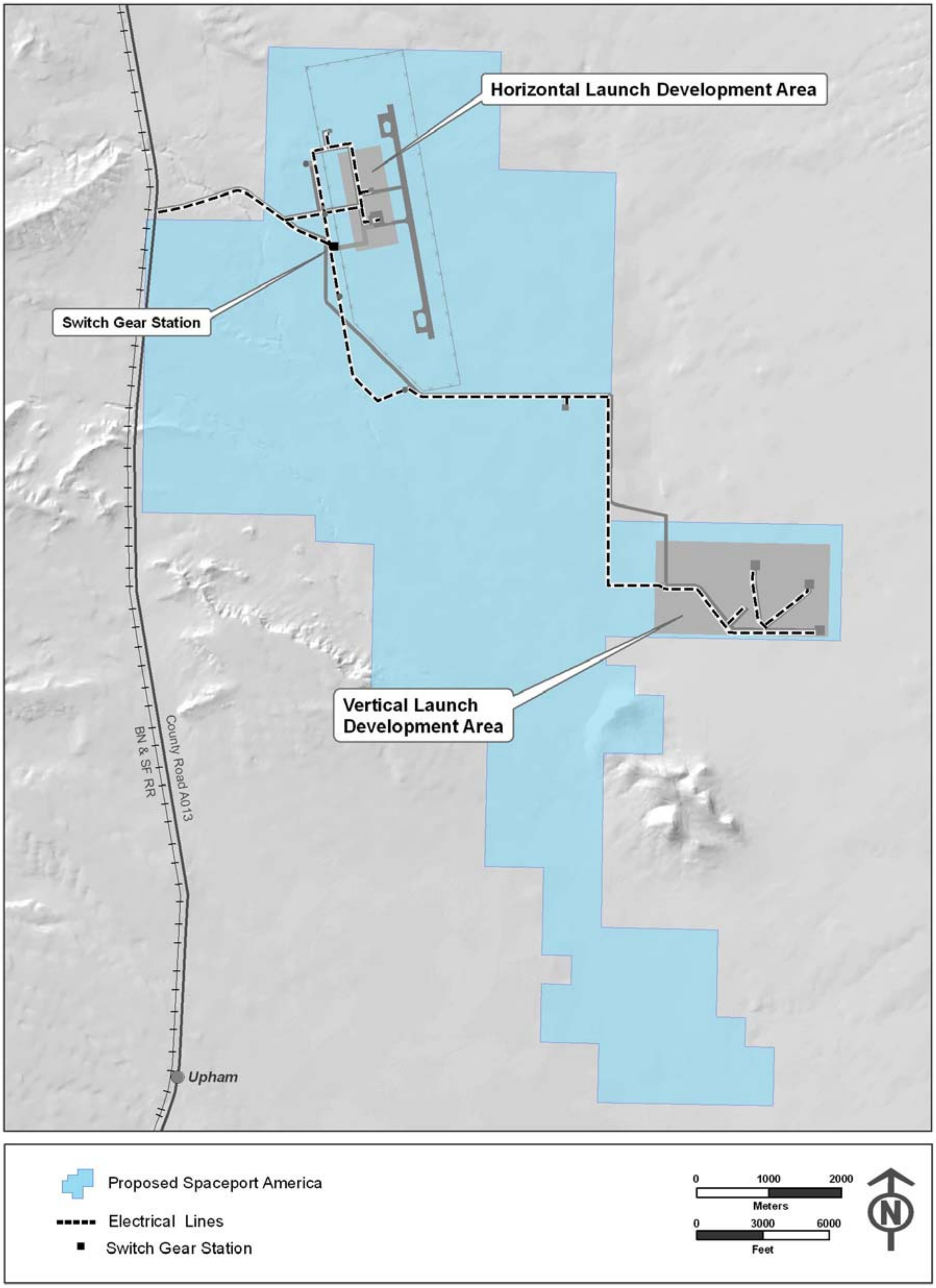


Exhibit 2-10. Proposed Re-Routing of Aboveground 7.2 kV Transmission Lines

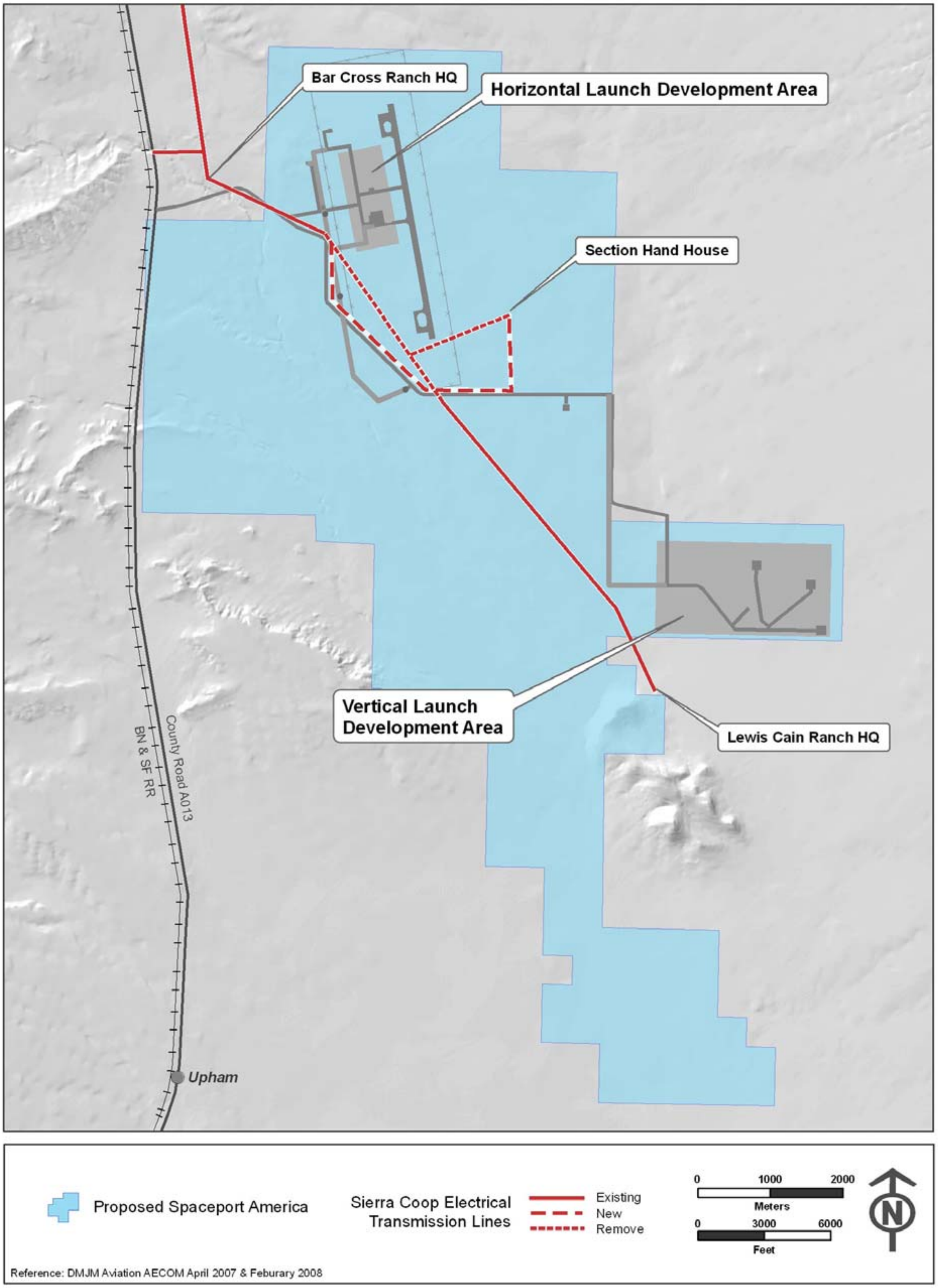
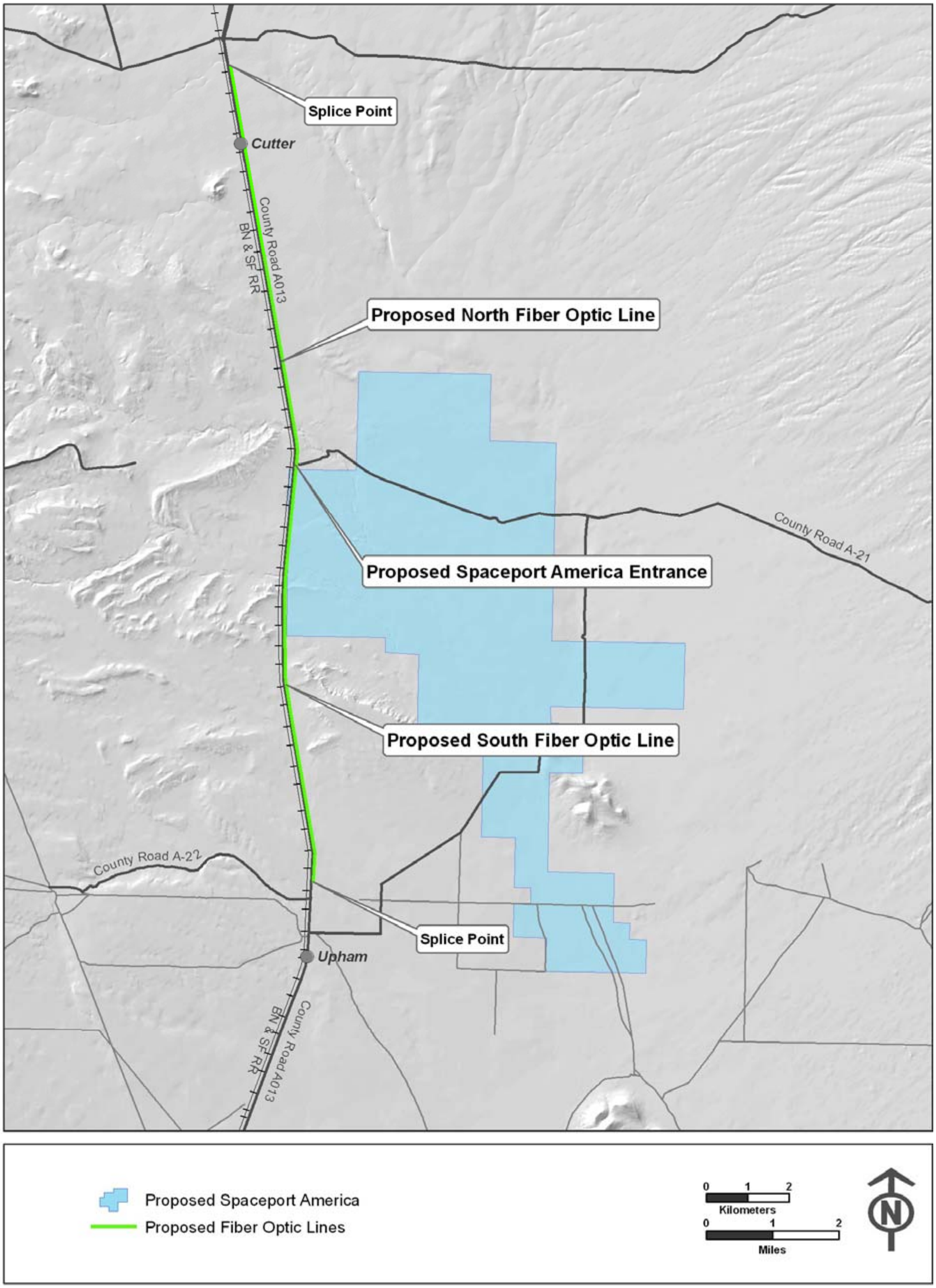


Exhibit 2-11. Proposed Off-site Fiber Optic Communications Infrastructure



Fiber optic cables would be installed underground along the entrance road into the proposed Spaceport America horizontal launch area and to the various facilities. The fiber optic cables would run south from the horizontal launch area, first in a utility corridor past the southern end of the runway, and then east along the primary access road, past the wastewater treatment plant (Exhibit 2-12). The cables would then extend south in the utility corridor and then east into the vertical launch area, where they would run to the various facilities along the secondary roads. The entire fiber optic communications system on the Spaceport America Project site would be constructed during Phase 1, and would be located underground on NM State Trust Land.

Water Supply

This EIS analyzes three scenarios for supplying water to Spaceport America for construction and operation. Water supply planning is currently underway by NMSA. The final planned water supply scenario would fit within the bounds set by these three scenarios. Scenario 1 would include three water supply wells with associated pump stations, a storage tank, a booster station, and collection and distribution pipelines would be installed at Spaceport America during Phase 1 of construction on NM State Trust Land. The three wells (Well Sites 1, 2, and 3) would be located 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 located 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. Buried distribution pipelines would extend to the various facilities within the horizontal launch area and along the airfield (Exhibit 2-13). Underground distribution pipelines would also extend southeast in the utility corridor, the primary access road, and another utility corridor to deliver water to the vertical launch area. Pipelines would extend along secondary roads to each of the facilities.

Scenario 2 is the same as Scenario 1, except the three wells (Well Sites 4, 5, and 7c) would be located along Yost Draw and Aleman Draw (Exhibit 2-13). Water would still be pumped through buried collection pipelines to the storage tank located west of the horizontal development area. From there, water would be pumped by booster station through buried distribution pipelines located in the same corridors as Scenario 1 to the horizontal and vertical launch areas. As with Scenario 1, Scenario 2 would be constructed during Phase 1 on NM State Trust Land.

Scenario 3 has all water coming to the site via truck from an off-site supplier. Construction at the Spaceport America site would include a storage tank, booster station, and distribution pipelines. Water would be stored in a storage tank in the same location west of the horizontal development area. From there, water would be pumped by booster station through buried distribution pipelines located in the same corridors as Scenarios 1 and 2 to the horizontal and vertical launch areas (Exhibit 2-13). As with Scenarios 1 and 2, Scenario 3 would be constructed during Phase 1 on NM State Trust Land.

Exhibit 2-12. Proposed On-site Fiber Optic Communications Infrastructure

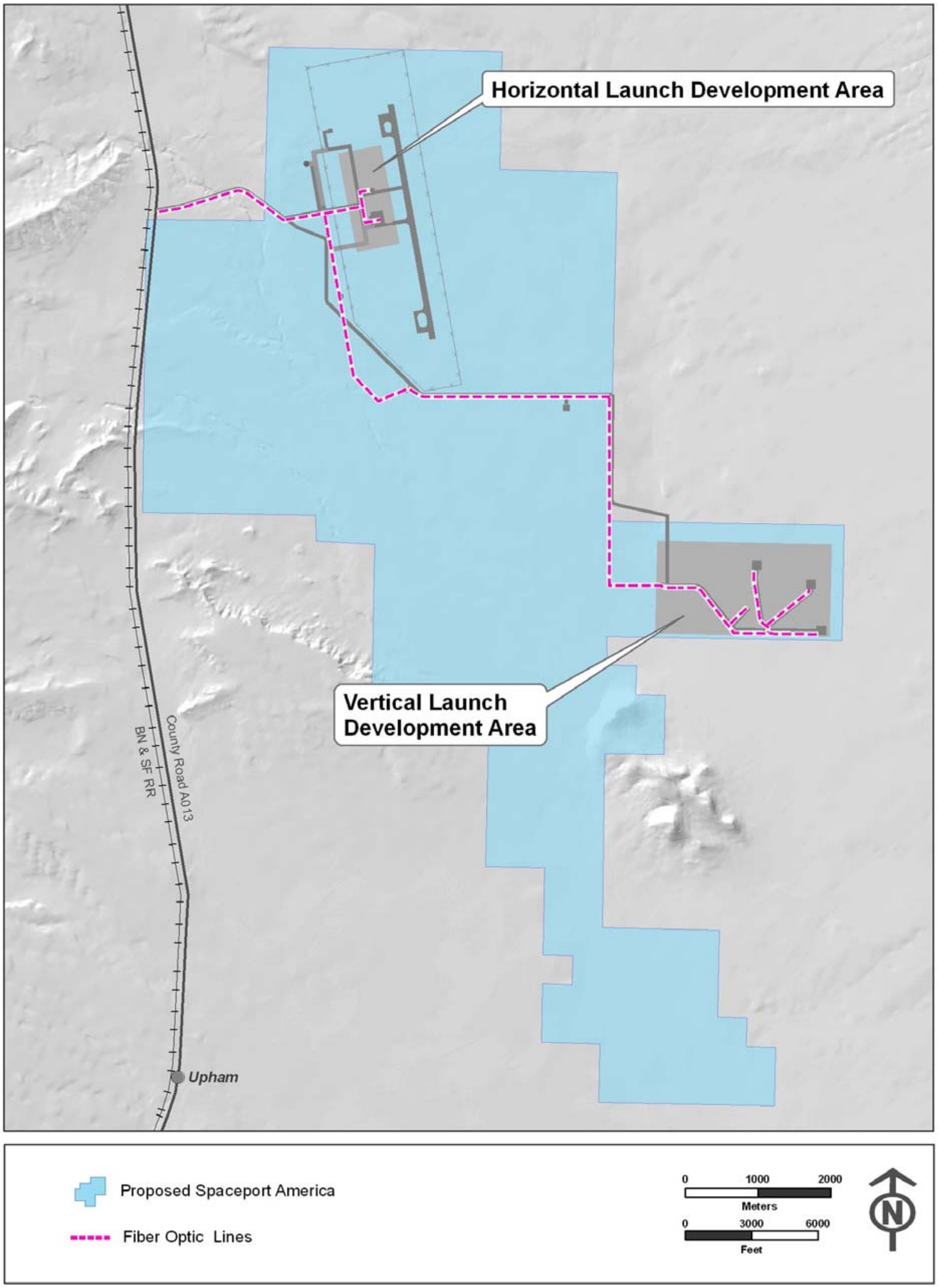
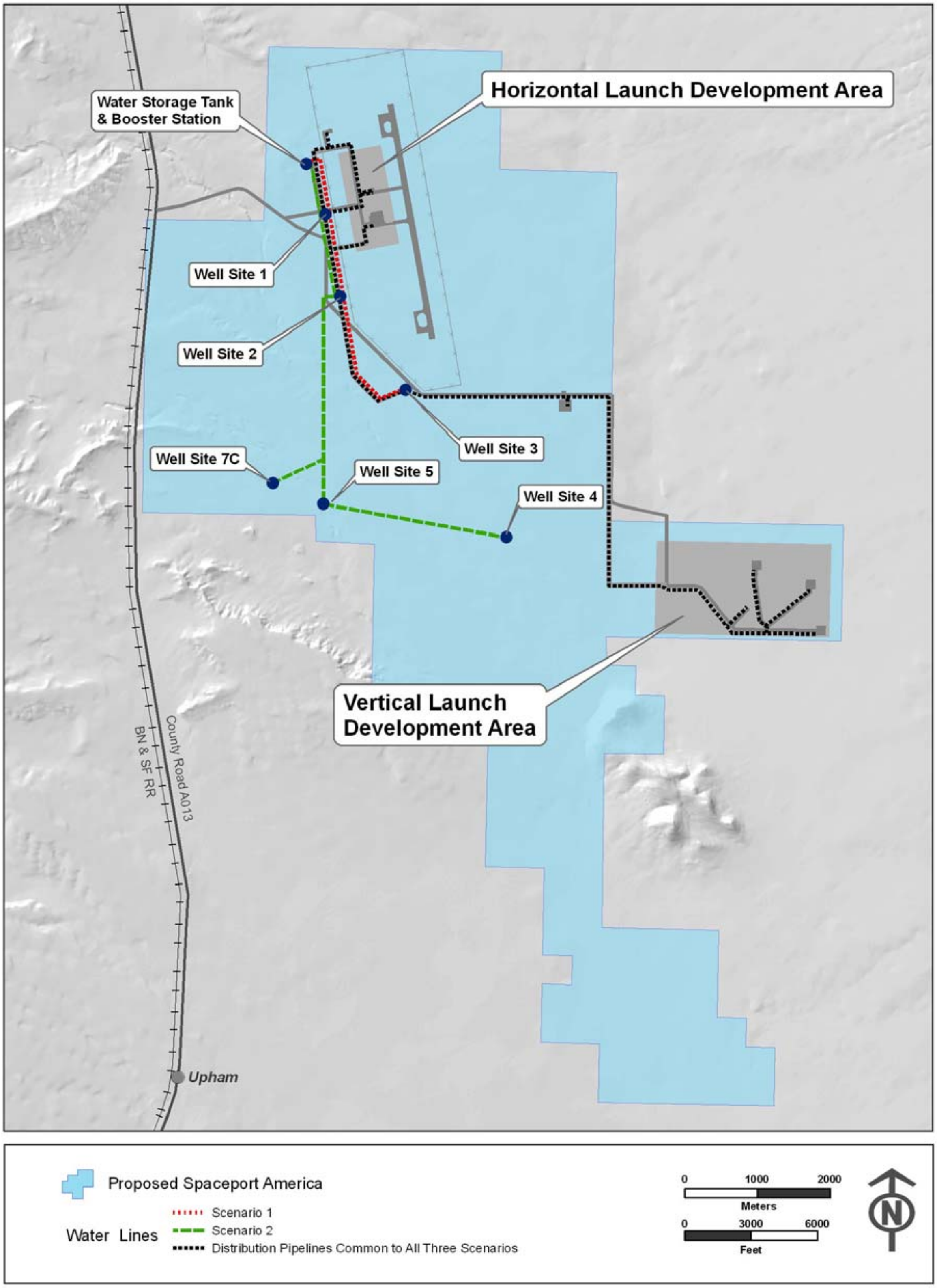


Exhibit 2-13. Proposed Spaceport America Infrastructure for the Three Water Supply Scenarios



Wastewater Treatment

A wastewater treatment plant, overflow leach field, and collection pipelines would be constructed for processing and disposition of wastewater (Exhibit 2-14). Sewage pipelines would be constructed underground and would follow the utility corridor and primary access road between the horizontal launch area campus and the treatment plant. Treated waters would be collected and used for irrigation of facility landscaping and other non-potable uses. The wastewater treatment plant and overflow leach field would be fenced with cattle fencing, enclosing approximately 6 acres. Wastewater treatment at the vertical launch area would be accommodated through facility-specific septic tanks and leach fields in the vertical launch development area. All sewage treatment infrastructure would be constructed during Phase 1 on NM State Trust Land.

2.1.2.4 On-Site Roads

County Road A039, which provides access to Spaceport America, would serve as the entrance road. This road would be expanded to two lanes with paved shoulders during Phase 1 to provide an all-weather road (Exhibit 2-15). A portion would be re-routed to the south to avoid an area that crosses the Ben Cain Ranch headquarters. The crossing of Aleman Draw, a 15-foot deep arroyo, would include channelization of the arroyo and installation of culverts or a bridge. The western half of the entrance road would be located on private land, and the eastern half would be located on NM State Trust Land. The paved entrance road would extend east into the development area of the horizontal launch area, where it would branch into secondary paved roads leading to facilities, the runway, and the propellant storage area. A secondary gravel road would lead to the water storage tank and booster station. These secondary roads would also be constructed during Phase 1 and would be located on NM State Trust Land.

Road construction during Phase 1 on the proposed Spaceport America Project site would also include construction of a primary access road, about half of which would be located on an existing two-track county road. The primary access road would start at the entrance road, west of the horizontal launch area campus. The road would run south and southeast past the end of the runway, then turn directly east and go past the wastewater treatment plant to intersect with existing County Road (CR) A020. The primary access road would be gravel and located on NM State Trust Land. CR A020 is a dirt road on BLM land that runs south to the vertical launch area. This road would continue to be used to access the vertical launch area; however, no improvements would be made to CR A020 and Sierra County is responsible for maintenance. Both the primary access road and CR A020 would remain open and accessible to the public during construction and operation to maintain open access to the BLM land located east of the proposed Project site.

Secondary gravel roads in the vertical launch area’s development area would be constructed during Phase 1, with additional secondary gravel roads developed in Phase 2 (Exhibit 2-15). These secondary roads would connect from CR A020 to the facilities and launch pads in the vertical launch area. All of these secondary roads would be located on NM State Trust Land.

Exhibit 2-14. Proposed Spaceport America Wastewater Treatment Plant, Leach Field, and Collection Pipelines

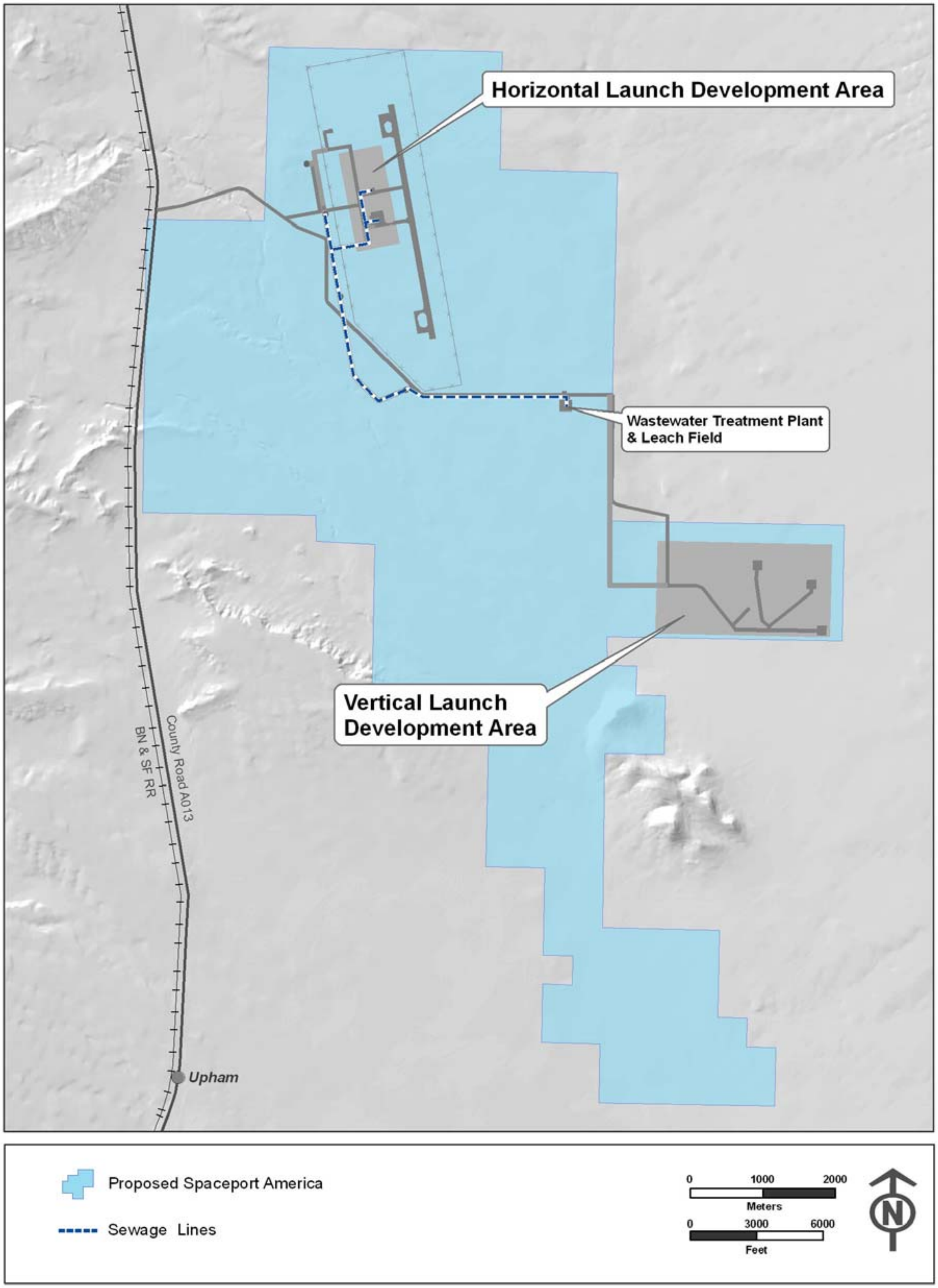
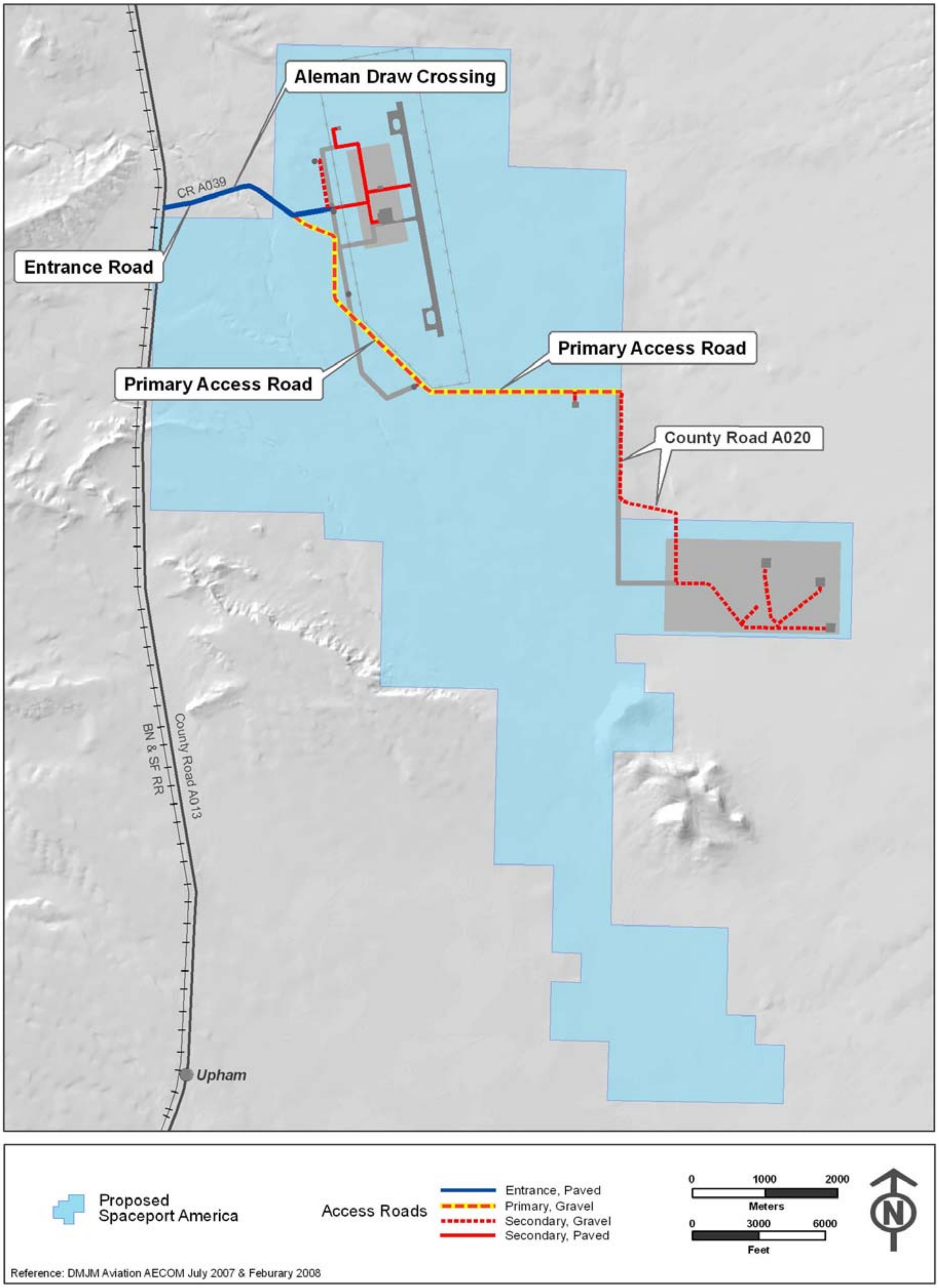


Exhibit 2-15. Proposed Spaceport America On-site Roads



2.1.2.5 Sierra County Road A013

Sierra County Road A013 runs from north of Engle, New Mexico, south past the proposed Project site to match with Doña Ana County Roads E070 and E072 at the Upham exit on I-25, at Rincon (Exhibit 2-16). This road is a bladed dirt road with few improved drainage crossings. This road is the only access to the entrance road of the proposed Spaceport America. The State of New Mexico has proposed temporary and permanent improvement projects for this road, as described below.

Temporary Road Improvements

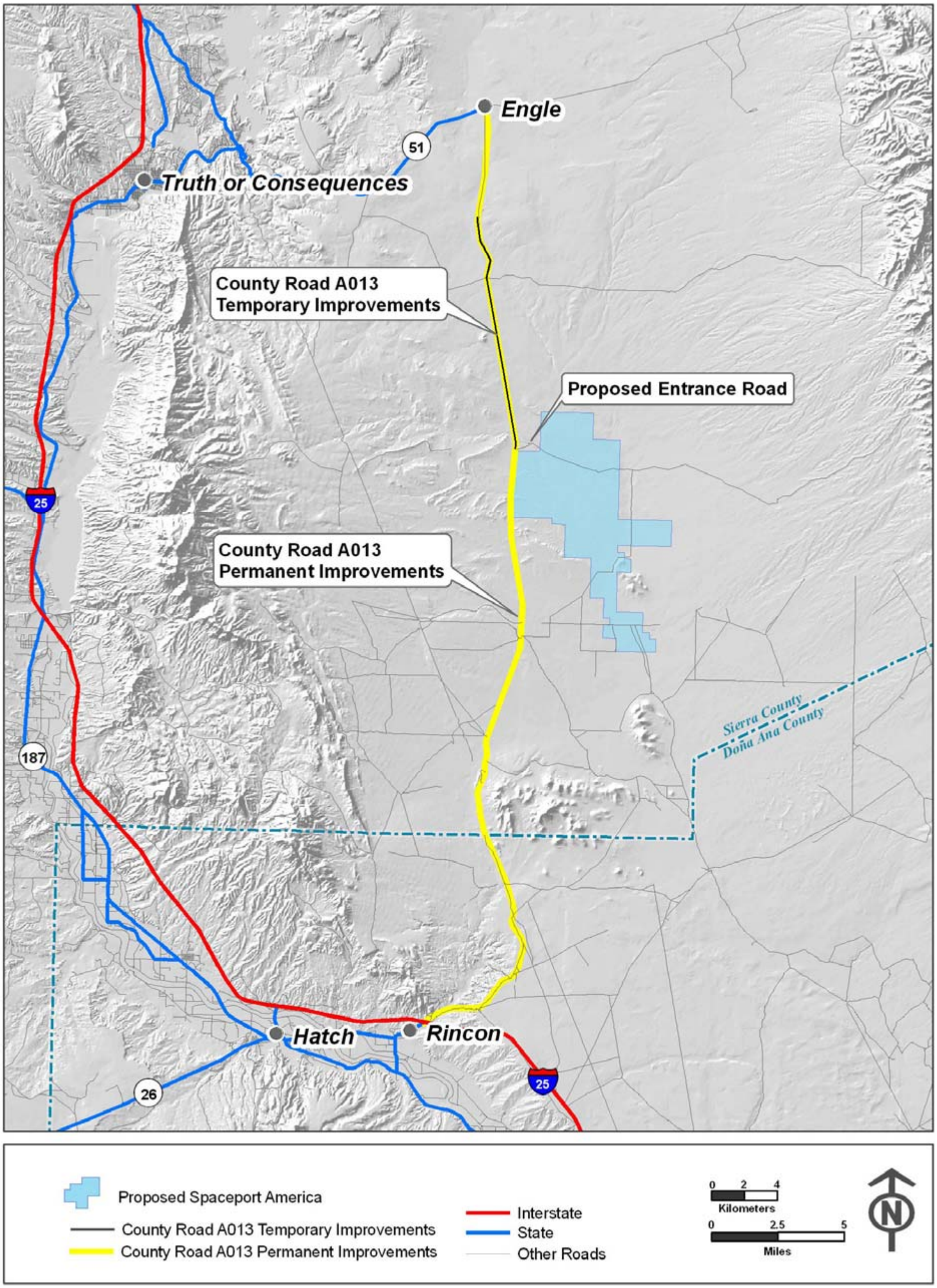
The first Project involves temporary improvements to County Road A013. A 4.3 mile-long portion of the road south of Engle is already chip sealed. The portion from the end of the chip-sealed portion south to the proposed entrance road (8.2 miles) was damaged during heavy rains in the summer of 2006. The New Mexico Department of Transportation (NMDOT) agreed to work with Sierra County to repair the road and damaged drainage crossings in this portion that were determined to be unsafe. NMDOT is currently conducting design and environmental analysis for chip-sealing this portion of the road and replacing three drainage crossings with new bridges, drainage structures, or low water crossings to make the road passable in inclement weather for the current users. The purposes of the repairs are to resolve current deficiencies in local and regional access, to enhance safety, and to ensure all weather access along this route. This road project would go forward regardless of whether or not the FAA decides to issue a Launch Site Operator License to NMSA to operate Spaceport America. NMDOT is preparing an EA for the proposed improvements. These proposed improvements are considered in this EIS in the assessment of cumulative impacts (Chapter 5).

Permanent Road Improvements

The other project proposed by the State of New Mexico for County Road A013 consists of permanent improvements to the road from Engle south to the Upham exit on I-25. The Project could include realignment, paving, widening, addition of shoulders, or some combination of improvements. Bridges or other drainage structures could be constructed at drainage crossings that currently flood the road. This Project would improve access to the area, including to Spaceport America.

NMDOT has just begun the alignment and corridor analysis process necessary to determine the route and location of the improvements. Once the route and location of the improvements are determined, NMDOT will analyze and disclose the environmental impacts from the Project in a separate analysis conducted by NMDOT through their environmental process. This environmental analysis would comply with BLM and Federal Highway Administration (FHWA) requirements. The process NMDOT uses for its corridor analysis and environmental impact analysis is described below. The proposed improvements are included in this EIS in the assessment of cumulative impacts (Chapter 5).

Exhibit 2-16. Sierra County Road A013 Proposed Projects



NMDOT Environmental Analysis Process

NMDOT would design the permanent road improvements and alternatives, and conduct environmental impact analysis, in accordance with *Location Study Procedures: A Guidebook for Alignment and Corridor Studies* (NMSHTD, 2000). Alignment and corridor studies conducted under these procedures are generally conducted in three distinct phases, commonly referred to as Phases A, B, and C. It is the policy of NMDOT that agency coordination and public involvement are cornerstones of the Project development process. Involvement of the public is intended to be proactive, comprehensive, and continuous through all three phases of the Project development process. As such, the results of each phase are presented to the public in a public meeting, before continuing on to the next phase.

Phase A, called the *Initial Evaluation of Alternatives*, verifies the need for an action, develops a range of potential alternatives to achieve the need, and eliminates alternatives that are clearly not feasible. It is during this phase that NMDOT determines the appropriate level of environmental documentation needed to meet the requirements of NEPA. Also during Phase A, NMDOT initiates agency coordination and develops a public involvement program that is implemented throughout all three phases of the alignment and corridor study. Phase B, the *Detailed Evaluation of Alternatives*, further evaluates and refines the alternatives advanced from Phase A. Information collected and developed during this phase serves as the basis for preparation of the environmental document. Phase C, the *Environmental Documentation and Processing* phase, includes the preparation of either an EIS or EA and publication of the document for review and comment by affected and interested agencies, stakeholders, and the general public.

2.1.3 Proposed Spaceport America Operational Activities

Operational activities related to the Proposed Action are described in more detail below and include:

- Transport of LVs to the assembly or staging area,
- Transportation and storage of propellants and other fuels,
- Launch, landing and recovery of vehicles,
- Airspace operations, and
- Other activities.

As the phased construction activities related to the Proposed Action are completed, Spaceport America would begin operational activities in support of the Proposed Action. Access to the launch site would be controlled by the NMSA (per 14 CFR 420.53). Private-use areas, such as vehicle assembly areas, would be under the administrative control of individual Spaceport America launch operators. These operators would be responsible for adhering to NMSA policies and procedures as well as compliance with the FAA’s regulations.

The operational activities that may have environmental consequences and would support, either directly or indirectly, licensed launches are described in the following sections. These activities would commence as construction phases are completed, as shown in Exhibit 2-17.

Exhibit 2-17. Proposed Schedule of Spaceport America Operational Activities

Development Phase	Operation Start	New Launch Support Operational Activities
Phase 1: Licensed vertical launch capabilities	1 month after issuance of Record of Decision	• Spaceport America operating with a Launch Site Operator License • Launches of vertical LVs from existing amateur vertical launch facilities
Phase 2: Horizontal launch and additional vertical launch capabilities; support of X Prize Cup events	18 months after issuance of Record of Decision	• Full support of annual X Prize Cup events in 2010 • Launches of both vertical and horizontal LVs with spectators in attendance • Static rocket firings, flight demonstrations by conventional aircraft, and other similar activities • Launches carrying space flight participants

2.1.3.1 Transport of Launch Vehicles to the Assembly or Staging Areas

LVs and LV components and payloads would arrive at Spaceport America by heavy truck (tractor-trailers) or airplane. The proposed Spaceport America entrance road and primary access road and internal secondary roads would be used to move components and payloads on-site. Vertical launch vehicles and components arriving by airplane at Spaceport America airfield would be transferred to trucks for transport within Spaceport America. Horizontal LVs and components would be off-loaded at the designated hangar facility at the Spaceport America airfield. Vertical LVs and components would be off-loaded at the designated assembly building and storage areas at the Spaceport America vertical launch area.

2.1.3.2 Transport and Storage of Rocket Propellants and Other Fuels

Initially, mobile tanker trailers would provide propellant storage for rocket engine tests and licensed launches. These tankers would be moved to the site where the fueling of the LV would take place. The site would be a launch pad in the vertical launch complex or the designated fueling area at the airfield. After the fueling process is complete, the mobile tanker trailers would be moved to a nearby safe storage area away from launch activities. For vertical LVs, Spaceport America would use tankers provided by each individual launch operator. Only 1 or two fuel and oxidizer tankers would be needed at the launch site at any one time.

During construction Phase 1, permanent propellant storage facilities would be built north of the horizontal launch area campus for the fueling of horizontal LVs. In Phase 2, permanent propellant storage facilities would be built in the vertical launch area for the fueling of vertical LVs. Federal regulations for separation distances between fuel tanks and between fuels and the public would be followed (14 CFR Part 420). Berms would be constructed to contain liquid spills and maintain separation distances. Security fences to prevent unauthorized access and maintain separation of the public from fuels would surround all rocket propellant storage facilities.

Limited numbers of solid rocket motors (SRMs) would be stored in appropriate containers at Spaceport America. The FAA has specific requirements for explosives siting, handling, and storage (14 CFR Part 420.63 – 420.69). The FAA will analyze the proposed Spaceport America explosives handling and storage procedures as part of its Launch Site Operator License application review (separate from this EIS). As an example, SRMs to be used to propel small commercial sounding rockets would be stored in a magazine that meets Bureau of Alcohol, Tobacco, and Firearms specifications.

Small explosive initiators (squibs) and rocket motor igniters, if needed for any of the flight vehicles, would be stored in a locked bunker in Spaceport America vertical launch complex at a sufficient distance from any propellant storage area to meet Federal safety requirements (14 CFR Part 420.65 – 420.69). Small quantities of flammable materials would be stored in a small locked steel building in the horizontal launch development area at a sufficient distance from any propellant storage area to meet Federal safety requirements.

2.1.3.3 Launch, Landing, and Recovery of Vehicles

The primary types of vehicles initially proposed to be launched from Spaceport America are reusable. However, expendable suborbital vehicles could be launched if the vehicles and their components are designed to return safely to Spaceport America or WSMR lands. These missions would be performed for public exhibition, space tourism, commercial payloads, and developmental flights to obtain flight experience and operations data for the purpose of obtaining additional launch licenses.

The detailed specifications of all vehicles that could be launched within the 5-year term of the license are not known at this time because many of the vehicles have not yet been developed. The description of the Proposed Action in this document uses vehicle concepts that are broadly defined to include a range of vehicles likely to be launched during this period. These concept vehicles are given the designation “H” for horizontal launch and “V” for vertical launch. For example, Concept 1 horizontal LVs are referred to as Horizontal launch concept 1 (H1) vehicles. Some of these vehicle concepts could carry crewmembers and space flight participants.

Vehicles launching from the proposed Spaceport America would conduct operations within the WSMR restricted airspace in accordance with the 2002 MOA. A commercial launch operator would be required to obtain a launch license or experimental permit to conduct operations at the site. If the proposed operations fall outside of the scope of this EIS, a new or supplemental environmental analysis would be conducted.

In the event that a LV lands, or has the potential to land, on BLM land, a set of appropriate procedures would be developed and implemented, which meet applicable requirements or restrictions of:

- Spaceport America’s launch site operator’s license;
- Specific customer’s launch operator’s license;
- NMSA operational policies and procedures; and
- BLM regulations or policies, and regulations or policies of other affected Federal or State agencies.

NMSA and BLM have developed a draft set of appropriate procedures that is currently under review. These include the following steps to be taken:

- Trajectory data analysis would be performed to identify the most likely impact point of the vehicle;
- A specific vehicle recovery plan to access the most likely impact point would be developed by the launch operator with NMSA oversight; and
- A written report will be provided to BLM of the recovery operations.

<u>Horizontal Launch Vehicles</u>

The LV concepts described in the PEIS HL are summarized and/or referenced here. The concept horizontal LVs to be considered in this Proposed Action are:

- ***Concept H1 vehicles*** – These vehicles use jet powered take off with subsequent rocket engine ignition and powered horizontal landing.
- ***Concept H2 vehicles*** – These vehicles use rocket powered take off and flight and unpowered horizontal landing.
- ***Concept H3 vehicles*** – These vehicles are carried aloft via assist aircraft with subsequent rocket engine ignition and unpowered horizontal landing.

All launches occurring from the proposed Spaceport America site would use suborbital flight profiles and would land on the Spaceport America airfield runway. Illustrations of typical concept horizontal LVs from the PEIS HL are shown in Exhibits 2-18, 2-19, and 2-20. These LVs would typically range from 30 to 70 feet in length and weigh about 2,900 to 9,900 pounds unfueled. These vehicle concepts should be considered an "envelope" that includes the characteristics of possible vehicles that could be launched from Spaceport America in the 5-year term of the Launch Site Operator License. If the characteristics of a horizontal LV are outside of this envelope, the FAA would not license its launch from Spaceport America without appropriate NEPA analysis and impact evaluation. The types of rocket propellants and systems that would be used in these LV concepts are described in PEIS HL Section 2.1.1.3. Exhibit 2-21 shows the types of propellants that may be used by each of these vehicle concepts. These propellants may include:

- Jet fuel used in conventional and modified jet engines,
- Hydrocarbon fuel (e.g., Rocket Propellant-1 [RP-1], kerosene, alcohol, or liquid methane) plus an oxidizer such as liquid oxygen (LOX),
- Cryogenic propellants (i.e., LOX/liquefied hydrogen [LH_2], where the fuel and oxidizer are maintained at very low temperatures),
- Solid propellant (e.g., polybutadiene matrix with acrylonitrile oxidizer and powdered aluminum), or
- Hybrid propulsion systems, consisting of solid propellants with a liquid oxidizer such as LOX or nitrous oxide.

Exhibit 2-18. Typical Concept H1 Launch Vehicle

Exhibit 2-19. Typical Concept H2 Launch Vehicle

Exhibit 2-20. Typical Concept H3 Launch Vehicle

Exhibit 2-21. Rocket Propellant Systems Proposed for Use in Horizontal LV Concepts

Horizontal LV Concept	Propellant			
	Hydrocarbon	**Cryogenic**	**Solid**	**Hybrid**
Concept H1	X	X		
Concept H2	X	X		
Concept H3	X	X	X	X

Estimated Number of Licensed Horizontal Launches

The maximum estimated numbers of licensed horizontal launches for the 5-year period of the Launch Site Operator License are shown in Exhibit 2-22. The actual numbers would depend on the development of these vehicles and the number of operators that use Spaceport America. These estimates are extremely conservative, and the actual number of launches per year would most likely be lower.

Exhibit 2-22. Estimated Number of Horizontal Launches from Spaceport America Per Year

Horizontal LV Concept	Estimated Number of Horizontal Launches				
	2009	**2010**	**2011**	**2012**	**2013**
Concept H1	0	0	5	5	5
Concept H2	0	0	2	2	2
Concept H3	0	50	250	500	750
Total	0	50	257	507	757

Launch, Landing and Recovery Activities for Horizontal Vehicles

The following activities would typically be associated with horizontal launches:

- Launch facility preparation: Spaceport and launch operator would work with land management agencies to ensure that the necessary safety advisories have been issued and that procedures and plans are in place to safely conduct the proposed activities.
- Preparation of the LV: Preparation would begin with the arrival of the LV and associated payload at the launch site, and would include vehicle and payload assembly, integration, and checkout.
- Pre-flight ground operations: This would include fueling and final preparations for horizontal launch.
- Horizontal take off, flight, and/or launch: The launch, landing, and recovery for horizontal LVs operating at Spaceport America would take place at the proposed airfield. Hangar facilities, propellant storage facilities, propellant loading area, and control centers at Spaceport America airfield would be used for LV preparation and pre-launch ground

operations. For launch, the LV would taxi (if jet powered) or be towed to the runway. The LV would initiate its formal launch sequence (ignition of its propulsion system) when all preparation and pre-flight operations are completed.

- Attainment of the intended altitude: After ignition of the rocket engines, the LV would continue along its flight path until it reaches its desired altitude. In the case of Concept H3 LVs, the assist aircraft would take off and climb to the designated altitude prior to the initiation and execution of the launch sequence for the suborbital LV.
- Flight profiles: The flight profiles of the horizontal concept vehicles are described in detail in the PEIS HL.

Vertical Launch Vehicles

The vertical launch concept vehicles considered in this Proposed Action include:

- Vertical Launch Concept (V1) vehicles – These vehicles consist of a single-stage rocket in which the rocket stage and payload or crew-/passenger-module return separately to Earth by parachute.
- Vertical Launch Concept (V2) vehicles – These vehicles consist of a single-stage rocket in which the rocket stage returns to Earth by parachute and a payload or crew/passenger module returns with a powered or unpowered horizontal landing.
- Vertical Launch Concept (V3) vehicles – These vehicles consist of a single-stage rocket with rocket-powered vertical landing.

Illustrations of typical concept vertical LVs are shown in Exhibits 2-23, 2-24, and 2-25.

Exhibit 2-23. Typical Concept V1 LV

Exhibit 2-24. Typical Concept V2 LV

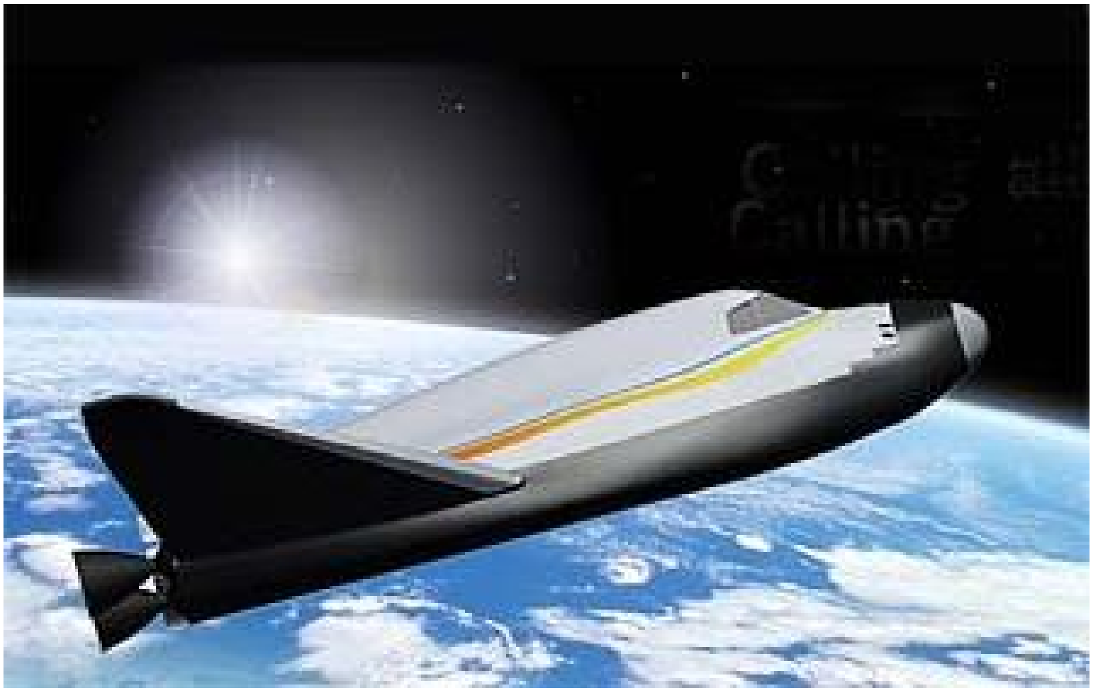


Exhibit 2-25. Typical Concept V3 LV

Exhibit 2-26 provides the physical characteristics of these vertical concept LVs. The ranges for the values of these characteristics are broad for two reasons. First, the sizes of vertical LVs are not as constrained as the sizes of horizontal LVs. The sizes of vertical LVs can vary considerably depending on payload. Sounding rockets may carry payloads of 100 pounds or less, while large rockets may carry crew and space flight participants into suborbital space. Second, many of these vehicles are in early design stages and not yet in development. These vehicle concepts should be considered an "envelope" that includes the characteristics of possible vehicles that could be launched from Spaceport America in the 5-year term of the Launch Site Operator License. If the characteristics of a vertical LV are outside of this envelope, the FAA would not license its launch from Spaceport America without appropriate NEPA analysis.

Exhibit 2-26. Vertical Launch Vehicle Characteristics

	Vehicle Characteristics				
Vertical LV Concept	**Empty Weight (lb)**	**Gross Weight (lb)**	**Height and Diameter (feet)**	**Number of Engines**	**Engine Thrust (N)**
Concept V1	220 - 22,000	660 - 88,000	15 - 100 (height) 1 - 15 (diameter)	1 or 2	20,000 - 350,000
Concept V2	2,200 - 22,000	8,800 - 88,000	15 - 100 (height) 3 - 15 (diameter)	1 or 2	40,000 - 350,000
Concept V2 Powered Landing Module	2,200 - 22,000	8,800 - 88,000	15 - 100 (height) 3 - 15 (diameter)	1 or 2	40,000 - 350,000
Concept V3	2,200 - 22,000	8,800 - 88,000	15 - 100 (height) 3 - 15 (diameter)	1 or 2	40,000 - 350,000

N = Newton; 1 N = 0.225 pounds of force; lbs = pounds

The types of rocket propellants and systems used in vertical LV concepts would be the same as those described in the previous section for horizontal LVs, except for the addition of concentrated hydrogen peroxide, which can be used as a monopropellant or as an oxidizer. Exhibit 2-27 shows the types of propellants that would be used by each of the vertical LV concepts. Two propellant systems are included for the Concept V2 vehicle, those for the main rocket stage and those for the powered horizontal landing of the crew/passenger module.

Exhibit 2-27. Propellant Systems for the Proposed Vertical LV Concepts

Vertical LV Concept	Propellant				
	Hydrocarbon	**Cryogenic**	**Solid**	**Hybrid**	**Hydrogen Peroxide Monopropellant**
Concept V1	X		X	X	X
Concept V2 Main Rocket Engine	X	X		X	
Concept V2 Powered Landing Module	X	X			
Concept V3	X	X			

Estimated Number of Licensed Vertical Launches

Exhibit 2-28 shows the estimated numbers of licensed vertical launches for the 5-year period of the Launch Site Operator License. The number of launches was estimated based on a study for NMEDD (Futron, 2005).

Exhibit 2-28. Estimated Number of Vertical Launches from Spaceport America Per Year

Vertical LV Concept	Estimated Number of Vertical Launches				
	2009	**2010**	**2011**	**2012**	**2013**
Concept V1	25	60	80	90	100
Concept V2	0	0	5	5	5
Concept V3	0	2	10	20	20
Total	25	62	95	115	125

Launch, Landing and Recovery Activities for Vertical Vehicles

The types of activities that would typically be associated with horizontal launches are described in the previous section and also apply to vertical LVs. The launch and recovery activities that would be specific to vertical LVs at Spaceport America are described below.

The launch activities for vertical LVs would take place at the proposed Spaceport America vertical launch facilities. Assembly facilities, fuel storage facilities, fueling vehicles, and control centers at Spaceport America vertical launch facilities would be used for LV preparation and pre-launch ground operations. Control centers at the Spaceport America airfield would also be used to coordinate pre-launch activities. For launch, the LV would be moved from its assembly building to a launch pad by a self-powered or towed transport vehicle, or the LV would be assembled on a launcher (such as a rail) inside a rollaway building on the launch pad, and the building would be rolled away from the LV prior to launch.

After launch, Concept V1 vehicles would climb at a near-vertical launch angle under rocket power until the propellants are consumed. The main rocket section would separate from the payload before or after apogee and return to WSMR by parachute. The payload or crew/passenger module would continue to climb unpowered in a parabolic trajectory until reaching apogee. The payload/module would descend and return to land at WSMR by parachute.

After launch, Concept V2 vehicles would climb at a near-vertical launch angle under rocket power until the propellants are consumed. The main rocket section would separate from the payload and return to land at WSMR by parachute. The payload or crew/passenger module would continue to climb unpowered in a parabolic trajectory until reaching apogee. For unpowered landings, the module would descend and glide to an unpowered horizontal landing at the Spaceport America airfield. For powered landings the module would descend and at the appropriate altitude restart its rocket engine(s) for a powered horizontal landing at the Spaceport America airfield. Although such a powered landing capability is unlikely in the near future, it will be considered in the EIS as a possibility.

After launch, Concept V3 vehicles would climb at a near-vertical launch angle under rocket power until the engines are turned off. The rocket would continue to climb in a parabolic trajectory until reaching apogee. The rocket would begin a controlled descent possibly using aero braking or some other form of braking technology. As the vehicle approaches the ground, it would orient itself vertically and ignite rocket engines for a powered vertical landing at the Spaceport America airfield or vertical launch facilities.

Components landing at WSMR would be recovered and removed from WSMR lands. Recovery from WSMR lands would be assisted by WSMR personnel and would follow standard WSMR procedures for recovery of rockets. Landings and recoveries at WSMR would be subject to prior coordination and approved by WSMR based on applicable laws, regulations, policies, and procedures.

2.1.3.4 Airspace and Airfield Operations

This section discusses Spaceport America airfield operations related to the Proposed Action that would occur in the airspace above and surrounding Spaceport America. This includes aircraft and horizontal LV flights. The airspace immediately above the proposed Spaceport America (Area 5111-B) is currently available for use by WSMR through notification of the Albuquerque Air Route Traffic Control Center. When not required for WSMR operations, this airspace is open for civil use. The airspace above WSMR is always restricted and never available for civil use. Operations in any airspace, including WSMR-restricted airspace, would be subject to applicable laws, regulations, policies, and procedures.

The airfield at Spaceport America would be limited to Spaceport America-related flights. It would not be used by general aviation or regularly scheduled commercial flights. Chartered flights may occur, such as those that would use the Spaceport America airfield to transport flight crew and participants to Spaceport America for participation in space tourism flights.

Estimates of airfield usage for the 5-year term of the Launch Site Operator License for representative and surrogate aircraft are shown in Exhibit 2-29. Typical operations are those that do not include X Prize Cup event operations and would be typical of Spaceport America airfield operations for all weeks of the year except for the week of X Prize Cup. Airspace operations are estimated and are assumed to be in addition to normal Spaceport America operations. Estimated X Prize Cup usage of the airfield is included in Exhibit 2-29 and more information about the event follows in Section 2.1.3.5.

Exhibit 2-29. Estimated Airfield Operations at Spaceport America

Representative Type of Aircraft	Purpose of Flights	Number of LTOs or Passengers: Number LTOs[1]	Passengers per LTO[2]	Total Number of Passengers
Typical Operations (per week)				
Cessna 206H	Carry passengers	7	6	42
Cessna Caravan	Carry passengers	7	14	98
Cessna Caravan	Carry small cargo	7	3	21
Boeing 727-200	Carry passengers or large cargo	1	200	200
Learjet 35	Transport of horizontal LV flight crew and participants	7	10	70
Bell 206L	Helicopter transport of passengers and cargo	7	8	56
Boeing 707 (Surrogate)	Horizontal suborbital flights[3]	7	8	56
	Total per week	43		543
	Total per year	2,236		28,236
Additional X Prize Cup Event Operations (per day)				
Learjet 35	Carry passengers or Rocket Racer chase plane	4	N/A	N/A
Boeing 707 (Surrogate)	Horizontal LV flights (competition and demonstration)	2	N/A	N/A
Boeing 727-200	Zero-gravity flights	3	N/A	N/A
Learjet 25 (Surrogate)	Rocket Racers	20	N/A	N/A

[1] LTO: a single, two-step activity that includes one landing and one take-off.
[2] Passengers per LTO is the sum of those arriving and departing (including crew).
[3] Almost all (255 of 257) horizontal suborbital flights would take off and land under jet power; although already included under launch activities, they are included again here as a more accurate and conservative summary of airfield flight operations.

Training

Spaceport America would include facilities for training crew members and space flight participants. These could include medical examination facilities, classrooms, and possibly other facilities such as a centrifuge and a water immersion tank. These facilities would be located in the Horizontal Launch Development Area.

X Prize Cup Events

Annual competitive X Prize Cup events, and perhaps similar events involving flights of space vehicles and aircraft, would begin at the proposed Spaceport America in October 2010. Over the course of the annual event, which could last up to 7 days, up to 20,000 spectators per day could be expected. Spectators would be bused to Spaceport America from Welcome Centers located in Truth or Consequences and Hatch, NM. The Welcome Centers would provide visitor information about Spaceport America, the site, and the region, and would be the departure point of bus tours to Spaceport America. The spectators would be concentrated in the campus area of the horizontal launch area, which would contain temporary portable visitor services and viewing areas. Activities would include licensed or permitted launches of both vertical and horizontal LVs. Some of the flights may carry space flight participants. Activities that do not require an FAA launch license could occur at the X Prize Cup events, including static rocket firings, flight-demonstrations by conventional aircraft, rocket racing, and other similar activities.

Support Services

There are several types of indirect support that would be associated with Spaceport America. These services are described briefly below:

- Security: Spaceport America may enter into a contract with a security services provider or may rely on local police departments. Security infrastructure would be included in the horizontal and vertical launch areas. Launch operators would adhere to all Spaceport America security policies and procedures, as well as all local, State, and Federal laws. Launch operators would cooperate fully with security officials.
- Fire and emergency response: As with security, Spaceport America may enter into a contract with a fire and emergency medical provider or may rely on local police and fire departments. Fire suppression infrastructure would be included in the horizontal and vertical launch areas. Fire and rescue personnel would be present on-site during all launch activities. Launch operators would adhere to all Spaceport America fire and emergency response policies and procedures, as well as all local, State and Federal laws. Launch operators would cooperate fully with fire and emergency response personnel.
- General services: These include maintenance of utilities, janitorial services, and day-to-day operation of facilities. They would be provided to keep Spaceport America fully functional.
- WSMR coordination: Coordination with WSMR would be provided on a continuing basis pursuant to the MOA between NMSA and WSMR that was signed on September 5, 2002. This agreement covers a large number of areas and issues including the following: integrated scheduling, integrated launch operations, mutually agreed upon flight safety criteria, and interchange of flight safety data. In addition to the MOA, NMSA would still comply with all applicable laws, regulations, policies, and procedures when coordinating activities with the WSMR.

2.2 Alternatives to the Proposed Action

The FAA action is whether to issue a Launch Site Operator License, which is being sponsored by a State or local government or private applicant. The scope of alternatives the FAA considers derives from the action(s) proposed by a license-seeking entity and the need for and purpose of Federal action in connection with the applicant's proposal. In deciding which alternatives to consider, the FAA must look carefully at the factors relevant to the definition of purpose for the action, taking into account the needs and goals of the applicant. The FAA's consideration of alternatives may give substantial weight to the preferences of the applicant in the siting and design of the Project. The FAA always considers the views of Congress, expressed in the agency's statutory authorization to act, as well as in other pertinent congressional directives.

The following alternatives to the Proposed Action present two options that would limit the types of LVs that would be launched under the Launch Site Operator License. These alternatives have been retained for further analysis and are evaluated in the EIS.

2.2.1 Horizontal Launch Vehicles Only (Alternative 1)

Under Alternative 1, the FAA would consider issuing a Launch Site Operator License only for the operation of a launch site to support horizontal launches. In this alternative, the vertical launch complex would not be built. Vertical commercial launches licensed or permitted by the FAA would not occur from Spaceport America and no vertical vehicles or components would land at WSMR. However, amateur vertical launches, which do not require a license or permit from the FAA, could still occur. This is considered a feasible alternative because a significant number of launches of horizontal LVs are projected, and most X Prize Cup activities would be located at the airfield.

Infrastructure components under this alternative, as compared to the Proposed Action (see Exhibit 2-4), would be the same for the horizontal launch area and airfield. In the vertical launch area, the components listed for Phase 2 would not be built and the Vertical area sewage collection and treatment system would be constructed in Phase 2 instead of Phase 1. The vertical area infrastructure, such as secondary roads and utilities (power, water, communications, and sewage treatment) would still be built to support on-going amateur launches.

The number and types of horizontal launches proposed under this alternative would be the same as for the Proposed Action (see Exhibit 2-22). Vertical launches requiring an FAA launch license would not be conducted. However, amateur class launches would still continue in the vertical launch area.

Airfield and airspace operations, and training activities and facilities, would be the same under Alternative 1 as for the Proposed Action (see Exhibit 2-29). The number and frequency of ground-based tests and static firings would be reduced due to having no licensed vertical launches. X Prize Cup events would be the same as under the Proposed Action, with the exception that no licensed vertical launches would take place.

2.2.2 Vertical Launch Vehicles Only (Alternative 2)

Under Alternative 2, the FAA would consider issuing a Launch Site Operator License only for the operation of a launch site to support vertical launches. In this alternative, the vertical launch complex would be built but the airfield facilities would be more limited than described under the Proposed Action. Many X Prize Cup activities would still be located at the airfield. Horizontal commercial and X Prize Cup launches would not occur from Spaceport America. This is considered a feasible alternative because a significant number of launches are projected to be of vertical LVs.

Infrastructure components that would be built under this alternative, as compared to the Proposed Action (see Exhibit 2-4), would differ in both the horizontal and vertical launch areas. In the horizontal launch area and airfield, the Phase 1 facilities would be scaled back to more appropriately support the reduced amount of air traffic. The Phase 2 facilities would not be built. For the vertical launch area, the same facilities would be built. However, the propellant storage facilities, general purpose building, launch pad 2, and launch control facility would be constructed in Phase 1 instead of Phase 2.

No FAA-licensed horizontal launches are proposed under this alternative. However, the airfield would be used to support licensed launches in the vertical area and other Spaceport America operations. The number and types of vertical launches under this alternative would be the same as for the Proposed Action (see Exhibit 2-28).

Airfield operations would be reduced as compared to the Proposed Action (see Exhibit 2-29) due to fewer overall launches taking place at the spaceport. Demonstration flights and non-space operations would continue. Training activities and facilities would be reduced under Alternative 2 as compared to the Proposed Action. The number and frequency of ground-based tests and static firings would be the same as under the Proposed Action. X Prize Cup events would be somewhat reduced as compared to the Proposed Action, due to no licensed horizontal launches taking place. However, many activities would still occur at Spaceport America under Alternative 2.

2.3 No Action Alternative

Under the No Action Alternative, the FAA would not issue a Launch Site Operator License to the NMSA. Because the NMSA would not be authorized to offer the site for commercial licensed launches, facilities to support commercial launches would not be constructed. The current land use in the proposed Project areas would remain unchanged or the land would be put to some other use, as designated by the entities that have authority over the land, namely the NM State Land Office. The need to support commercial launches and host the X Prize Cup would not be met by the State of New Mexico.

2.4 Alternatives Not Carried Forward for Further Analysis

This section describes other alternatives to the Proposed Action, which for reasons given below, were found either to be not feasible or to not meet the purpose and need for the Proposed Action. These alternatives were not carried forward for further analysis in the EIS.

2.4.1 Alternative Suborbital and Orbital Launch Vehicles

One suborbital LV concept was considered but eliminated from detailed study. The concept is an LV that could be carried aloft vertically via an assist balloon with subsequent rocket engine ignition. This type of LV could conceivably be launched from Spaceport America, but neither the rocket nor the balloon would be guaranteed to land within Spaceport America or WSMR due to drift of the balloon prior to rocket ignition. Also, such an LV may not be able to fully control its launch azimuth because it hangs below a balloon. This alternative was determined to be infeasible and will not be analyzed in the EIS.

Single stage to orbit-type vehicles similar to the X-33-derived Lockheed Martin Venture Star also were considered, but because the technologies for this type of LV have not sufficiently matured to be viable within the 5-year period of the proposed Launch Site Operator License, they are not considered to be reasonably foreseeable.

Other orbital LV concepts were considered, including large expendable LVs such as multistage rockets with or without solid rocket boosters. These types of LVs were dropped from further consideration because large vehicle components jettisoned or dropped during the flight to orbit could land in populated areas, causing harm to people and property.

2.4.2 Alternative Sites

NMSA developed considerations and criteria that were used in the site evaluation process (see Exhibit 2-30). Each consideration and criterion was applied to the potential locations for the launch site, including:

- Sites outside of New Mexico,

- Sites within New Mexico,
- Sites near WSMR,
- Sites west of WSMR, and
- Sites within the WSMR MOA area.

Exhibit 2-30. Site Selection Criteria

Consideration	Criteria
Trajectory Pathway	• Located in southern tier of States
Flight Safety	• Low population density • Availability of suitable land for safety buffer zone
New Mexico Economic Development Goals	• Located in New Mexico
Operational considerations	• Weather • Airspace availability • Non-corrosive environment
Technical considerations	• Availability of power • Transportation access • Suitability for construction of facilities
Airspace needs	• Large volume of airspace that does not normally support heavy aircraft traffic • Bulk of airspace located east of the launch point
State Land Ownership	• Necessary amount of contiguous State-owned land to accommodate proposed Spaceport America
WSMR	• Located as far west of WSMR (within call-up zone) as possible • Located to have minimal effects on critical flight operations and resulting debris dispersion impacts from WSMR launch complexes

Additional criteria not outlined in the table include: land use and accessibility; orbital insertion physics; existing infrastructure; topography and soil characteristics; extent of landing zones; meteorological conditions; and general environmental considerations.

Safety considerations were of primary concern throughout the site selection process, and safety remains the most important criteria to be met by any potential commercial spaceport location. Operational safety analyses included: the length and desired orientation of the runway; potential approach and departure vector hazards; availability of protected safety zones at the ends of the proposed runway; restricted airspace in the vicinity; topography and soil conditions that would allow runway construction in the desired orientation; access to infrastructure to support runway operations; safe separation distances and orientation between horizontal and vertical launch areas; and available land for launch and recovery operations for both types of technology. Appendix C provides detailed information on the evaluation of all potential site locations against the criteria.

2.4.3 Alternative Site Layouts

The conceptual layout of the notional vertical and horizontal launch facilities shown at the public scoping meetings (Exhibit 2-31) reflected the technical, engineering, general environmental and topographic analyses accumulated to that date by the State. The location of the spectator area was chosen for two main reasons: to provide a raised and sloped area for best viewing of horizontal and vertical launches and X Prize Cup event activities, and to be a safe distance from the vertical launch area.

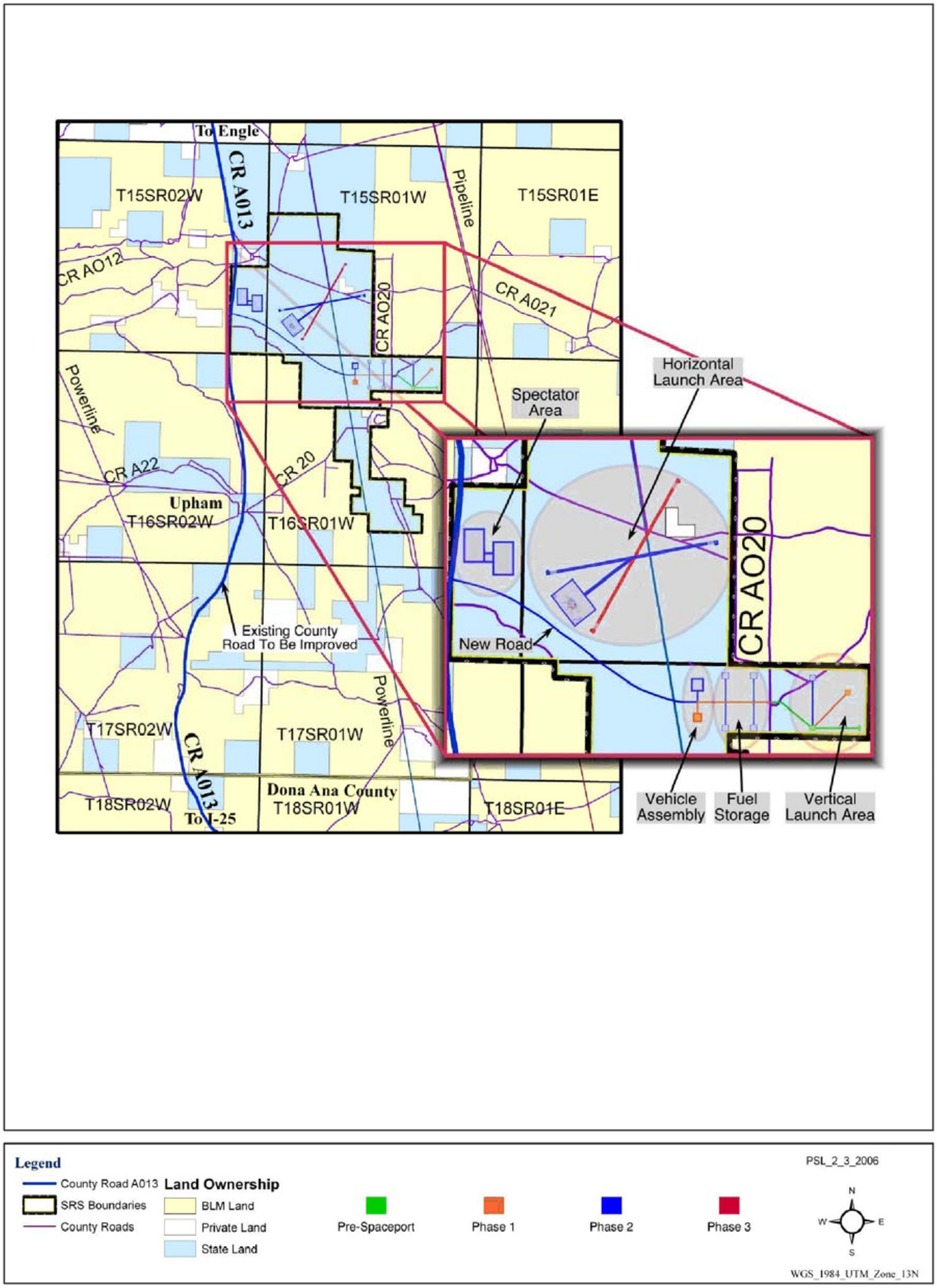
Subsequently, comments were received from BLM, NPS, and others concerning the specific location of certain notional spaceport features in the conceptual layout shown in the supporting materials released for public scoping meetings. Comments were directed at potential impacts to El Camino Real de Tierra Adentro NHT. The FAA initiated consultations with BLM, NPS, and the NM State Historic Preservation Officer in early 2006 (see Appendix A). During consultations, BLM indicated that they opposed a land-exchange and encouraged the State of New Mexico to locate Spaceport America on existing State-administered lands. The consultations resulted in the current proposed layout shown as the Proposed Action (Exhibit 2-5). This layout, while retaining the general preferred location of major vertical and horizontal launch facilities, addressed concerns through certain changes, including:

- Consolidated buildings and support facilities as far from El Camino Real as possible;
- Eliminated a new access road crossing El Camino Real in favor of improvement to an existing road;
- Located Welcome Centers in surrounding communities, with bussing of visitors to Spaceport America;
- Envisioned all utilities to be buried along existing roads or other rights-of-way to the furthest extent possible; and
- Aligned the primary runway parallel with existing contours in order to reduce visual effects from grading.

In addition, NMSA addressed concerns with administrative actions, including:

- Negotiated an agreement with New Mexico State Land Office (NMSLO) to waive NMSLO’s rights to develop mineral rights and to grant easements on the approximately 26 square miles that Spaceport America is leasing;
- Negotiated an agreement with the private landowners to maintain their ranching operations, to not develop their private lands, and to give NMSA right of first refusal to buy their private lands; and
- Developed a ranch mitigation proposal in consultation with the private landowners to optimize continued ranch operations as Spaceport America is developed.

Exhibit 2-31. Conceptual Facilities Layout for the Proposed Spaceport America As Shown at the Public Scoping Meetings



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3. AFFECTED ENVIRONMENT

This section describes the existing environmental and socioeconomic characteristics of the area that could be affected by the Proposed Action and Alternatives described in Chapter 2 of this EIS. The information provided serves as a baseline from which to identify and evaluate environmental changes resulting from the Proposed Action and Alternatives. To provide this baseline, the affected environment is briefly described and those resource areas with a potential for concern are described in greater detail. Each section provides a definition of the resource area, the relevant regulations, the region of influence (ROI), and the existing conditions.

3.1 Compatible Land Use

3.1.1 Definition and Description

Land use is interconnected with most of the other resource areas considered in a NEPA document. The EPA defines land use as…"the way land is developed and used in terms of the kinds of anthropogenic activities that occur" (EPA, 2007). Land use refers to the use of land for economic production; for residential, recreational or other purposes; and for natural or cultural resource protection. Related to land use is the issue of property ownership and management.

Depending on the use, location, and ownership of a particular land parcel, land can be subject to regulation by Federal, State, local government entities, special districts, or a combination of entities. Land use is frequently regulated in some manner by management plans, policies, or ordinances that stipulate the permissible uses within an area to protect designated areas or environmentally sensitive uses. Land classifications can be defined in broad terms (i.e., agricultural, forest, urban, or industrial) or include sub-classifications for more specific purposes such as low-density residential or light industrial uses. Other limits or controls on how land can be used may also be overlaid on ownership through leasing of property, easements, covenants, and other property agreements. Section 4(f) properties are a special class of public lands or resources whose use by agencies in the Department of Transportation is restricted unless no feasible and prudent alternative exists. Section 4(f) properties and prime and unique farmland are described in greater detail in Section 3.2.

Changes in land use are analyzed to determine whether the Proposed Action is compatible and consistent with current and future uses, plans and agreements. This section describes in detail current land uses, the land use regulatory environment, land ownership, land cover, facilities and infrastructure, economic land uses, recreational land uses, and special management areas.

3.1.2 Regulatory Setting

3.1.2.1 Local

Land use is regulated by all levels of government. Typically the most immediate governmental jurisdiction, such as county or local municipalities, is most likely to control land use and have site specific stipulations. This is less common in rural areas. The proposed Spaceport America is located entirely within Sierra County, which does not have a comprehensive land use plan or zoning regulations in unincorporated areas. Formal applications to the county are a pre-requisite for new subdivisions and construction. There is an Interim Land Use Policy Plan (Sierra County Ordinance No. 91-001), which was developed by the Sierra County Commission to "guide the use of public land and public resources in Sierra County and to protect the rights of private landowners." The ordinance establishes as policy that Federal and State agencies inform local governments of "all pending actions" and coordinate with local communities in planning and implementation.

Doña Ana County is located immediately south of the proposed Spaceport America and includes Las Cruces, the second largest municipality in New Mexico. Many of the support services and staffing for the construction and operation of Spaceport America would likely be based in Doña Ana County. In 1994, the county adopted a comprehensive land use plan as authorized by New Mexico Statutes, Section 3-21-1 et. seq. The primary goals of the comprehensive plan are to:

- Provide basic infrastructure;
- Maintain and protect the county's resources;
- Provide community facilities and services;
- Promote economic development and employment opportunities;
- Adopt and implement a land use plan;
- Encourage affordable housing and a variety of housing types; and
- Improve inter-governmental relations.

Most of the county land in the vicinity of the proposed Spaceport America is designated as Low Intensity/Rangeland Land Use. This land use category refers to government or private open range used for grazing livestock or low density residential. There are also lands designated for agricultural use near the Rio Grande and one incorporated urban area, Hatch. The plan includes policies which guide development, zoning, administration of the subdivision ordinance, capital improvements and transportation improvements for these land use designations. Permit applications are administered by the Doña Ana County Community Development Department (Doña Ana County, 1994).

3.1.2.2 State

The site proposed for Spaceport America is almost exclusively on State Trust lands (Exhibit 2-2). State Trust lands were granted to the territory and then State of New Mexico to generate income to support schools and other public institutions. These lands are administered by the NMSLO. The ownership pattern of these lands has changed throughout the years due to land sales and exchanges to consolidate and better manage holdings.

Use of these lands is regulated by the several sections in the New Mexico Administrative Code (NMAC) 19.2 (Natural Resources and Wildlife, State Trust Lands). These sections cover the following land use categories relevant to Spaceport America:

- Sub-surface minerals, oil, coal, and gas;
- Surface minerals;
- Agricultural, geothermal, and business leasing;
- Easements and rights-of way;
- Water use and disposal;
- Geophysical exploration; and

- Recreational access.

Access to State Trust lands is restricted and permits are required for most activities. Hunting in accordance with New Mexico Department of Game and Fish (NMDGF) regulations is permitted under an agreement between the NMDGF and the NMSLO. The use of motorized vehicles or any mechanical form of transportation for recreational access is restricted to public highways and roads. Other sections of NMAC 19.2 relevant to the proposed Spaceport America are referenced elsewhere in this EIS as appropriate.

3.1.2.3 Federal

A variety of Federal regulatory measures and consultation requirements are relevant to land use. Specific mention is made of the following Federal regulatory land use guidance and regulation: NEPA, BLM planning processes under the Federal Land Policy and Management Act (FLPMA) of 1976, and the National Trails System Act. The FAA Order 1050.1E addresses potential land use impacts in terms of compatible land use, noise contours, and noise sensitive areas. Noise is discussed in Section 3.3. Land use guidance and regulation under the Department of Transportation Section 4(f) requirement and the Farmland Protection Policy Act are also applicable and are discussed in detail in Section 3.2.

National Environmental Policy Act

Specific guidance relevant to land use is given in the NEPA implementing regulations which require consideration of "possible conflicts between the Proposed Action and the objectives of Federal, regional, State, and local land use plans, policies and controls for the area concerned (See 40 CFR 1506.2(d))" and indirect effects including "growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate (See 40 CFR 1508.8)."

Bureau of Land Management Planning

BLM land use planning requirements are established by Sections 201 and 202 of FLPMA, 43 U.S.C. 1711, and the regulations in 43 CFR 1600. Land use plans ensure that public lands are managed in accordance with the intent of Congress as stated in FLPMA (43 U.S.C. 1701 et seq.), i.e., under the principles of multiple use and sustained yield. As directed by FLPMA, public lands must be managed in a manner that:

- Protects the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archaeological values;
- Preserves and protects certain public lands in their natural condition, where appropriate;
- Provide food and habitat for fish and wildlife and domestic animals;
- Provides for outdoor recreation and human occupancy and use by encouraging collaboration and public participation throughout the planning process; and
- Recognizes the need for domestic sources of minerals, food, timber, and fiber from the public lands.

The FLPMA directs the BLM to consider, evaluate and recommend lands for a variety of special designations during the land use planning process. Some designations require presidential or congressional action, while many can be accomplished administratively. Areas with special designations are managed with additional protections and considerations in order to maintain the values and resources that the BLM has recognized.

The management of lands and resources administered by the BLM in the areas surrounding the proposed Spaceport America are guided by two resource management plans (RMPs) and a variety of plan amendments addressing specific resources or issues such as fluid mineral leasing, National Trail protection, or military use. The White Sands Resource Area RMP (BLM, 1985) includes the public lands in Sierra and Otero Counties, NM. The proposed Spaceport America would be located entirely on State Trust Land in Sierra County, adjacent to BLM-administered lands that are within the White Sands Resource Area. The Mimbres Resource Area RMP (BLM, 1985) includes the public lands in Doña Ana, Grant, Luna, and Hidalgo Counties, NM. The El Camino Real de Tierra Adentro National Historic Trail Comprehensive Management Plan (CMP) (NPS and BLM, 2004b) amends these two RMPs and is very relevant to the proposed Spaceport America site. Other important BLM land management issues include grazing, grassland habitat restoration, and wildlife conservation. Sections of these BLM planning documents are referenced elsewhere in this EIS as appropriate.

The BLM is currently preparing a combined RMP revision for Sierra and Otero Counties and a plan amendment for Doña Ana County to update these plans and policies and to address new issues and resource conditions affected by increased population growth and use of public land and the urban-rural interface. The record of decision for the Tri-Counties RMPs/EIS is not expected before 2009.

National Trails System Act

The National Trails System Act of 1968 (16 U.S.C. 241-1251) created a national system of trails for recreation and preservation of linear resources. The system consists of national recreation trails, national scenic trails, national historic trails, and connecting or side trails. The original Act designated 19 national scenic and national historic trails and has been amended many times to include additional properties. Public Law 106-307 amended the National Trails System Act to designate El Camino Real de Tierra Adentro (Royal Road of the Interior) as a NHT. The designation recognizes the primary route between the colonial Spanish capital of Mexico City and the three successive provincial capitals in northern New Mexico. The Trail passes through portions of the proposed Spaceport America location. The NHT may also be a Section 4(f) property and is discussed in Section 3.2.

3.1.3 Region of Influence

The ROI is the surrounding area that could be impacted from construction and operation of the proposed Spaceport America. The ROI includes the proposed site, adjacent and nearby private and public lands, and Sierra and Doña Ana Counties.

3.1.4 Existing Conditions

3.1.4.1 Overview

The proposed Spaceport America would be located in the southern Jornada del Muerto Basin, near Upham, New Mexico, approximately 45 miles north of Las Cruces, NM and 30 miles southeast of Truth or Consequences in Sierra County. The region around the proposed Spaceport America is shown in Exhibit 2-1. The proposed location is in the high desert with an extremely sparse population. Within the approximately 26 square mile area of the proposed Spaceport America boundaries, there are two permanent and four occasional residents. Current infrastructure and utilities are limited. The main economic activity is cattle grazing, although some recreational activities such as hunting and hiking are allowed. The proposed location is entirely on New Mexico State Trust Land except for private properties of two landowners needed for access roads and utility corridors to the proposed facilities. The NMSA has secured long-term access to about 16,000 acres through agreements with the NMSLO, Sierra County, and the two private ranch operations. The agreements would allow the ranching operations to co-exist with the proposed spaceport and provides compensation for any losses.

The lands adjacent to the proposed Spaceport America include hundreds of square miles of open land with a variety of vegetation and habitat types. The spaceport footprint is located within a high quality remnant Chihuahuan Desert Grassland habitat. The western WSMR boundary lies 11 miles east of the proposed Spaceport America and is largely open space that provides a buffer for military testing. Other lands surrounding the proposed Spaceport America are primarily administered by the BLM, but also include additional State Trust and private land. The private Armendaris Ranch, north of Engle, is managed to benefit biodiversity and endangered species. It contains some of the most pristine Chihuahuan desert grassland in the southwest and is home to a reintroduced population of desert bighorn sheep, the Bolson's tortoise, and was the release site for Aplomado falcons. The volcanic crater at Armendaris is a migratory sanctuary for one of the largest Mexican free-tailed bat populations in North America. The El Camino Real de Tierra Adentro NHT runs north/south through the Jornada del Muerto basin just west of the proposed Project site. A section of the Trail passes through the westernmost part of the proposed Spaceport America, although no facilities are planned in that area.

3.1.4.2 Land Ownership

The proposed Spaceport America total area would cover approximately 26 square miles. Exhibit 2-2 shows land ownership in the vicinity of the proposed location. Each small square is one section (1 square mile) of land. All proposed Spaceport America facilities would be located within the large State-owned block of land in the center of this map. Adjacent lands include private holdings and public land managed by the BLM. The easternmost edge of this block is 9 miles west of WSMR and the western edge is approximately 18 miles east of I-25. This area currently contains both State Trust and private land:

• Private deeded land owned by two different landowners	280 acres	2 percent
• New Mexico State Trust Land	16,000 acres	98 percent

The NMSA has secured long term access for Spaceport America through agreements with the NMSLO, Sierra County, and two private ranch operations. Under the Amended Joint Powers Agreement dated December 21, 2006, Sierra County and the NMSA agreed to exercise their respective powers to enter into the business lease with the NMSLO. On January 1, 2007, NMSA, Sierra County, and the SLO entered into Business Lease No. BL-1729, which names both NMSA and the County as "Lessee," and names NMSA as "Managing Lessee." The lease with the NMSLO was contingent on the NMSA establishing an agreement with the ranchers who held existing agricultural leases with the NMSLO. The term of the lease for the State lands is 25 years, with option to renew for successive 25-year terms. In addition to the base rent, which will be adjusted in time, the NMSLO will also receive payments in lieu of rights to develop mineral rights or to construct roads or grant other easements that might impair the operation of the spaceport.

The agreement with the private landowners includes compensation for initial and ongoing impacts to their ranches, compensation for evacuating their properties, if necessary, and a fund for potential relocation of ranch structures and facilities. The ranchers would be consulted on issues directly affecting ranching operations, such as fencing, roads, and water use. The NMSA can be obligated to purchase the ranches at a price based on the ranches' full value if it is determined that the spaceport operations have damaged the ability to operate. A ranch/allotment management plan is in development by NMSA, the ranchers, NMSLO, and BLM in order to allow the ranchers to continue to graze State Trust lands and adjacent BLM lands under the terms of their existing grazing permits.

The goal of these agreements and the plan is to identify specific range management practices necessary and appropriate for co-existence of spaceport and ranching operations and to mitigate potential impacts to wildlife and wildlife habitat. These practices may include such things as: range improvement projects; range fire prevention and management; location of fencing, cattle guards, or other security and control features; and identification of ground hazard areas within existing allotments. The process would be dynamic and ongoing, with modifications as necessary to adapt to changes either in spaceport operations or ranching practices.

3.1.4.3 Land Cover, Facilities and Infrastructure

The proposed Spaceport America and surrounding area is primarily undeveloped open ranch lands. Vegetative cover is low and consists of semi-desert grassland, plains-mesa sand scrub, and Chihuahuan desert scrub. Two private ranches with residences, associated ranch structures and fence lines are in the vicinity. Primary access is through Sierra County Road A013, a north/south unpaved road which is parallel to the Burlington Northern Santa Fe Railroad line. County and State roads connect A013 with I-25. Other unimproved roads connect to the ranch facilities. A north/south 115 kV transmission line is located approximately 6 to 8 miles west of the proposed Spaceport America, but there are no local substations. A 345 kV power line traverses the valley floor 5 miles to the east of the county road with a series of large wood double poles progressing in a north-northwest to south-southeast line through the middle of the valley. Existing electrical service is provided to the ranches through a 7.2 kV single-phase power line. The ranches use local wells for domestic and ranch water.

3.1.4.4 Economic Land Use

The only economic activity currently on the lands of the proposed Spaceport America is limited cattle grazing under leases from the NMSLO. The BLM also has issued leases to land owners to graze cattle on Federal lands to the east of the proposed Spaceport America. In anticipation that grazing at some locations would be impractical once construction and flights begin, NMSA, the ranchers, NMSLO, and BLM are developing the ranch/allotment management plan to allow for the co-existence of spaceport and ranching operations. Continuation of grazing on Federal grazing allotments, or some other economic use consistent with the proposed Spaceport America use and the multiple use policies of BLM, would be determined. Land currently leased by the State for grazing also provides base water for the BLM grazing leases and is good grassland habitat for livestock and wildlife use. If these waters and lands are not available, adjustments may need to be made to adjacent BLM grazing permits.

There are no commercial farms and no prime or unique farmland within the Spaceport America. There is an extensive discussion of prime or unique farmland as defined by the Farmland Protection Policy Act in Section 3.2. Productive farmlands are located several miles west and south of the proposed Spaceport America along the Rio Grande corridor.

Although numerous leasable, locatable, and salable minerals claims have been explored in the past, there are no patented mineral lands or active mining claims within the proposed boundary of Spaceport America or the immediately adjacent lands. Some minerals claims on BLM-administered land several miles to the south have been active as recently as 1992. Much of the area has been leased for drilling and seismic exploration, but all oil and gas leases had expired by 1991. The last active geothermal lease expired in 1975. The agreements between NMSA and the NMSLO include payments to the NMSLO in lieu of rights to develop mineral rights on NMSLO lands. A more comprehensive look at mineral resources is presented in Appendix E.

3.1.4.5 Recreational Land Use

Recreational access to the State Trust lands proposed for Spaceport America is restricted and a permit is needed for most activities. Hunting in accordance with NMDGF regulations is permitted under an agreement between the NMDGF and the NMSLO. The use of motorized vehicles or any mechanical form of transportation for recreational access is restricted to public highways and roads. Recreational activities available in the BLM-administered lands adjacent to the proposed Spaceport America include hiking, hunting, picnicking, bird watching, rock hounding, astronomy, and vehicle recreation. The White Sands RMP states that BLM-administered lands not designated as limited or closed will remain open for off-road vehicle (ORV) use. None of the BLM lands adjacent to the proposed Spaceport America are so designated, and thus all such public lands are currently open for ORV use.

Current recreational use of the El Camino Real NHT in the vicinity of the proposed spaceport is probably light. A self-directed auto tour parallels the Trail route along County Road A013. There are no developed interpretive sites, signage or pullouts. County Road A039 crosses the Trail on restricted State Trust and private lands. The El Camino Real CMP (NPS and BLM, 2004a) describes potential locations for recreational and interpretive sites that have not yet been developed. The plan emphasizes the scenic quality and freedom from intrusions available that would provide a high quality recreation experience and allow visitors to vicariously share the experience of the original users of a historic route (NPS and BLM, 2004a).

3.1.4.6 Special Designations

Special designations result from the recognition and need for protection of the unique natural and cultural resource qualities of certain areas. These unique qualities often are identified from the results of agency research and public and external agency input. Areas with special designations are managed with additional protections and considerations in order to maintain the values and resources that have been identified. Issues identified in BLM RMPs are implemented through development of resource activity plans. The BLM White Sands and Mimbres RMPs include a number of areas with special designations, most of which are not in the immediate vicinity of the proposed Spaceport America.

Three potential Areas of Critical Environmental Concern (ACECs) are under preliminary consideration in the Tri-Counties RMPs/EIS including one near the proposed Spaceport America. The Southern Caballo Mountain ACEC nomination includes both the east and west sides of the Caballo Mountains, the Red House Mountains and Point of Rocks Hills. If designated, any management restrictions would be identified in an ACEC Management Plan. The designation is proposed to protect cultural resource values.

Two current special designations are relevant to proposed Spaceport America. The El Camino Real de Tierra Adentro NHT passes through the western portion of the proposed Spaceport America and Jornada del Muerto Wildlife Habitat Management Area includes BLM lands adjacent to the proposed site. There are no local or State land use designations relevant to the proposed Spaceport America.

El Camino Real de Tierra Adentro National Historic Trail

Public Law 106-307 amended the National Trails System Act to designate El Camino Real de Tierra Adentro (Royal Road of the Interior) as a NHT. The designation recognizes the primary route between the colonial Spanish capital of Mexico City and the three successive provincial capitals in northern New Mexico. The NHT includes the portions of the Trail within the U.S. and extends 404 miles from El Paso, Texas, to San Juan Pueblo, New Mexico. The BLM and the NPS are charged with joint administration of the Trail. The Trail passes through portions of the proposed Spaceport America location. The El Camino Real de Tierra Adentro NHT CMP (NPS and BLM, 2004b) defines the current land management policies for this NHT. The CMP was developed jointly by the NPS and the BLM and was analyzed in an EIS that resulted in a ROD endorsed by both agencies (NPS and BLM, 2004a).

The CMP calls for a program of resource protection and visitor use. Resources that best illustrate the Trail's significance (high-potential historic sites and segments) will be identified and protected on both public and private land. Certification priorities will be placed upon sites and segments supporting interpretive and educational programming and protecting significant resources. Protection efforts are proposed to "help ensure that resources related to the NHT are preserved and sections of the historic route are maintained as natural or cultural landscapes" (NPS and BLM, 2004b). The CMP also includes developing interpretive sites and signage at landmarks and points of interest. Specific policies and actions that are relevant to the proposed Spaceport America include a 5-mile visual impact zone around the Trail and proposed interpretive sites. Ten Trail segments in the vicinity of Spaceport America have been designated as high-potential route segments (NPS and BLM, 2004b). The New Mexico Historic Preservation Division in conjunction with the NPS is considering proposals to prepare a formal National Register of Historic Places (NRHP) Multiple Property Documentation Form for the NHT and to complete individual National Register nominations for Trail segments (Historic Preservation Division [HPD], 2008).

Currently there are no historical markers, pullouts, interpretive trails, or other facilities for visitors to the NHT near the proposed Spaceport America. There has been growing interest in the NHT with the opening of the El Camino Real International Heritage Center near I-25 in November of 2005 and the publication of scholarly and interpretive materials. It is not known how many people traveling on CR A013 do so with the purpose of visiting the NHT and/or its environs, but it is believed to be very lightly used. The NHT and associated sites and landscapes are also addressed in the visual (Section 3.4) and cultural resources (Section 3.5) sections of this EIS.

Jornada del Muerto Wildlife Habitat Management Area

The proposed Spaceport America Project is situated on NMSLO lands near the center of BLM's Jornada del Muerto Wildlife Habitat Management Plan area (WHA 037-9) (BLM, 1982). This extensive wildlife habitat management area is located in Sierra and Doña Ana Counties within the geographic area known as the Jornada del Muerto Plains. The area is bounded on the east by the foothills of the San Andres Mountains and on the west by the Fra Cristobal-Caballo Mountain complex and Pedro Armendaris Grant. It extends south from the Sierra/Socorro County line to the northern boundary of the Jornada Experimental Range and New Mexico State University (NMSU) College Ranch. The plan area overlays private, State Trust and BLM land, but the plan does not regulate land use on private or State Trust land. Cooperative habitat and grassland improvements consistent with the plan are conducted on private and State Trust lands in consultation with landowners. Local ranch operations are dependent on BLM and State Trust grazing leases.

The BLM's habitat management objectives for this area focus on maintaining and enhancing habitats for the benefit of pronghorn antelope and other grassland obligate species. This is accomplished by allocating grazing land for forage with the goal of increasing antelope populations, establishing permanent water sources to increase the distribution of antelope, providing food and cover for small and nongame species near water sources, implementing range improvements, and improving forage through projects to change the vegetative composition to more favorable species.

3.2 Section 4(f) Lands and Farmland

3.2.1 Definition and Description

Section 4(f) lands and prime and unique farmlands are specific land use classifications which require special consideration in assessing Federal actions. A full discussion of land use and other land use classifications is found in Section 3.1.

3.2.1.1 Section 4(f) Lands

Section 4(f) lands are a class of public lands or resources whose use by agencies in the U.S. Department of Transportation (DOT) is restricted unless no feasible and prudent alternative exists. Section 4(f) lands include publicly owned parks, recreational areas, wildlife or waterfowl refuges, or cultural resources that are listed on or are eligible for listing on the NRHP. In order for a park, recreational area, or wildlife or waterfowl refuge to qualify for protection under Section 4(f), it must be publicly owned and officially designated as a park, recreational area, or wildlife or waterfowl refuge. When such areas are owned by private institutions and individuals, even if the areas are open to the public, Section 4(f) does not apply. However, cultural resources that are listed on or are eligible for listing on the NRHP can be subject to Section 4(f) regardless of public ownership or access.

3.2.1.2 Farmland

The Farmland Policy Protection Act (FPPA) was enacted based on concerns that millions of acres of farmland were being lost to development in the United States each year. This problem was identified in an agricultural land study that resulted in a congressional report that identified the need for Congress to implement policies and programs to protect farmlands from development and minimize urban sprawl.

Protected farmland includes prime farmland (prime soil characteristics), unique farmland (high value specialty crops), and land of statewide or local importance, as defined by the Natural Resource Conservation Service. Farmland subject to FPPA requirements does not have to be currently used for cropland. It can be forestland, pastureland, cropland, or other land, but not water or urban built-up land.

3.2.2 Regulatory Setting

3.2.2.1 Department of Transportation Act, Section 4(f)

DOT Act, Section 4(f) applies to all projects that receive funding from or require approval from an agency of the DOT, including the FAA. The Section 4(f) requirements in the act have been re-codified and renumbered as Section 303(c) of 49 U.S.C., but continue to be referred to as Section 4(f). Section 4(f) of the DOT Act provides, in pertinent part, as follows:

> [T]he Secretary [of Transportation] may approve a transportation program or project…requiring the use of publicly owned…land of a historic site of national, State, or local significance (as determined by the Federal, State, or local officials having jurisdiction over the park, area, refuge, or site) only if –
> (1) there is no prudent and feasible alternative to using that land; and
> (2) the program or project includes all possible planning to minimize harm to the park, recreation area, wildlife and waterfowl refuge, or historic site resulting from the use.

Use within the meaning of § 303(c) includes not only actual physical takings of such lands, but also adverse indirect impacts (constructive use) as well. When there is no physical taking, but there is the possibility of constructive use, the FAA must determine if the impacts would substantially impair the § 303(c) resource. If there would be no substantial impairment, the action would not constitute a constructive use and would not, therefore, invoke § 303(c). Because of the requirement that the FAA must determine that no feasible and prudent alternative exists, Section 4(f) is considered to have stringent approval standards by statute and court interpretation. Section 4(f) applies only to the actions of agencies within the DOT. While other agencies may have an interest in Section 4(f), the agencies within the DOT are responsible for applicability determinations, evaluations, findings and overall compliance.

Section 4(f) applies to protected resources when a "use" occurs. "Use" can be permanent, temporary, or constructive. Permanent use is the incorporation of the resource into the facility. Temporary adverse use occurs when a project temporarily occupies any portion of the resource, and results in an adverse condition. Constructive or indirect use occurs when the resource is not physically occupied but the proximity effects of the transportation project are so great that the activities, features or attributes that qualify the property for Section 4(f) protection are substantially impaired.

3.2.2.2 National Trails System Act, Section 7(g)

Section 7(g), 16 U.S.C. 1242(g), of the National Trails System Act (as amended through P.L. 95-625) states:

> Except for designated protected components of the Trail, no land or site located along a designated historic trail . . . shall be subject to the provisions of Section 4(f) of the Department of Transportation Act (49 U.S.C. 303[f]) unless such land or site is deemed

> to be of historical significance under appropriate historical criteria such as those for the National Register of Historic Places.

The National Trails System Act, at 16 U.S.C. § 1242(a)(3), provides that:

> Only those selected land- and water-based components of an historic trail which are on federally owned lands and which meet the national historic trail criteria established in this chapter are included as Federal protection components of a national historic trail.

The El Camino Real de Tierra Adentro National Historic Trail CMP/EIS defines "Federal protection components" as "those components on federally owned lands that meet national historic trail criteria." (NPS and BLM, 2004a)

The El Camino Real de Tierra Adentro National Historic Trail Act, at 16 U.S.C. § 1244(a)(21)(d), provides that:

> No lands or interests therein outside the exterior boundaries of any federally administered area may be acquired by the Federal Government for El Camino Real de Tierra Adentro except with the consent of the owner thereof.

Accordingly, only designated protected trail components, and lands or sites adjacent to historic trails that are on or eligible for the National Register of Historic Places, are subject to Section 4(f).

3.2.2.3 The Farmland Protection Policy Act

The FPPA is intended to minimize the unnecessary and irreversible conversion of farmland to nonagricultural uses. It requires a consideration of potential project impacts associated with the conversion of prime, unique, statewide, or locally important farmland to nonagricultural uses. The FPPA is intended to minimize the impact Federal projects and programs have on the unnecessary and irreversible conversion of farmland to nonagricultural uses. It stipulates that, to the extent possible, Federal programs be administered to be compatible with State, local, and private programs and policies to protect farmland.

3.2.3 Region of Influence

The ROI for Section 4(f) lands includes areas that contain these resources and could be directly or indirectly "used." Direct use would include areas where construction activities would occur and the resource could be physically incorporated into the proposed Spaceport or support facilities on a permanent basis or by temporarily and adversely occupying any portion of the resource. The ROI for constructive or indirect use would include areas where there is a potential for substantially impairing the visual and audible setting of the resources present.

The ROI for prime and unique farmland would include the direct disturbance area of any designated farmland or indirect or secondary effects on other off-site farmland that would result from the Federal action.

3.2.4 Existing Conditions

3.2.4.1 Potential Section 4(f) Lands

Section 4(f) lands include publicly owned parks, recreational areas, wildlife or waterfowl refuges, or cultural resources that are listed on or are eligible for listing on the NRHP, regardless of ownership. There are no publicly owned parks, recreational areas, wildlife or waterfowl refuges within the boundaries of the proposed Spaceport America. The Jornada del Muerto Wildlife Habitat Area is on BLM land adjacent to Spaceport America. (NPS and BLM, 2004b) Portions of the Jornada del Muerto Wildlife Habitat Area may meet broad tests for consideration as a 4(f) property as publicly owned land where the major purpose is the conservation, restoration, or management of endangered species, their habitat, and other wildlife and waterfowl resources.

The inventory and evaluation of cultural resources at the proposed Spaceport America is described in detail in Section 3.5. Most of the recorded cultural resources are archaeological sites. Additional cultural resources may be identified in subsequent inventories or discovered during construction. The FAA may determine that cultural resources meet the criteria for listing on the NRHP, based on the professional recommendation of the cultural resource contractor and after required consultations. If determined eligible, Section 4(f) may be applicable to any use of these historic properties. To be considered Section 4(f) lands, archaeological sites must be eligible for inclusion on the NRHP and also warrant preservation in place. Section 4(f) does not apply if the FAA, after required consultations, determines that the archaeological resource is important chiefly because of what can be learned by data recovery and has minimal value for preservation in place (23 CFR 771.135(g)). The Aleman Draw Historic District is recommended as eligible for listing on the NRHP and includes a portion of the NHT. Designated protected components of the NHT or sites adjacent to the NHT that are independently determined eligible for the NRHP may be subject to Section 4(f), if use would occur.

3.2.4.2 Farmlands

Farmlands are evaluated based on a variety of factors including location, growing season, and moisture supply and soils. Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion, as determined by the Secretary of Agriculture, upon the recommendation of the Natural Resources Conservation Service (NRCS). Prime farmland can include land that possesses the above characteristics but is not being used for farming as long as it is not committed to urban development or water storage. Because of New Mexico's arid climate in agricultural areas, it has been determined that no lands in New Mexico qualify as prime farmland unless irrigated with a dependable supply of irrigation water. Highly productive ranch lands could qualify as prime if irrigated, as determined by NRCS.

Unique farmland is land other than prime farmland that is used for production of specific high-value food and fiber crops, as determined by the Secretary of Agriculture. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed according to acceptable farming methods.

Irrigated farmlands in New Mexico which do not meet the criteria of prime farmland may be considered statewide important farmland if they meet certain criteria. Criteria for locally important farmland have not been developed in New Mexico. These lands could be identified by local agencies and could include tracts of land that have been designated for agriculture by local ordinance. There are no lists of locally important farmland developed for New Mexico (NRCS, 2007a).

Soil characteristics are the most studied and important determinant in these evaluations. Soil is defined as unconsolidated mineral or organic surface material that serves as a natural medium for the growth of plants. It is composed of minerals, organic matter, water, and air. Soil and sediments are typically described in terms of their composition, slope, and physical characteristics. Differences among soil types potentially affect their ability to support or sustain agriculture, filtration, and natural detoxification processes. Soil quality refers to organic matter content, nutrient and water-holding capacity, soil tilth (the physical condition of the soil with respect to its fitness for the growth of a specific crop), structure, and internal drainage. The three principle types of soils are clay, sand, and loam. Factors determining the nature of soils are vegetation type, climate, parent rock material, elevation, and the geological age of the developing soil.

NRCS has classified over 20,000 types of soils in the U.S., including areas classified as prime and unique farmlands. Information pertaining to a given area's soil types is typically available from county soil surveys.

A review of the Soil Survey of the Sierra County Area, New Mexico (Neher, 1984) indicates that the proposed Spaceport America site is underlain by soils belonging to the Doña Ana-Stellar-Wink soil complex, which is composed of about 41 percent Doña Ana soils, 17 percent Stellar soils, and about 15 percent Wink soils. The remaining 27 percent consists of minor components. The Doña Ana soils are described as deep and well-drained fine sandy loam developed on piedmonts from mixed alluvium. Stellar soils are deep and well-drained loam and clay loam developed in slightly depressed areas on piedmonts. Wink soils are deep and well-drained loamy fine sand and gravelly sandy loam produced on ridges and side slopes of piedmonts. Soil limitations include high susceptibility of the sandy loam surface layers to soil blowing, and a moderate hazard of water erosion. However, these limitations are mostly controlled by proper rangeland management practices (Neher, 1984).

The NRCS in Truth or Consequences was consulted regarding a determination of the presence or absence of prime or unique farmland within Spaceport America Project site. The consultation was based on the prior submission and completion of United States Department of Agriculture (USDA) Form AD 1006, Farmland Conversion Impact Rating, as mandated by the FPPA and Executive Orders (NRCS, 2007b). The NRCS determined that there were "no unique prime or important farmland acres located within the proposed site" (Tafoya, 2007). There is no Federal, State or locally designated farmland within the Spaceport America Project site that is protected under the FPPA.

3.3 Noise

3.3.1 Definition and Description

Sound results when air or other media vibrate. The vibrations may be a combination of many frequencies to produce a complex sound. Humans are sensitive to vibrations with frequencies ranging from 20 to 20,000 cycles per second (hertz), with greatest sensitivity between 2,000 and 4,000 hertz. The energy of the vibrations is a measure of the "loudness" of the sound. Sound levels are measured in decibels (dB), which are calculated in mathematical terms from a ratio of the sound level to a reference sound level, which is generally the threshold of hearing. To make the decibel unit more applicable to the human response to sound frequencies, a variation of the unit has been created known as the A-weighted decibel (dBA). Another sound level weighting is the C-weighted scale (dBC), which emphasizes low frequency sounds. A remote desert environment generally has sound levels in the range of 22 to 38 dBA, whereas, an interstate highway interchange might have sound levels in the 55 to 70 dBA range. A low-level jet flyover could have sound approximately 100 dBA, depending on altitude and power level. Very large rocket launches such as the Space Shuttle have sound levels around 175 dBA at 50 feet from the test pad. Humans begin to experience pain at levels above 100 dBA. Section 3.2 of the Programmatic EIS for Licensing Launches (FAA, 2001) has more complete information about sound and its measurement.

3.3.2 Regulatory Setting

Noise is primarily regulated through local noise ordinances, which are designed to protect noise sensitive areas (e.g., residential population centers and schools). No local noise ordinances exist in Sierra County. Federally regulated noise standards are designed to protect worker safety, and various commercial standards address commercial aircraft noise.

Occupational Safety and Health Administration (OSHA) regulation 1910.95 establishes a maximum noise level of 90 dBA for a continuous eight-hour exposure during a working day and higher levels for shorter exposure time in the workplace. The Environmental Protection Agency (EPA) has recommended an average equivalent noise level of 70 dBA for continuous 24-hour exposure to noise to protect hearing (EPA, 1974). Under OSHA regulation 1910.95, exposure to impulse (very short term) noise should not exceed 140 dBA. The 140 dBA threshold should be considered advisory rather than mandatory.

The FAA Order 1050.1E (FAA, 2006a) states that, for aviation noise analysis, the FAA's primary metric for the cumulative noise energy exposure of individuals is the day/night average sound level (DNL). The DNL is the sound level in dBA averaged over a 24-hour period. It is used to predict human annoyance and community reaction to unwanted sound (i.e., noise). Because humans are more sensitive to noise at night, the DNL places a 10 dBA penalty on noise produced between the hours of 10 p.m. and 7 a.m.

As defined by the FAA Order 1050.1E, a significant noise impact would occur if the Proposed Action would cause noise-sensitive areas to experience an increase of 1.5 dB DNL or more at or above DNL 65 dB when compared to the No Action Alternative for the same timeframe. For example, an increase from 63.5 dB to 65 dB is considered a significant impact. Special consideration needs to be given to the evaluation of the significance of noise impacts on noise sensitive areas within national parks, national wildlife refuges, and historic sites, including traditional cultural properties. For example, the DNL 65 dB threshold may not adequately address the effects of noise on visitors to areas within a national park or national wildlife refuge if ambient noise is very low and a quiet setting is a generally recognized purpose and attribute.

3.3.3 Region of Influence

Noise from the Proposed Action would affect the area surrounding the launch site and along CR A013. This region is a remote, desert environment as described more thoroughly in other sections of this chapter.

3.3.4 Existing Conditions

The proposed site is in a remote area with few noise sources. Sources of noise that have been noted during visits to the area by Project personnel include:

- Vehicular traffic on the limited network of unsurfaced roads;
- Trains on the Burlington Northern and Santa Fe Railroad (BNSF) railway tracks located west of the proposed site;
- Aircraft noise resulting from passing airliners, light aircraft, and occasional military training flights in the area;
- Constant noise (hum) emanating from high voltage electrical transmission lines that pass through the Project site; and
- Natural noise sources including thunder, wind, insects, and birds.

Existing noise in the proposed area was characterized and measured using standard measurement techniques and instrumentation during the week of May 6, 1996 for a previously proposed project (Gutman, 2007). These measurements constitute the preconstruction baseline noise level and are summarized in Exhibit 3.3-1. Although these measurements were taken in 1996, the area has remained essentially unchanged since that time.

The three largest anthropogenic contributors to noise at the site of the proposed Spaceport America are vehicular traffic, railroad traffic, and passing aircraft. There are no available traffic count data for Sierra County Roads A013, A039, and A020, nor are there any available counts of trains on the railroad or of air traffic. It is known, however, that vehicular, train, and aircraft traffic are very light. Daily traffic on CR A013 in the area is estimated at only 20 vehicles daily (Dustin, 2007; Spalding, 2007). Therefore, effects of noise sources can be characterized in the context of a quiet rural area. Exhibit 3.3-2 is a listing of estimated day-night average sound level that would be produced by 100 minutes (67 during daytime and 33 during nighttime hours) of sound at the highest level of any of the anthropogenic sources at each of the analysis points. For comparison the typical natural sound levels is also included. As indicated in Exhibit 3.3-2, the DNL sound level at the proposed site is estimated at 31 to 41 dBA, a quiet rural area (Gutman, 2007).

The FAA Order 1050.1E states that special consideration needs to be given to the evaluation of the significance of noise impacts on noise sensitive areas, including wildlife refuges. Although the land surrounding the proposed Spaceport America site is sparsely populated, it is not pristine and does not have the characteristics usually associated with a wilderness area. The northern edge of the San Andres National Wildlife Refuge is located about 25 miles east/southeast of the proposed site. As it is within the boundaries of WSMR, no visitors are allowed. The nearest Class I Areas (areas designated for the most stringent air quality standards and including national parks and wilderness areas) are the Aldo Leopold Wilderness (56 miles west), the Sierra de Las Uvas Wilderness Study Area (30 miles southwest), the Bosque del Apache National Wildlife Refuge (55 miles north), the Apache Kid Wilderness (70 miles north), and the White Mountain Wilderness (70 miles northeast).

Exhibit 3.3-1. Summary of Noise Measurements of Existing Sources Near the Proposed Site

Source	Measurement Condition	Measured Level[1]	Level under Standard Conditions[2]
Background noise level	Calm wind, predominant source: insect wing noise	27 dBA	27 dBA
Wind noise	Approximately 10 mph in desert scrub environment	33 dBA	33 dBA
Wind noise	Approximately 20 mph in desert scrub environment	52 dBA	52 dBA
Passing airliner	Boeing 737 at approximately 30,000-ft altitude[3]	32 dBA	32 dBA
Military training aircraft	None were recorded during noise characterization measurements[3, 4]	—	—
Vehicular noise	Light truck on unimproved road, approximate speed 40 mph	68 dBA at 50 feet	68 dBA
Railroad noise	Passing 2-engine train, approximately 40 cars	73 dBA at 125 feet	81 dBA 50 feet
Electrical transmission line hum	Directly beneath line, approximately 40 ft overhead	42 dBA	40 dBA at 50 feet

Source: Gutman, 2007

1 Values reported are the highest values observed during the recording period.

2 Standard conditions are sound levels at 50 feet.

3 The airspace above the proposed site is restricted during working hours on most weekdays and WSMR airspace to the east is always restricted. Observation of aircraft of any kind is unusual, indicating that the airspace is used lightly.

Military training/testing flights had been reported by field crews, but are seldom observed. Lowlevel military aircraft flights can produce maximum noise levels ranging from 88 to 115 dBA at 500 feet altitude. (USAF, 1998).

Exhibit 3.3-2. Estimated DNL Sound Levels

Location	Highest Anthropogenic Level	Source	Estimated DNL[1] (dBA)	Typical Natural Level[2] (dBA)
Terminal and Hangar Facility	37	Traffic on Road A020	31	27-40
Bar Cross Ranch	47	Railroad	41	27-40
Lewis Cain Ranch	45	Traffic on Road A020	39	27-40
Yost Escarpment	42	Railroad	36	27-40

Source: Gutman, 2007

1 Assumed conditions are 100 minutes of total exposure, 67 during daytime and 33 during nighttime hours.

2 Typical dominant natural sound source is wind during daylight hours and insects during nighttime hours during warm months.

3.4 Visual Resources and Light Emissions

The FAA incorporates an analysis of potential impacts on visual resources associated with the Federal action. This analysis includes the potential impacts of light emissions, the effects on viewsheds enjoyed by people, and the visual setting of Section 4(f) lands.

3.4.1 Definition and Description

Visual resources refer to the aesthetic qualities of natural landscapes and modifications to them, to the perceptions and concerns of people for landscapes and landscape change, and to the physical or visual relationships that influence the visibility of proposed landscape changes. These concepts are discussed in the FAA Order 1050.1E, Change 1 (2006).

Visual or aesthetic effects are inherently difficult to define and quantify because they require a subjective judgment on the part of observers of the value of the existing visual resources, the extent of change and the sensitivity of different viewers to the contrasts with the existing environment. Another important consideration is whether any organization with regulatory authority considers this contrast objectionable. Public involvement and consultation with appropriate Federal, State, local agencies, and tribes is necessary to determine the extent of impacts.

Visual resource analysis must also consider the extent to which outdoor lighting associated with an action would create an annoyance among people in the vicinity or interfere with their normal activities. The International Dark-Sky Association is a non-profit organization formed by a group of astronomers in order to preserve and protect the nighttime environment and dark skies through quality outdoor lighting. While the association has no regulatory authority, it works with local, national, and international governments to reduce the adverse effects of light pollution through education and awareness programs, conducting research, developing standards, and assisting in preparing light emission ordinances (IDA, 2008). For the proposed Spaceport America, lighting must be considered in the context of potential impacts on a pristine dark sky environment. Existing night lighting is minimal and is associated with ranch residences and outbuildings.

This section focuses on aesthetic qualities of the landscape and visual sensitivity. Visual setting as it relates to maintaining the character and integrity of historic properties is addressed in Section 3.5, Cultural Resources. Because of the presence of important intact segments of the El Camino Real de Tierra Adentro NHT and the Aleman Draw Historic District, visual setting can contribute to the significance of cultural resources and therefore is a potential Section 4(f) issue. The Aleman Draw Historic District is located along the NHT on private land adjacent to the proposed project site. Management of the NHT includes a 5-mile visual impact zone around the portion of the Trail located just west of the proposed Spaceport America site. The integrity of the visual setting of the NHT and the Aleman Draw Historic District is considered in determining effects on these historic properties in the Section 106 process. Proposed interpretive sites would create new viewpoints and would increase visitation and appreciation of the NHT and its visual setting. Please refer to the cultural resource (Section 3.5) and Section 4(f) (Section 3.2) for additional information relevant to visual resources that may be impacted.

3.4.2 Regulatory Setting

3.4.2.1 Local and State

There are no local visual resource regulations that are applicable to unincorporated sections of rural Sierra County. State regulation of visual resource impacts is generally limited to permit applications that are not relevant to Spaceport America. The New Mexico State law, the Night Sky Protection Act [74-12-1 to 74-12-10 New Mexico Statutes Annotated 1978], regulates outdoor night lighting fixtures to preserve and enhance the State's dark sky while promoting safety, conserving energy, and preserving the environment for astronomy.

3.4.2.2 Federal

No Federal laws specifically address visual and light impacts. FLPMA states that "... public lands be managed in a manner that will protect the quality of ...scenic...values...." and identifies scenic values as one of the resources for which public land should be managed. NEPA requires measures be taken to "...assure for all Americans...aesthetically pleasing surroundings..." There are visual resource considerations that are part of land use or land status designations such as those for the NHT or for maintaining the integrity of cultural resources and landscapes.

The BLM manages land adjacent to the proposed Spaceport America and is co-administrator of the El Camino Real NHT with the NPS. The BLM uses the Visual Resource Management (VRM) classification system to ensure that the scenic values of public lands are considered before allowing uses that may have negative visual impacts. This two-part system (1) inventories the scenic values of an area and assigns certain management objectives, and (2) evaluates proposed activities to determine if they conform to the area's management objectives, or if the Proposed Action needs adjustment (BLM, 1974). The VRM system inventories include an analysis of three elements:

- Scenic quality (highly distinctive, moderately distinctive, or indistinctive);
- Sensitivity levels (high, moderate, or low);
- Distance zones;
    - Foreground /middle ground: 0 - 3 miles;
    - Background: 3 - 15 miles, or;
    - Seldom seen: over 15 miles or screened from view.

Based on a combination of these elements, inventory classes are assigned ranging from I through V. Inventory classes provide the basis for considering visual resources by the BLM in the planning process. VRM Classes are assigned to establish management direction and objectives for each visual resource. The five VRM Classes are as follows:

- Class I – This class is assigned to those areas where a management decision has been made previously to maintain a natural landscape such as wilderness areas, natural areas, and areas with restricted activities. The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

- Class II— The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.
- Class III— The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
- Class IV— The objective of this class is to provide for management of activities which would result in major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.
- Class V—Applies to areas where the landscape character has been so disturbed from a visual standpoint that rehabilitation is needed to bring it up to one of the other classifications.

VRM objectives are expected to be followed for all projects developed on BLM-administered land and generally do not apply to activities on land that is not federally-owned. Although the proposed Spaceport America would be developed on State-owned and leased private land, it would be within the viewshed of the NHT and the Aleman Draw Historic District and would be adjacent to BLM lands.

3.4.3 Region of Influence

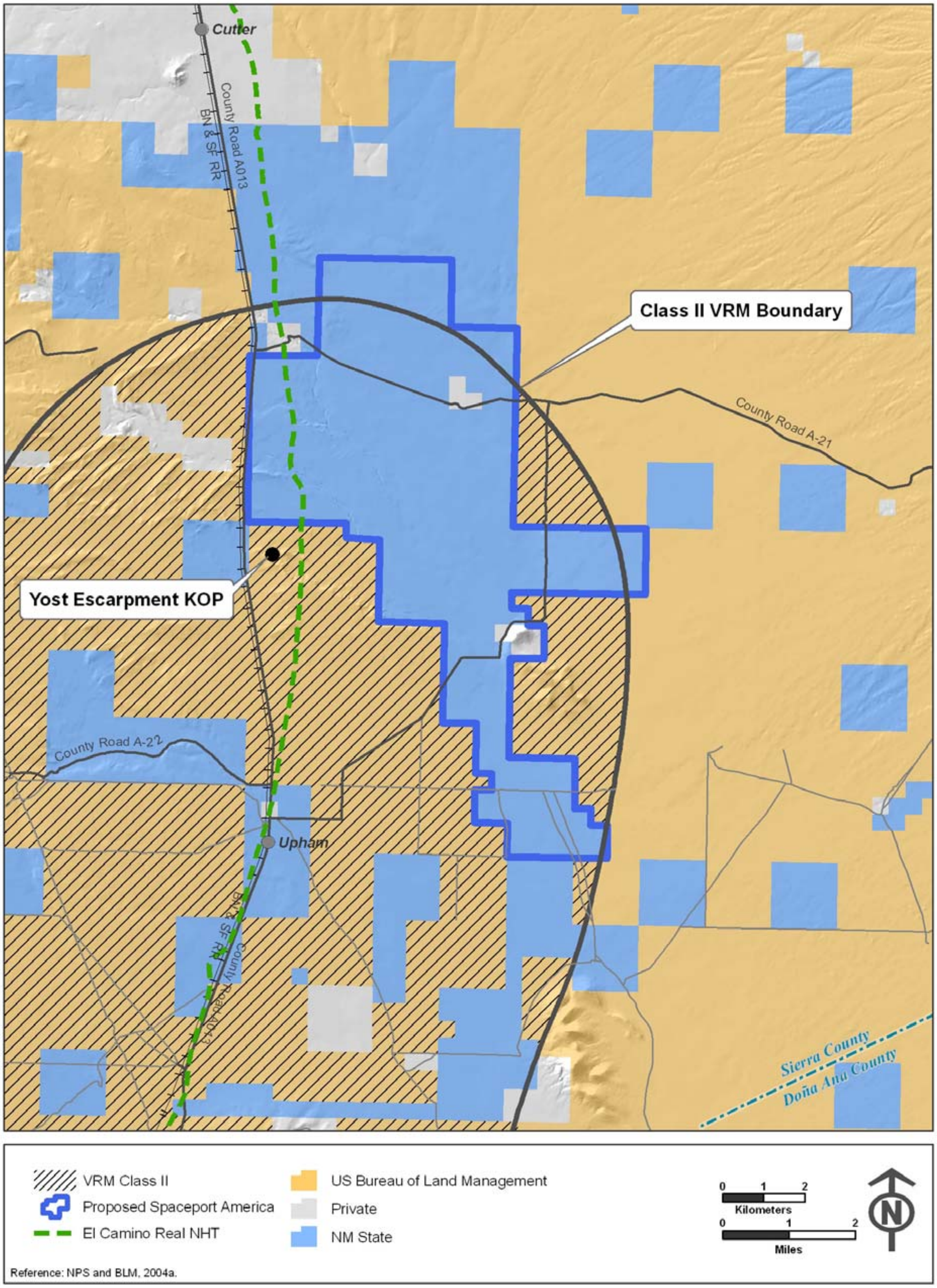
By agreement among the FAA, BLM, and NPS, the region of influence for potential impacts to visual resources has been deemed to be the area from which facilities, roads, and utility infrastructure of the proposed Spaceport America might be visible. It is bounded by the Caballo Mountains on the west, the San Andres Mountains on the east, from the Black Hill area to the Chalk Hills on the north, and the Flat Lake/Point of Rocks area on the south. These areas of high ground are visible from much of the Jornada del Muerto.

3.4.4 Existing Conditions

3.4.4.1 VRM Classifications

The BLM designated El Camino Real de Tierra Adentro NHT a VRM Class II area in 2004 to provide for a high-quality visitor experience and to protect resources along relatively undisturbed segments of the Trail. The NHT comprehensive management plan (NPS and BLM, 2004b) amended the White Sands Resource Area RMP (BLM, 1995) in which BLM had conducted a systematic evaluation of visual resources and applied VRM Class IV standards to all BLM-administered lands within the region at the time. The BLM adjusted the VRM classes in accordance with the presence of NHT resources, resulting in a reassignment of VRM Class II for Federal lands within the 5-mile radius from the Trail centerline (Exhibit 3.4-1). BLM guidance allows for assigning VRM classes based on legislative or administrative mandates. After review

Exhibit 3.4-1. El Camino Real de Tierra Adentro NHT VRM Class II area



of VRM Classes it was felt that VRM Class II objectives were the most appropriate for relatively undisturbed areas that contained a definite segment of the NHT.

The Class II area extends approximately 5 miles to the west and east of the NHT, from Point of Rocks north just past the Aleman Ranch. The radius of the northern portion is centered near the Yost Escarpment Key Observation Point (KOP) (NPS and BLM, 2004b). This broad Class II band extends beyond BLM land onto NM State and private lands and encompasses most of the proposed Spaceport America infrastructure. The remainder of the proposed Spaceport America area is within a Class IV area as delineated by the White Sands Resource Area RMP (BLM, 1985).

Spaceport America would be developed on State-owned land and would not be governed by BLM VRM objectives on acceptable visual change. However, by agreement among the FAA, BLM, and NPS, the VRM classes and objectives are used here in describing the resource and are treated as a reference point for assessing impacts. This is especially important in consultations with other agencies on effects to the NHT and Aleman Draw Historic District as cultural resources and Section 4(f) properties.

3.4.4.2 Existing and Updated Inventory Description

An unpublished visual resource analysis conducted by NMSU in 1996 is applicable to the proposed Project area and is summarized here. The visual resource information describes scenic quality, visual sensitivity, and distance zones.

Scenic Quality

Scenic quality is a measure of the visual appeal of a tract of land. As described earlier, scenic quality can be highly distinctive, moderately distinctive, or indistinctive. In the visual resource inventory process, public lands are given a rating based on the apparent scenic quality, which is determined using seven key factors: landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications. The overall aesthetic character of the area that includes the proposed Spaceport America is neither unique nor uncommon for southern New Mexico. The study area is, for the most part, indistinctive in scenic quality. It is comprised of six major landforms, each assigned a scenic quality rating shown in Exhibit 3.4.2.

Exhibit 3.4-2. Scenic Quality in the Spaceport America Study Area

Scenic Quality Rating Unit	Scenery Quality
Basin Floor—Drainage	Indistinctive
Basin Floor—Aeolian	Indistinctive
Alluvial Fans	Indistinctive
Piedmont Slopes	Indistinctive
Volcanic Hills/Mesas	Moderately distinctive
Foothills of the Caballo Mtns	Moderately distinctive

Visual Sensitivity

Sensitivity levels are a measure of public concern for scenic quality. Public lands are assigned high, medium, or low sensitivity levels by analyzing the various indicators of public concern such as type of users, amount of use, public interest, adjacent land uses, and special land management areas. For the proposed Spaceport America Project, typical viewers and viewpoints for visual resources would include drivers along the access roads, dispersed recreational users, ranchers and their homes, and visitors to the El Camino Real de Tierra Adentro (El Camino Real) resources.

The Sierra County Road A013 (Exhibit 2-16) is west of Spaceport America and parallels the BNSF rail line. The El Camino Real also parallels County Road A013 and is about one mile east of it. The Spaceport America entrance road is located at Aleman and approaches the proposed Spaceport America area from the northwest. All of these roads currently experience low use. The majority of the existing traffic along County Road A013 is comprised of vehicles associated with the on-site ranches and BNSF maintenance vehicles. According to Sierra County, approximately 20 to 30 cars travel County Road A013 per day at the turn-off to the Bar Cross Ranch. Another minor road, located south of the Point of Rocks, provides access to the Lewis Cain ranch in the southeast corner of the Project area and the eastern side of the proposed Spaceport America area.

Scattered and dispersed recreation use occurs throughout the proposed Spaceport America vicinity, mostly concentrated near the Upham Hills area, the Point of Rocks, along El Camino Real, and the eastern and central portions of the proposed Spaceport America area. The proposed Spaceport America is not visible from I-25. A 345 kV power line traverses the valley floor 5 miles to the east of the county road (within the VRM Class II area) with a series of large wood double poles progressing in a north-northwest to south-southeast line through the middle of the valley. The 345 kV power line was constructed prior to applying the VRM Class II designation to the El Camino Real. From Upham and the Bar Cross Ranch headquarters, these towers are moderately visible, and from the Yost Escarpment KOP they are barely visible.

The following three residences are located within the proposed Spaceport America area and are associated with ranch operations on the site. These residences exhibit moderate visual sensitivity.

- The Lewis Cain Ranch headquarters at the base of Prisor Hill (east side);
- The Ben Cain Ranch headquarters (Bar Cross Ranch) at Aleman Draw near Sierra County Road A013; and
- A foreman’s ranch residence, about three miles southeast of the Ben Cain Ranch headquarters.

Other potential viewers include astronomy club members from Las Cruces that use a location well south of the Project area to take advantage of the dark sky (a location where the lack of artificial lighting improves visibility) for viewing.

El Camino Real has high visual sensitivity from the general area of Upham to Aleman Draw, but Spaceport America infrastructure would be mostly blocked from view by terrain from all but a small portion of the Trail at and near the KOP at the Yost Escarpment. Yost Escarpment is of high sensitivity and line-of-sight analysis and direct observation indicate that Spaceport America infrastructure would be visible. Prominent landmarks are identified as places having moderate sensitivity and include Prisor Hill, the Upham Hills, and Point of Rocks. The remainder of the proposed Spaceport America area is characterized as having low visual sensitivity.

Distance Zones

Landscapes are subdivided into three distance zones based on relative visibility from travel routes or observation points: foreground-middleground, background, and seldom-seen. The foreground-middleground zone includes areas seen from viewing locations that are less than 3 to 5 miles away. Areas beyond the foreground-middleground zone, but usually less than fifteen miles away, are in the background zone. Areas not seen as foreground-middleground or background (i.e., hidden from view) are in the seldom-seen zone.

From viewpoints on County Road A013, the El Camino Real corridor, and the ranch homes, the visible distance zone area is primarily in the foreground-middleground zone. Views of the background and beyond are not generally visible from most locations due to terrain. From the KOP on the Yost Escarpment there are views of the background and distance views of the "seldom seen" zone.

3.5 Historical, Architectural, Archaeological, and Cultural Resources

3.5.1 Definition and Description

Cultural resources are archaeological sites, architectural properties, and other historical resources relating to human activities, society, and cultural institutions that hold communities together and link them to their surroundings. Cultural resources include past and present expressions of human culture and history in the physical environment, such as prehistoric and historic archaeological sites, buildings, structures, objects, districts, natural features, and biota, which are considered important to a culture, subculture, or community. Cultural resources also include aspects of the physical environment that are a part of traditional lifeways and practices, and are associated with community values and institutions.

Cultural resources include prehistoric and historic resources, as well as ethnographic resources. Prehistoric and historic resources are the tangible remains of past activities that show use or modification by people. They can include artifacts, as well as features such as hearths, rock alignments, trails, roads, or acequias (community ditches), landscape alterations, or architecture. These are sometimes grouped in distinct geographic areas that represent broad cultural styles and traditions. Prehistoric and historic resources are the loci of purposeful human activity that has resulted in the deposition of cultural materials. In general, prehistoric resources are those that originate from cultural activities prior to the establishment of a European presence in southern New Mexico in the early 17th century. Historic resources are those that date from the period of written records, which began with the arrival of Europeans in the region.

Resources that have a direct association with a living cultural group 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 formation, the confluence of two rivers, or a rock pile (cairn); large areas, such as landscapes and viewsheds; 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 man-made or natural.

The NRHP is a listing of buildings, structures, sites, districts, and objects that are considered significant at a national, State, or local level. Cultural resources that are listed on the NRHP or have been determined eligible for listing have been documented and evaluated according to uniform standards, and have been found to meet criteria of significance, integrity, and age. Cultural resources that meet the criteria for listing on the NRHP are called *historic properties*. Resources that have undetermined eligibility are considered as historic properties until a determination otherwise. If an ethnographic resource is found to meet the criteria for listing on the NRHP, it is called a *traditional cultural property* (TCP). A TCP is generally defined as a property "that is eligible for inclusion in the National Register because of its association with 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" (NPS, 1990a).

3.5.2 Regulatory Setting

3.5.2.1 Federal Statutes

A number of Federal statutes address cultural resources and Federal responsibilities regarding them. The long history of legal jurisdiction over cultural resources, dating back to the 1906 passage of the *Antiquities Act* (16 U.S.C. 431-433), demonstrates a continuing concern on the part of Americans for their cultural resources. Cultural resources include historic properties, as defined in the *National Historic Preservation Act* (NHPA) (16 U.S.C. 470); cultural items, as defined in the *Archaeological and Historic Preservation Act* (AHPA) (16 U.S.C. 469); cultural items and human remains, as defined by the *Native American Graves Protection and Repatriation Act* (NAGPRA) (25 U.S.C. 3001); archaeological resources, as defined by the *Archeological Resources Protection Act* (ARPA) (16 U.S.C. 470aa-mm); the cultural environment, as defined by Executive Order (EO) 11593, *Protection and Enhancement of the Cultural Environment* (36 FR 8921); Indian sacred sites to which access is provided under the *American Indian Religious Freedom Act* (AIRFA) (42 U.S.C. 1996), and as defined in EO 13007 *Indian Sacred Sites* (61 FR 26771); and collections and associated records, as defined in 36 CFR Part 79, Curation of Federally-Owned and Administered Collections. Requirements set forth in this legislation, and their implementing regulations, define the FAA's responsibilities for management of cultural resources.

Foremost among these statutory provisions is Section 106 of the NHPA. Section 106 of the NHPA requires Federal agencies to take into account the effect of their undertakings on historic properties. The Advisory Council on Historic Preservation (ACHP) regulations that implement Section 106 (36 CFR Part 800) describe the process for identifying and evaluating cultural resources; assessing effects of Federal actions on historic properties; and consulting to avoid, reduce, or mitigate adverse effects. The NHPA does not mandate preservation of historic properties, but it does ensure that Federal agency decisions concerning the treatment of these resources result from meaningful consideration of cultural and historic values, and identification of options available to protect the resources. Similarly, Section 101(b)(4) of NEPA establishes a Federal policy for the conservation of historic and cultural aspects of the nation's heritage. Regulations implementing NEPA stipulate that Federal agencies must consider the consequences of their actions on cultural resources that are included in, or eligible for inclusion in, the NRHP, and mitigate adverse impacts.

Certain 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. Section 101(d)(6) of the NHPA mandates that Federal agencies consult with Indian tribes and Native American groups who either historically occupied the Project area or may attach religious or cultural significance to cultural resources in the region. The legislation is designed to identify cultural resources important to tribes and to address tribal concerns about potential impacts to these resources. The NEPA implementing regulations link to the NHPA, as well as AIRFA, NAGPRA, EO 13007, EO 13175 *Consultation and Coordination with Indian Tribal Governments* (65 FR 67249), and the Executive Memorandum on Government-to-Government Relations with Native American Tribal Governments (59 FR 22951). This legislation calls on agencies to consult with Native American tribal leaders and others knowledgeable about cultural resources important to them. The FAA initiated tribal consultation for the Spaceport America EIS with letters on February 3, 2006, and March 22, 2007 (see Section 3.5.4.3 below). Consultation will continue throughout development of the EIS.

3.5.2.2 State Statutes

In addition to Federal regulations, the State of New Mexico has laws and regulations to protect cultural resources. New Mexico's *Cultural Properties Act* (NM Statute §18-6-1 through 17), prohibits, among other things, destroying cultural properties on State land without a permit or on private land without the owner's consent, and regulates excavation or disturbance of unmarked human burials within New Mexico outside of Federal lands.

3.5.3 Region of Influence

The Region of Influence for cultural resources is identical to the Area of Potential Effects (APE), as defined by the regulations implementing Section 106 of the NHPA. An APE is

> ". . . the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking." (36 CFR 800.16[d])

The proposed Project has the potential to affect cultural resources in two ways: through physical impacts to resources, and through changes to the visual and auditory character of the rural setting of resources. For physical impacts, the APE is defined as the areas within which construction or operations activities would occur, hereafter referred to as the Physical APE. Because the APE boundaries include more area (the Project boundary plus a buffer area) than would be specified for construction of the Spaceport America facilities, not all of the resources identified within this APE would necessarily be impacted by the Project. The Physical APE was developed to allow for possible minor shifting of facility locations during Project design and construction to avoid resource impacts and to allow ample area for construction activities. Due to the nature of the undertaking, the APE also includes areas outside of, but in proximity to, the limits of disturbance of the proposed Spaceport America facilities. These are areas that may contain resources that could be impacted through the introduction of visible or audible intrusions into the setting by the proposed Project. This area has been defined by the FAA, in consultation with the New Mexico State Historic Preservation Officer (NMSHPO), the BLM, the NPS, and the National Trust for Historic Preservation, as a 5-mile radius surrounding any proposed aboveground infrastructure or facilities, and is hereafter referred to as the Setting APE. Information from the FAA's ongoing consultation with Indian Tribes on potential effects to ethnographic resources or TCPs could modify the Setting APE.

3.5.4 Existing Conditions

3.5.4.1 Cultural Background of the Project Area

The significance of a cultural resource can be explained only when it is evaluated within its prehistoric or historic context. Contexts are the broad patterns or trends in history by which a specific resource is understood and its meaning (and ultimately its significance) within prehistory and history is made clear (NPS, 1990b). Cultural resources in south-central New Mexico embody a long progression of time beginning with the Paleoindian occupation of 12,000 years ago and continuing through 400 years of historic use (Exhibit 3.5-1). The following section briefly describes the major patterns of prehistory and history for the proposed Project area and its vicinity. The text in this section is based on information in the cultural resource inventory reports prepared for the proposed Spaceport America Project (Zia EEC, 2007d, 2008a, and 2008b).

Exhibit 3.5-1. Regional Cultural Chronology

Period/Phase	Approximate Date	Reference
Paleoindian	Ca. 10,000-6000 B.C.	Irwin-Williams 1979
Archaic	6000 B.C.- A.D. 200	MacNeish and Becket 1987
Early	6000-4000 B.C.	MacNeish and Becket 1987
Middle	4000-1200 B.C.	O'Laughlin 1980
Late	1200 B.C.-A.D. 200	O'Laughlin 1980
Formative	A.D. 200-1450	Lehmer 1948; LeBlanc and Whalen 1980
Mesilla	A.D. 200-1100	Lehmer 1948
Doña Ana	A.D. 1100-1200	Lehmer 1948
El Paso	A.D. 1200-1450	Lehmer 1948
Protohistoric	A.D. 1450-1659	Becket and Corbett 1992
Historic	A.D. 1659-present	Wilson et al. 1989

Source: Zia EEC, 2007d, 2008a, and 2008b

<u>Prehistory</u>

The Paleoindian period dates from 12,000 to 7,500 years ago, during which the now-dry Jornada del Muerto basin was a lush woodland/grassland environment with major, internally drained draws providing a focus for hunting activities of the inhabitants. The earliest of these hunters subsisted on the now-extinct mammoth that congregated around Pleistocene lake beds throughout southern New Mexico. Most Paleoindian artifacts found in the basin area are isolated projectile points and hearths, although ash stains and artifact scatters also have been recorded. Sites are rare, probably because of small population densities and extensive erosion and deposition. Several sites in the vicinity of WSMR have yielded dates from the Paleoindian tradition, including Clovis, Folsom, and Plano/Cody phases. Paleoindian sites and/or materials are present in the proposed Spaceport America Project area.

During the Archaic Period (6000 B.C. to A.D. 200), there was a long, gradual period of changing food collection practices from hunter/gatherers to horticulturalists in which the collection of natural resources was supplemented with cultivated resources to provide a more reliable food supply. Early tools have been found for plant cooking and seed grinding, as well as tools for hunting and skin processing. Early to Late Archaic period sites appear to be centered along or near major arroyo systems and their playas. Domesticated corn seeds probably were imported to the area, and corn, as well as wild food sources, were collected and used. During the Late Archaic phase (1200 B.C. to A.D. 200), other new strains of corn were introduced along with beans and perhaps amaranth. Archaic sites and/or materials are present in the proposed Spaceport America Project area.

The Formative period (called the Jornada Mogollon in south-central New Mexico) encompasses the Mesilla, Doña Ana, and El Paso phases dating from A.D. 200 to 1450. The Formative period is marked by increased reliance on agriculture and increased population concentration. Large-scale camps and large subterranean pithouse villages along major west-draining arroyos indicate an intensive occupation in the basin east of the proposed Spaceport America Project site. Potentially arable soils within and surrounding the arroyos, as well as other abundant resources, appear to have been an important factor in the settlement. Ceramic vessel functions changed, indicating an expansion of activities from gathering to cooking and then to storage. Formative sites and/or materials are present in the proposed Spaceport America Project area.

Protohistoric/European Contact

By 1450, the prehistoric phase villages lay abandoned. When the Spanish arrived in the area in the 1500s, it was home to the Mansos Indians. The first Europeans to see south-central New Mexico were the Spanish explorers Francisco Sanchez Chamuscado (1581–1582), Antonio de Espejo (1582–1583), and Francisco Leyva de Bonilla (1593). They helped explore the route between what would later be known as Ciudad Chihuahua, Chihuahua, Mexico, and Santa Fe, New Mexico. The route was called El Camino Real de Tierra Adentro, which is described in more detail in Section 3.5.4.6, and served for three centuries as the swiftest method of transportation by Spanish, Mexican, and later Anglo-American groups traveling north and south between frontier Santa Fe and Mexico City. 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 proposed Spaceport America. This essentially waterless portion of the route is the reason the basin acquired the Spanish name of the Jornada del Muerto or "Dead Man's Journey". Archaeological remains of the route include campsites, ramps, and other improvements to cross environmental barriers, such as arroyos and ridges. The Yost Draw Study Area of El Camino Real is located near the proposed Spaceport America Project area, and evidence of El Camino Real is located within the Project area.

The Apache - Athabascans who migrated from Canada, possibly by way of the eastern slopes of the Rocky Mountains - probably entered the southwest about A.D. 1500. By A.D. 1600, they employed a hunting and gathering subsistence strategy for scheduled seasonal harvesting of large areas with varied resources. 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. It is currently unknown if Apache sites or materials from this period are located within the proposed Spaceport America Project area, although it is likely. Currently, sites exist with unknown affiliation that may be attributed to Apache use upon further archaeological and ethnohistoric investigation.

History

The Aleman Draw Historic District, discussed in more detail in Section 3.5.4.7, is located along El Camino Real and is now a working ranch. Settlement in the Aleman area developed when it became the first permanent water source along the El Camino Real. In 1867, California Column veteran John Martin hand-excavated a well and set up a ranch called "El Aleman." Having the only area with water for miles, the ranch flourished and had a military presence in the early years. Later, telegraph service and a post office came to the area, and in 1882, the railroad. In the mid-1880s, the ranch became part of the Bar Cross Ranch, a title it retains to this day. In the 1930s, the Civilian Conservation Corps (CCC) built several dams and earthworks, and a temporary camp was established in 1937 at the Aleman Ranch headquarters. As wells were drilled in the Jornada del Muerto, ranching became more important to the region. Although ranching is a mainstay in Sierra County, ranches in the Jornada del Muerto are still affected by limited rainfall and a desertification of rangeland. After construction of the Atchison, Topeka, and Santa Fe railroad (now the BNSF) in 1882, stations such as Engle and Upham (now abandoned as railroad stations) were used for servicing locomotives and for shipping cattle to the beef markets of the Midwest. The Aleman Draw Historic District is located adjacent to and partially within the proposed Spaceport America Project area.

A small number of identifiable, Apache-related materials and sites that are attributed to Historic times have been recorded in the region. These consist of hearths, roasting pits, stone circles, and petroglyphs. Spanish sites consist of hunting hearths and El Camino Real. Anglo sites are relatively numerous and variable, and have features that include wells, cairns, ash stains, corrals, tanks, windmills, barns, house and outbuilding foundations, mine shaft/tunnels, dumps, and roads. The Spaceport America Project area contains sites dating to the Historic Period.

3.5.4.2 Status of Cultural Resource Investigations

In accordance with Section 106 of the NHPA, the FAA has identified and evaluated historic properties within the Physical APE and the Setting APE of the proposed Project. The FAA conducted three intensive cultural resource inventories of the APEs to identify historic properties that would meet the criteria for listing on the NRHP. One inventory includes all construction areas located on the proposed Spaceport site (referred to as the on-site inventory), including the vertical and horizontal launch areas (runway and development areas), access roads, wastewater treatment plant, and utility corridors (Zia EEC, 2007d). The second inventory covers all off-site construction areas (referred to as the off-site inventory), including the location of the substation and 10 MVA transmission line and two fiber optic cables (Zia EEC, 2008a). The third inventory includes the water well field and associated pipeline corridors (Zia, 2008b). The total area covered by the three inventories is 3,364 acres. The inventory area is much larger than the area needed for construction activities or the actual footprint of the facilities as described in Chapter

2. This survey area was designed to allow NMSA room to relocate Project components during planning and design of the facilities in order to avoid impacts to resources, or for other reasons. Some planned facilities were revised after the inventory was conducted, thus some resources recorded during the inventories are no longer within areas planned for construction.

The inventories include background research to determine the prehistoric and historic contexts of the Project area and vicinity, site file searches for information on previously recorded resources in the two APEs, 100 percent-coverage pedestrian survey of the Physical APE, recording of all identified cultural resources aged 50 years or older, a windshield survey of the Setting APE, and viewshed assessments to determine what proposed facilities would be seen from potential historic properties in the Setting APE. The results are presented in three inventory reports, including evaluations of NRHP eligibility for each recorded resource and assessments of potential effects to NRHP-eligible resources (Zia EEC, 2007d, 2008a, and 2008b).

The FAA has invited 12 entities in addition to nine tribes to participate in the Section 106 process as consulting parties. There are 17 entities who have indicated their intent to participate: NPS, BLM, WSMR, NASA, NMSA, NMSLO, NMDOT, NMSHPO, Sierra County, private landowners, National Trust for Historic Preservation, New Mexico Heritage Preservation Alliance, El Camino Real de Tierra Adentro Trail Association, and four tribes (see Section 3.5.4.3).

One of the opportunities for the consulting parties to be involved in the Section 106 process is through review and comment on the inventory reports. The consulting parties have been provided with the draft on-site inventory report for their review and comment. Comments have been received on the draft on-site report, and those comments are currently being addressed through revisions to the report and additional field work to more fully assess potential effects to the settings of historic properties. The revised report will be submitted to the NMSHPO for formal consultation under Section 106 and provided to the consulting parties so that they can see how their comments were addressed. The off-site report and well field report have been disseminated to all of the consulting parties for their review and comment. Comments will be addressed, and revised reports will be submitted to the NMSHPO for formal Section 106 consultation and provided to the consulting parties. Information from the final reports and consultation from NMSHPO will be included in the final EIS.

3.5.4.3 Native American Consultation

The FAA initiated consultation under NEPA and Section 106 of NHPA with nine potentially interested tribes, including the Comanche Indian Tribe, Fort Sill Apache Tribe of Oklahoma, Hopi Tribe, Isleta Pueblo, Kiowa Tribe of Oklahoma, Mescalero Apache Tribe, Navajo Nation, White Mountain Apache Tribe, and Ysleta del Sur Pueblo. These tribes were selected based on guidance provided by New Mexico's Historic Preservation Division (HPD, 2007). The purpose of the consultation is to elicit from tribal representatives concerns for potential impacts from the proposed Project on resources that are significant to the tribes, and to identify possible mitigation measures to address any potential impacts.

The FAA initiated consultation with a letter on February 3, 2006. Another letter was sent on March 22, 2007, describing the Proposed Action and asking for comments or concerns that the tribes may have. The FAA contacted each tribe by telephone to ensure receipt of the letter, answer questions, and determine interest in the proposed Project. Responses of interest in the project were received from the White Mountain Apache Tribe, Comanche Tribe, Hopi Tribe, and

Ysleta del Sur Pueblo. The Pueblo of Isleta responded that there would be no impact to cultural resources affiliated with their tribe (see Appendix A, Agency and Tribal Correspondence). No responses were received from the other tribes.

The four tribes who responded with interest in the project are considered to have consulting party status in the Section 106 process. They received a copy of the draft on-site cultural resource inventory report; however, no comments were received from the tribes on that report. The consulting tribes have received copies of the draft off-site and well field inventory reports. Final inventory reports, as well as Draft and Final versions of this EIS, will also be made available to them for their review and comment. The FAA continues to contact these four tribes via telephone to inform them of the status of the Section 106 and NEPA processes, and to ensure that their concerns are addressed. This will continue throughout the EIS process.

3.5.4.4 Archaeological/Architectural Resources in the APEs

Archaeological, architectural, and engineering resources were identified within the two APEs from the background research and field surveys of the proposed Project area. Within the Physical APE, the inventory identified 64 archaeological sites and 622 isolated occurrences of artifacts. One of the archaeology sites includes architectural buildings and structures and a water control feature, and a non-visible segment of El Camino Real passes through it. This site, an archaeological site with a visible segment of El Camino Real, and two additional archaeology sites, have been grouped together to form the Aleman Draw Historic District. The resources in this District are related based on the common themes of water availability and transportation. The District is discussed in more detail in Section 3.5.4.7. In the Setting APE, the inventory identified an historic-aged ranch, the Aleman Draw Historic District, and 13 additional archaeological sites along the El Camino Real de Tierra Adentro NHT. El Camino Real is discussed in more detail in Section 3.5.4.6.

Exhibits 3.5-2 and 3.5-3 list the sites and resources identified in the APEs, their eligibility to the NRHP, and the portion of the project area where they are located. Twenty-six sites in the Physical APE are located in portions of the Project area that are not planned for use during construction. These sites are indicated in the table with “not in impact area” under Project Area Location.

All of the identified resources were recorded and evaluated to determine if they are eligible for listing on the NRHP. The FAA is consulting with the NMSHPO and the consulting parties regarding these eligibility determinations. Resources that are eligible are afforded consideration under Section 106 of the NHPA. If a Federal action would adversely affect an eligible resource, then measures must be considered to avoid, minimize, or mitigate the effect (see Section 4.5). NRHP eligibility is currently a recommendation; upon consultation with the consulting parties and the NMSHPO, the FAA will make final eligibility determinations. The 622 isolated occurrences were scattered across all areas of the Physical APE. They include ground stone artifacts, projectile points, other chipped stone tools, chipped stone flakes, ceramic artifacts, fire-cracked rock, and historic glass and metal artifacts. The isolated occurrences are not associated with any site context and are not eligible for listing on the NRHP.

Exhibit 3.5-2. Cultural Resources Identified in the Physical and Setting APEs for On-site Infrastructure and Facilities

Resource #	Description	Land Status	NRHP Eligibility Recommendation	Project Area Location
Physical APE for On-site Infrastructure and Facilities				
LA 8871	38.7 acres; Aleman Ranch Complex; part of the Aleman Draw Historic District; unknown prehistoric affiliation, Spanish Colonial through NM Statehood Periods	NMSLO, private	Eligible	Access road, Utility corridor
LA 51205	63 acres; artifact scatter; part of the Aleman Draw Historic District; Formative through U.S. Territorial Periods (also in off-site APE)	NMSLO, BLM, private	Eligible	Access road, Utility corridor
LA 80070	El Camino Real de Tierra Adentro NHT, Yost Draw Study Area, Road Segment 10; part of the Aleman Draw Historic District; Spanish Colonial through U.S. Territorial Periods	NMSLO, private	Eligible	Access road, Utility corridor
LA 111420	2.2 acres; artifact scatter; Early to Middle Archaic Periods	NMSLO, BLM	Eligible	Utility corridor
LA 111421	0.9 acres; artifact scatter; unknown prehistoric affiliation	NMSLO	Undetermined eligibility	Utility corridor
LA 111422	0.6 acres; artifact scatter and thermal features; Formative Period	NMSLO	Eligible	Utility corridor
LA 111429	39.5 acres; artifact scatter, ring midden, thermal features, and ground depressions; Paleoindian, Archaic, and Formative Periods	NMSLO	Eligible	not in impact area
LA 111432	2.6 acres; artifact scatter; Paleoindian Period	NMSLO, BLM	Eligible	Utility corridor
LA 111435	3.7 acres; artifact scatter and thermal features; Formative Period	NMSLO	Eligible	Utility corridor
LA 112367	1.2 acres; artifact scatter; Formative Period	NMSLO	Undetermined eligibility	Utility corridor
LA 112368	6.4 acres; artifact scatter, thermal features, and ground depression; Paleoindian and Archaic Periods	NMSLO	Eligible	not in impact area
LA 112369	0.5 acres; artifact scatter; Paleoindian Period and unknown prehistoric affiliation	NMSLO	Eligible	not in impact area
LA 112370	0.6 acres; artifact scatter; unknown prehistoric affiliation	NMSLO	Undetermined eligibility	Access road, Utility corridor
LA 112371	0.7 acres; artifact scatter; unknown prehistoric affiliation	NMSLO	Undetermined eligibility	Access road, Utility corridor
LA 112372	4.4 acres; artifact scatter and rock feature; Middle Archaic Period	NMSLO	Eligible	not in impact area

Exhibit 3.5-2. Cultural Resources Identified in the Physical and Setting APEs for On-site Infrastructure and Facilities (cont'd)

Resource #	Description	Land Status	NRHP Eligibility Recommendation	Project Area Location
LA 112374	0.1 acres; artifact scatter; unknown prehistoric affiliation	NMSLO	Undetermined eligibility	Access road, Utility corridor
LA 112376	0.4 acres; artifact scatter; unknown prehistoric affiliation	NMSLO	Undetermined eligibility	not in impact area
LA 112377	1.4 acres; artifact scatter and thermal features; Paleoindian Period	NMSLO	Eligible	not in impact area
LA 112378	19.8 acres; artifact scatter and thermal features; Paleoindian and Middle Archaic Periods	NMSLO	Eligible	not in impact area
LA 112379	0.4 acres; artifact scatter and thermal feature; Late Archaic Period	NMSLO	Eligible	not in impact area
LA 112380	4.9 acres; artifact scatter and thermal features; Paleoindian and Formative Periods	NMSLO	Eligible	not in impact area
LA 112383	0.6 acres; artifact scatter and thermal features; unknown prehistoric affiliation	NMSLO	Eligible	not in impact area
LA 112384	0.5 acres; artifact scatter and habitation features; Formative Period	NMSLO	Eligible	not in impact area
LA 112385	0.2 acres; artifact scatter and thermal feature; unknown prehistoric affiliation	NMSLO	Undetermined eligibility	not in impact area
LA 112395	2.6 acres; artifact scatter; Paleoindian Period and other unknown prehistoric affiliation	NMSLO	Eligible	not in impact area
LA 155962	14.8 acres; artifact scatter and thermal features; part of the Aleman Draw Historic District; Archaic through Historic Periods	NMSLO, private	Eligible	Access road, Utility corridor
LA 155963	124.0 acres; artifact scatter and thermal features; Archaic and Formative Periods	NMSLO	Eligible	Access road, Utility corridor
LA 155964	0.8 acres; artifact scatter and thermal features; Middle Archaic Period	NMSLO	Eligible	Utility corridor, Fence
LA 155965	2.6 acres; artifact scatter and thermal features; unknown prehistoric affiliation	NMSLO	Eligible	not in impact area

Exhibit 3.5-2. Cultural Resources Identified in the Physical and Setting APEs for On-site Infrastructure and Facilities (cont'd)

Resource #	Description	Land Status	NRHP Eligibility Recommendation	Project Area Location
LA 155966	1.8 acres; Registered Tank; Historic Period	NMSLO	Undetermined eligibility	not in impact area
LA 155967	0.4 acres; artifact scatter and thermal feature; unknown prehistoric affiliation	NMSLO	Eligible	not in impact area
LA 155968	2.2 acres; artifact scatter and thermal features; unknown prehistoric affiliation	NMSLO	Eligible	Access road, Utility corridor
LA 155969	0.3 acres; artifact scatter and thermal feature; unknown prehistoric affiliation	NMSLO	Eligible	Runway
LA155970	0.7 acres; artifact scatter; unknown prehistoric affiliation	NMSLO	Undetermined eligibility	Runway
LA 155971	0.05 acres; artifact scatter and ring midden; Formative Period or Apache	NMSLO	Eligible	not in impact area
LA 155972	0.2 acres; artifact scatter and feature; unknown prehistoric affiliation	NMSLO	Undetermined eligibility	not in impact area
LA 155973	0.4 acres; artifact scatter and thermal features; unknown prehistoric affiliation	NMSLO	Eligible	not in impact area
LA 155974	1.1 acres; artifact scatter and thermal feature; unknown prehistoric affiliation	NMSLO	Eligible	not in impact area
LA 155975	0.2 acres; artifact scatter and thermal feature; unknown prehistoric affiliation	NMSLO	Eligible	not in impact area
LA 156877	0.2 acres; artifact scatter; unknown prehistoric affiliation	NMSLO	Eligible	Access road
LA 156878	0.6 acres; artifact scatter and thermal feature; unknown prehistoric affiliation	NMSLO	Undetermined eligibility	not in impact area
LA 156879	0.6 acres; artifact scatter and thermal feature; Formative Period	NMSLO	Eligible	Access road, Utility corridor
LA 156880	0.3 acres; artifact scatter and thermal features; unknown prehistoric affiliation	NMSLO	Eligible	not in impact area

Exhibit 3.5-2. Cultural Resources Identified in the Physical and Setting APEs for On-site Infrastructure and Facilities (cont'd)

Resource #	Description	Land Status	NRHP Eligibility Recommendation	Project Area Location
Setting APE for On-site Infrastructure and Facilities				
none	Goetz Ranch headquarters	private	Undetermined eligibility	Setting
LA 8871, 51205, 80070, 155962	Aleman Draw Historic District; Spanish Colonial through NM Statehood Periods	NMSLO, private	Eligible	Setting
LA 80052	Yost Escarpment Road Segment; part of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; Spanish Colonial through U.S. Territorial Periods	BLM	Undetermined eligibility	Setting
LA 80053	scatter of olive jar sherds; on Road Segment 3 of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; Spanish Colonial to U.S. Territorial Periods	NMSLO	Undetermined eligibility	Setting
LA 80054	Yost Draw Crossing Road Segment; part of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; Spanish Colonial through U.S. Territorial Periods	NMSLO	Undetermined eligibility	Setting
LA 80070	Road Segments 1 through 10 of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; segment 10 is part of the Aleman Draw Historic District; Spanish Colonial through U.S. Territorial Periods	NMSLO, BLM, private	Eligible	Setting
LA 80071	historic trash scatter; located along El Camino Real de Tierra Adentro NHT; U.S. Territorial	BLM	Undetermined eligibility	Setting
LA 80072	historic trash scatter; located on Yost Escarpment Road Segment; part of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; Spanish Colonial through U.S. Territorial Periods	BLM	Undetermined eligibility	Setting
LA 110400	prehistoric artifact scatter and road remnants; part of El Camino Real de Tierra Adentro NHT; unknown prehistoric affiliation and Spanish Colonial through U.S. Territorial Periods	BLM	Undetermined eligibility	Setting

Exhibit 3.5-2. Cultural Resources Identified in the Physical and Setting APEs for On-site Infrastructure and Facilities (cont'd)

Resource #	Description	Land Status	NRHP Eligibility Recommendation	Project Area Location
LA 110401	prehistoric artifact scatter and road remnants; on Road Segment 2 of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; unknown prehistoric affiliation and Spanish Colonial to U.S. Territorial Periods	BLM	Undetermined eligibility	Setting
LA 110402	prehistoric lithic scatter and road remnants; part of El Camino Real de Tierra Adentro NHT; unknown prehistoric affiliation and Spanish Colonial through U.S. Territorial Periods	BLM	Undetermined eligibility	Setting
LA 110403	Prehistoric and historic artifact scatter and road remnants; on Road Segment 9 of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; Mogollon and Spanish Colonial to U.S. Territorial Periods	NMSLO	Undetermined eligibility	Setting
LA 110404	prehistoric artifact scatter and road remnants; on Road Segment 6 of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; unknown prehistoric affiliation and Spanish Colonial to U.S. Territorial Periods	NMSLO	Undetermined eligibility	Setting
LA 110405	artifact scatter and feature and road remnants; on Road Segment 9 of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; Archaic and Spanish Colonial to U.S. Territorial Periods	NMSLO	Undetermined eligibility	Setting
LA 111000	Upham Siding, historic trash scatter, and road remnants; part of El Camino Real de Tierra Adentro NHT; Spanish Colonial through U.S. Territorial Periods	NMSLO, private	Undetermined eligibility	Setting

Source: Zia EEC, 2007d

APE = area of potential effect, BLM = Bureau of Land Management, LA = Laboratory of Anthropology, NHT = National Historic Trail, NMSLO = New Mexico State Land Office, NRHP = National Register of Historic Places

Exhibit 3.5-3. Cultural Resources Identified in the Physical and Setting APEs for Off-site Infrastructure and Well Field Facilities

Resource #	Description	Land Status	NRHP Eligibility Recommendation	Project Area Location
Physical APE for Off-site Infrastructure and Well Field Facilities				
LA 51204	7.7 acres; artifact scatter with features; unknown prehistoric affiliation	NMSLO, BLM	Eligible	Fiber optic line
LA 51205	63 acres; artifact scatter; part of Aleman Draw Historic District; Formative through U.S. Territorial Periods (also in on-site APE)	NMSLO, BLM, private	Eligible	Fiber optic line, Underground power line
LA 156860	1.1 acres; artifact scatter; unknown prehistoric affiliation	NMSLO	Not eligible	Fiber optic line
LA 156861	22.4 acres; artifact scatter and historic Cutter railroad siding; unknown prehistoric affiliation, 1800s to 1900s	private	Eligible	Fiber optic line
LA 156862	0.7 acres; artifact scatter with features; Late Archaic Period	NMSLO	Eligible	Fiber optic line
LA 156863	2.6 acres; artifact scatter with features; Formative Period, late 1800s	private	Eligible	Fiber optic line
LA 156864	5.6 acres; artifact scatter with features; Late Archaic Period	NMSLO, private	Eligible	Fiber optic line
LA 156865	5.2 acres; artifact scatter with features; Middle Archaic Period, late 1800s to 1940	NMSLO, BLM	Eligible	Fiber optic line
LA 156866	0.6 acres; artifact scatter with features; unknown prehistoric affiliation	NMSLO	Undetermined eligibility	Fiber optic line
LA 156867	0.7 acres; artifact scatter with features; Archaic Period, 1900s	BLM	Undetermined eligibility	Fiber optic line
LA 156868	1.3 acres; artifact scatter; late 1800s to early 1900s	BLM	Not eligible	Fiber optic line
LA 156869	2.0 acres; artifact scatter; Paleoindian Period	BLM	Eligible	Underground power line
LA 156870	0.7 acres; artifact scatter; Early Archaic Period	BLM	Eligible	Aboveground power line
LA 156871	3.9 acres; artifact scatter with features; unknown prehistoric affiliation	BLM	Eligible	not in impact area
LA 156872	3.7 acres; artifact scatter with features; Formative Period	BLM	Eligible	not in impact area
LA 156873	16.1 acres; artifact scatter; Late Archaic Period	BLM	Eligible	Aboveground power line
LA 156874	2.3 acres; artifact scatter; unknown prehistoric affiliation	BLM	Eligible	Aboveground power line

Exhibit 3.5-3. Cultural Resources Identified in the Physical and Setting APEs for Off-site Infrastructure and Well Field Facilities (cont'd)

Resource #	Description	Land Status	NRHP Eligibility Recommendation	Project Area Location
LA 156875	1.5 acres; artifact scatter; unknown prehistoric affiliation	BLM	Eligible	Aboveground power line
LA 156876	1.8 acres; artifact scatter; unknown prehistoric affiliation	BLM	Eligible	Aboveground power line
LA 159142	3.9 acres; artifact scatter with feature; unknown prehistoric affiliation	NMSLO	Not eligible	Well field
LA 159143	3.3 acres; artifact scatter; unknown prehistoric affiliation	NMSLO	Not eligible	Well field
LA 159144	2.3 acres; artifact scatter; unknown prehistoric affiliation	NMSLO	Eligible	Well field
Setting APE for Off-site Infrastructure and Well Field Facilities				
none	Goetz Ranch headquarters	private	Undetermined eligibility	Setting
LA 8871, 51205, 80070, 155962	Aleman Draw Historic District; Spanish Colonial through NM Statehood Periods	NMSLO, private	Eligible	Setting
LA 80052	Yost Escarpment Road Segment; part of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; Spanish Colonial through U.S. Territorial Periods	BLM	Undetermined eligibility	Setting
LA 80053	scatter of olive jar sherds; on Road Segment 3 of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; Spanish Colonial to U.S. Territorial Periods	NMSLO	Undetermined eligibility	Setting
LA 80054	Yost Draw Crossing Road Segment; part of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; Spanish Colonial through U.S. Territorial Periods	NMSLO	Undetermined eligibility	Setting
LA 80070	Road Segments 1 through 10 of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; segment 10 is part of the Aleman Draw Historic District; Spanish Colonial through U.S. Territorial Periods	NMSLO, BLM, private	Eligible	Setting
LA 80072	historic trash scatter; located on Yost Escarpment Road Segment; part of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; Spanish Colonial through U.S. Territorial Periods	BLM	Undetermined eligibility	Setting
LA 110400	prehistoric artifact scatter and road remnants; part of El Camino Real de Tierra Adentro NHT; unknown prehistoric affiliation and Spanish Colonial through U.S. Territorial Periods	BLM	Undetermined eligibility	Setting

Exhibit 3.5-3. Cultural Resources Identified in the Physical and Setting APEs for Off-site Infrastructure and Well Field Facilities (cont'd)

Resource #	Description	Land Status	NRHP Eligibility Recommendation	Project Area Location
LA 110401	prehistoric artifact scatter and road remnants; on Road Segment 2 of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; unknown prehistoric affiliation and Spanish Colonial to U.S. Territorial Periods	BLM	Undetermined eligibility	Setting
LA 110402	prehistoric lithic scatter and road remnants; part of El Camino Real de Tierra Adentro NHT; unknown prehistoric affiliation and Spanish Colonial through U.S. Territorial Periods	BLM	Undetermined eligibility	Setting
LA 110403	prehistoric and historic artifact scatter and road remnants; on Road Segment 9 of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; Mogollon and Spanish Colonial to U.S. Territorial Periods	NMSLO	Undetermined eligibility	Setting
LA 110404	prehistoric artifact scatter and road remnants; on Road Segment 6 of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; unknown prehistoric affiliation and Spanish Colonial to U.S. Territorial Periods	NMSLO	Undetermined eligibility	Setting
LA 110405	artifact scatter and feature and road remnants; on Road Segment 9 of Yost Draw Study Area, El Camino Real de Tierra Adentro NHT; Archaic and Spanish Colonial to U.S. Territorial Periods	NMSLO	Undetermined eligibility	Setting

Source: Zia EEC, 2008a and 2008b

APE = area of potential effect, BLM = Bureau of Land Management, LA = Laboratory of Anthropology, NHT = National Historic Trail, NMSLO = New Mexico State Land Office, NRHP = National Register of Historic Places

3.5.4.5 Ethnographic Resources in the APEs

To date, none of the tribes consulted has indicated concerns for specific cultural resources that would be impacted by the proposed Project. Consultation with the interested tribes is still in progress. If a tribe identifies any cultural resources as important, consultation will include determining potential impacts of the proposed Project and identifying measures that would be appropriate to avoid, minimize, or mitigate those impacts.

3.5.4.6 El Camino Real de Tierra Adentro National Historic Trail

The following information on the description, history, and significance of El Camino Real is based on the Comprehensive Management Plan and Environmental Impact Statement (NPS and BLM, 2004a) prepared by the BLM and NPS in compliance with mandates by the National Trails System Act (16 U.S.C. 1241).

Description

El Camino Real de Tierra Adentro (Royal Road of the Interior) is an international road established by the Spanish in the 1500s to link Mexico City (the capital of New Spain) with San Juan Pueblo, the first Spanish Colonial capital in what was to become New Mexico. It was part of a network of royal roads throughout New Spain that connected the Spanish capitals. When Mexican independence was achieved, the route ceased to be a royal road; however, it remained in use as Mexican and Indian travelers, traders, settlers, soldiers, clergymen, and eventually Anglo-American merchants continued their activities along it.

The portion of El Camino Real located in the United States has been designated as a NHT. The NHT generally follows the Rio Grande north from what is now El Paso, Texas, to San Juan Pueblo (located north of Santa Fe). The route between San Juan Pueblo and El Paso is 404 miles. However, the total NHT mileage is 655 miles, which includes the 404-mile length of the route, plus the variant or alternative routes that parallel other segments. Although the general route of El Camino Real is clear and a number of specific locations associated with the Trail have been documented, in many areas the precise location of the Trail remains unknown. Historic activities, modern development, and natural processes of erosion and deposition have likely destroyed or obscured many Trail segments. In other areas, archaeological documentation is incomplete.

The setting of the NHT is considered an important component of the El Camino Real resource as a whole. Natural landmarks played an important role in guiding travelers who lived and worked along the road. The Rio Grande valley is the predominant feature associated with the NHT, as much of the route follows its course. However, one prominent portion of the road leaves the Rio Grande and traverses a desert basin east of the river, known as the Jornada del Muerto – "dead man's journey." This dry plain is defined by mountain ranges, including the Caballo Mountains and Fra Cristobal Mountains on the west and the San Andres Mountains to the east. Smaller features, such as Point of Rocks, Prisor Hill, and Black Hill, further define the location of the route. The proposed Spaceport America site is located in the Jornada del Muerto, northwest of Prisor Hill.

The Jornada del Muerto, stretching for almost 80 miles, is a north-south trending basin framed by mountains. It is defined by scrub vegetation, little firewood, and no permanent sources of water. Today it is a mostly undeveloped landscape that contains abundant evidence of its use as a traveling route. It retains a substantial amount of natural and cultural integrity of the past and suggests the scenery travelers experienced during the 300 years that the road was in use. The county roads, the railroad, bridges and trestles, powerlines, and ranch structures provide the few disruptions of the solitude and the feeling of the open vistas. The relative lack of development highlights the remoteness of the area that travelers may have experienced when traversing the valley. All of these characteristics comprise the setting of the route and contribute to the significance of this resource.

Historic Context

Don Juan de Oñate traveled the entire length of El Camino Real de Tierra Adentro within New Mexico for the first time in 1598. Oñate followed a patchwork of Indian trails over mountain passes and river crossings that facilitated passage through difficult topography and a complex range of Indian territories and societies. North of Las Cruces, Oñate and 60 horsemen left the slow-moving caravan and advanced north to select a settlement site; they traveled to San Juan Pueblo, following the Rio Grande for the entire route. Meanwhile, the caravan with its carts and wagons found a flatter route on the east side of the Caballo and Fra Cristobal Mountains. This route became known as the Jornada del Muerto. Nearly 80 miles long, the Jornada del Muerto segment terminated near San Marcial, where the route rejoined the river.

In the 1600s, caravans reached New Mexico every one to three years. The typical supply train likely consisted of about 30 wagons, each with two teams of oxen, and an escort of a company of soldiers. Herds of cattle, goats, sheep, and draft animals, along with smaller farm animals, further enlarged the road. Development along the road included mining, ranching, farming, and milling. In 1680, the Pueblo Revolt sent settlers scurrying south along the road to El Paso for 12 years. In 1692, Diego de Vargas led the Spanish Army along the road north to re-conquer the region and gain a foothold in Santa Fe.

In the 18th century, military installations were established along El Camino Real to bolster defenses against European rivals as well as resisting Indian groups. However, by the 1800s, Anglo-American, French, and British traders increasingly moved along the route taking advantage of the unwillingness of local authorities to control access. After Mexico gained its independence from Spain in 1821, the former El Camino Real, now a *camino nacional* (national road), expanded in importance as a trade route, linking to United States markets via the Santa Fe Trail from Missouri. In 1846, the road became an invasion route for U.S. troops heading into Mexico during the Mexican-American War. Despite the subsequent political changes, the commercial activities, cultural interactions, and communications on the road and across the new border never ceased. Some Civil War actions in New Mexico were fought at stopping-places along the former El Camino Real, including Valverde, Fort Craig, and Peralta. In the years after the War, the nature of commercial activities along the road changed. Supplying U.S. Army forts became one of the major sources of income for New Mexicans and the El Camino Real merchants came to depend on Federal government expenditures. In 1882, the railroad line was completed from Santa Fe to El Paso, leading to the decline of road-based transportation on El Camino Real.

Significance

El Camino Real is historically significant at a national level due to its role in exploration, colonization, settlement, economic development, military campaigns, and cultural exchange among Spanish, Anglo, and indigenous peoples in the southwest (NPS, 1996). The significance of El Camino Real is rooted in the dissemination of people, language, religion, science, medicine, foods, architecture, folklore, music, technology, and law along the road (NPS, 1996). It is tied to the history and development of two nations, and is a symbol of the cultural interaction between nations and ethnic groups (NPS, 1996). The period of significance for the road begins with Oñate's first journey on the route (1598) and ends with completion of the railroad to El Paso and the resulting decline in use of the road (1882) (NPS and BLM, 2004a; NPS, 1996).

The effect of El Camino Real on the natural and cultural environment of New Mexico was complex. Activities along El Camino Real had a major effect on the landscape through the introduction of the horse, European cattle, sheep, exotic flora, agriculture, mining, and other commercial enterprises, all of which contributed to altering the surroundings along the road (NPS, 1996). The road brought Spanish explorers and later settlers into contact with existing populations of indigenous Indian tribes and bands, and the legacy of this contact and acculturation exists today in the unique cultural heritage of New Mexico (NPS, 1996). El Camino Real has been described as the longest and most extensive archaeological site complex in New Mexico (NPS, 1996). It is considered a major archaeological resource that sheds light on significant periods of the history of New Mexico and the United States. The portion of the road that runs near the Project site is considered one of the most important remaining resources associated with El Camino Real (NPS, 1996).

Trail Management: NPS/BLM Comprehensive Management Plan

In October 2000, Congress added El Camino Real de Tierra Adentro NHT to the National Trails System. This system includes 17 national historic trails and eight national scenic trails across the country. According to the National Trails System Act, the purpose of the National Trails System is "to promote the preservation of, public access to, travel within, and enjoyment and appreciation of the open-air, outdoor areas and historic resources of the Nation" (16 U.S.C. 1241). "National historic trails shall have as their purpose the identification and protection of the historic route and its historic remnants and artifacts for public use and enjoyment," (16 U.S.C. 1242). The BLM and NPS, who are joint administrators of the NHT, developed a Comprehensive Management Plan (NPS and BLM, 2004a), which was adopted through a Final EIS and Record of Decision. The BLM also modified three Resource Management Plans to include the new management strategies related specifically to the NHT and trail-associated sites (NPS and BLM, 2004b).

The Comprehensive Management Plan describes a program that includes resource protection along with development of compatible visitor and recreational activities. The goals of the Plan are for a high-quality visitor experience, coordinated interpretation and education, effective administration, and active resource protection. Congress' NHT designation applies to the entire 655 miles of the NHT, regardless of land ownership. However, the NHT management policies in the Plan regarding resource protection and visitor experience apply only to designated protected components of the NHT and those portions belonging to certified preservation partners (see Exhibit 2-2).

The Plan designates certain resources along the NHT that best illustrate the Trail's significance, called high-potential historic sites and route segments. These two terms are defined in the National Trails System Act (16 U.S.C. 1251):

The term "high-potential historic sites" means those historic sites related to the route or sites in close proximity thereto, that provide opportunities to interpret the historic significance of the

NHT during the period of its major use. Criteria for consideration as high-potential sites include historic significance, presence of visible historic remnants, scenic quality, and relative freedom from intrusion (NPS and BLM, 2004a).

The term "high-potential route segments" means those segments of the NHT that would afford high quality recreation experience in a portion of the route having greater than average scenic values or affording an opportunity to vicariously share the experience of the original users of a historic route (NPS and BLM, 2004a).

Specific designations in the Plan that apply to NHT resources in the vicinity of the proposed Spaceport America site include:

- Designation of ten separate road segments and the crossing of Yost Draw as high-potential route segments within the Yost Draw Study Area; and
- Designation of Paraje del Alemán as a high-potential historic site (discussed in detail in Section 3.5.4.7).

Specific resource protection and visitation strategies described in the Plan that apply to the vicinity of the Spaceport America site include:

- Designation of areas on BLM-administered lands that are within 5 miles of high-potential sites and segments, or are in relatively undisturbed areas, as Visual Resource Management Class II. Five miles is considered the foreground/middle-ground visual zone. Class II is defined as retention of "the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape" (NPS and BLM, 2004a). Due to the presence of high-potential sites and segments adjacent to and near the proposed Project area, almost the entire proposed Spaceport America site is within the 5 mile radius of the Class II visual zone.
- Collaboration with other agencies and private landowners to maintain the natural and cultural landscapes along important route segments.
- Development of a pullout parking area at Yost Escarpment with a short foot-trail and interpretive signs to an overlook of the NHT wheel-ruts.
- Development of interpretive wayside exhibits for use at appropriate places along the NHT.

Trail Management: Historic Corridor Management Plan

El Camino Real Historic Corridor Management Plan for the Rio Abajo (NPS and BLM, 2004a) addresses the route between Los Lunas and Las Cruces, New Mexico, including the Jornada del Muerto. The plan makes recommendations for preserving and protecting the integrity and value of the NHT's qualities, with an emphasis on cooperation between the NHT administration and El Camino Real International Heritage Center.

El Camino Real NHT within the Project APEs

Extensive research was conducted of the NHT and its setting in the vicinity of the proposed Spaceport America Project site. This was due to the concerns about potential impacts to the NHT communicated to the FAA by Federal and State agencies, private preservation organizations, and members of the public. The research combined information from previous NHT studies, aerial photography, and extensive ground surveys and mapping using sub-meter accuracy Global Positioning System (GPS).

The proposed Spaceport America boundaries, encompassing approximately 26 square miles, would include high-potential route segment numbers 3 through 10, plus the Yost Draw Crossing route segment.

The Physical APE would include a portion of the high-potential route segment #10. Portions of the road are discernible on the ground within the Physical APE by altered topography and affected vegetation. There are also road-associated artifacts dating to the Spanish Colonial, U.S. Territorial, and later Historic Periods in the Physical APE, along both visible and non-visible portions of the road.

The entire Yost Draw Study Area portion of El Camino Real NHT is located within the Setting APE of the proposed Project. This portion of the NHT is 4.1 miles long and extends from the elevated plain above and south of the Yost Escarpment, north just past Aleman Draw. This study area includes ten high-potential route segments (numbered 1 through 10; all under archaeological site number LA 80070), plus two additional route segments, the Yost Escarpment route segment (LA 80052) and the Yost Draw Crossing route segment (LA 80054). The route in the study area is visible on aerial photographs. The segments, each measuring between 656 feet and 2,952 feet in length, have portions that are discernible on the ground through the presence of altered topography, affected vegetation growth, artifacts, and earthen features such as ramps. Also present in the Yost Draw Study Area are multiple sites associated with the NHT. These include the high-potential historic site Paraje del Alemán at the north end (see discussion in Section 3.5.4.7 below), and multiple locations that contain prehistoric and historic artifact scatters.

Multiple aspects of El Camino Real within the study area embody the significance and integrity of the resource. There are three types of significant historic features of El Camino Real in the Project area: the road itself, the associated sites and resources along the road, and the setting of the road. All of these features, when taken together, contribute to the significance of the road.

The actual road remnants are visible through depressed tracks, swales, and changes in vegetation. Much of the road can be traced through study of aerial photography. The routes demonstrate the considerations for location that had to be made by the travelers on the road, especially when accommodating things like ox-drawn carts and hundreds of farm animals. Multiple parallel segments in certain areas highlight the changing demands made on the road, especially as traffic increased and the types of users changed. Ramps and other engineered features along the road show how the travelers applied their ingenuity to the challenges that had to be met in an area of varied, and often changing, topography. All of these features of the road can be found in the Spaceport America APEs.

Artifact scatters, campsites, and architecture have been recorded along the road within the Spaceport America APEs. These sites contribute to the known history and interpretation of the road and the lives of the people who used the road. Some of these sites are prehistoric in age, and may indicate that the route used by the Spanish and later travelers actually followed, in places, existing prehistoric Native American trails (NPS and BLM, 2004a; NPS, 1996). These prehistoric sites also tell us about these very early travelers. Later artifacts and campsites provide evidence of the types of items that were considered important enough to be carried by the travelers and may shed light on what the travelers planned to do when they arrived at their destination. More permanent architecture along the road, such as the Aleman Ranch Complex (discussed in detail in Section 3.5.4.7), is tangible evidence of the impact the road had on New Mexico and the Project region, eventually leading to its economic development in agriculture. The fact that water was available here and Aleman became a regular stopping point along the road led to the eventual development of a permanent water source (John Martin's well), construction of a boarding house, development of a ranch that is still in operation today, and use as a post office and telegraph office. The water source eventually drew the railroad to the area, which ultimately caused the demise of the road as the main mode of travel.

The setting surrounding the road through this part of the Jornada del Muerto has retained enough of its integrity that it contributes to the significance of the road as an important cultural resource and contributes to the interpretation of the road by visitors (NPS, 1996). Although not pristine, the setting still retains a sense of remoteness, both through the relative lack of major visual intrusions and through the quiet environment. This feeling of remoteness may help the visitor 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.

3.5.4.7 Aleman Draw Historic District

The text in this section is based on information in the cultural resource inventory reports prepared for the proposed Spaceport America Project (Zia EEC, 2007d, 2008a, and 2008b).

Historic Context and Significance

Don Juan de Oñate and subsequent Spanish travelers created parajes, or campsites, along El Camino Real. Paraje del Alemán, also known as La Cruz del Alemán, was one of these campsites and was situated at about the midpoint of the Jornada del Muerto portion of El Camino Real. The name is thought to refer to Bernardo Gruber, a German trader from Sonora, who was arrested by the Holy Office of the Inquisition in New Mexico and faced charges of superstition or magic. He escaped from prison north of Albuquerque and fled south on El Camino Real with his Apache servant, Atanasio. Having reached the heart of the Jornada del Muerto and being without water, Atanasio rode to the next paraje to get water. When he returned, Gruber was nowhere to be found. Weeks later, remains thought to be Gruber's were found by accident at the location that became Paraje del Alemán (Alemán means "German" in Spanish).

Numerous references to Paraje del Alemán are in the historical records. It was used in the 1682 retreat of the New Mexico Governor Antonio de Otermin. In 1766, military engineer and mapmaker Nicholas de Lafora mentioned the paraje in his writings. Trader Josiah Gregg refers to Paraje del Alemán in his 1844 book Commerce of the Prairies. During the Mexican-American War, Colonel Doniphan and his troops stopped at Alemán on their way to Chihuahua.

As use of El Camino Real expanded during the Territorial Period, so did use of Paraje del Alemán. Stagecoaches began stopping at Alemán as early as 1852 and continued to stop until the railroad was completed in 1882. In 1867, a Union soldier named John Martin, who was familiar with El Camino Real from serving for two years as a military escort, dug an artesian well at the Alemán site and provided the first reliable water source in the Jornada del Muerto. He was honored for this feat by newspapers and the New Mexico legislature, who passed a law exempting Martin from the payment of territorial or county taxes on his business ventures at Alemán. He established his ranch, named The Aleman, with 200 head of cattle. He also built a hotel, stagecoach station, government forage agency, and a post office. Travelers described it as an oasis in the desert. Fort Selden established an outpost of the 3rd Cavalry at "Aleman Station" to protect the ranch and travelers. An 1877 newspaper article mentions that the stop had by that time two wells, reservoirs for catching rainwater, and was about to get a telegraph office. In 1880, the Aleman Ranch played a part in the hunt for the Apache leader Vittorio. After outsmarting three U.S. Army units in the San Andres Mountains, Vittorio brought his people to the Aleman Ranch to drink and water their horses before going south.

Aleman Station became a stop on the Atkinson, Topeka and Santa Fe Railroad line in the year 1880. In 1880 and 1881, troops from Fort Selden were housed at Aleman Station to protect the railroad construction crews. Around 1882, the function of the ranch became less for travelers, as use of El Camino Real slowed with the presence of the railroad, and Aleman became primarily a cattle operation. The ranch was bought in 1882 and Aleman became part of the Bar Cross Ranch holdings. The Bar Cross brand would maintain longevity over the next 30 years, though the ownership and the boundaries of the Aleman Ranch would change. Postal service was revived at Aleman in 1884 and was finally retired in 1889.

The CCC established a side camp at Aleman in 1937. This was a temporary camp with tents and wooden buildings that would be removed after the planned projects were completed. This camp focused on erosion control measures on nearby arroyos. The ranch was bought and sold many times over the years, but always maintained its function as a working ranch. The current owners and residents of the Aleman Ranch bought the property in 1954.

The Aleman Ranch is considered significant for its historic functions as a paraje, stagecoach stop, military outpost, post office, telegraph office, and railroad stop. It is also considered significant for its association with El Camino Real, the first artesian well in the Jornada del Muerto, and its ongoing ranching heritage in the region. The period of significance extends from 1670 to the present (Zia, 2007d).

<u>Aleman Draw Historic District within the Project APEs</u>

The Aleman Draw Historic District includes four individual properties that together illustrate the District's significance. The District is considered eligible for listing on the NRHP, and the four properties all contribute to the District's eligibility. In addition, each of the four properties is considered NRHP-eligible for listing as an individual property. The individual properties include:

- LA 8871 (Aleman Ranch Complex) – this property includes the main ranch house/headquarters and a number of associated buildings and structures; the CCC Camp with its buildings, windmills, water tanks, sidewalks, wall alignments, and foundations; an historic concrete water pipeline; historic trash scatters; and prehistoric archaeological scatters of artifacts and features.
- LA 80070 – this is High Potential Road Segment #10 of the Yost Draw Study Area of El Camino Real de Tierra Adentro NHT, and includes physical traces of the road, associated

artifacts, and a possible engineered road ramp leading down the south bank of Aleman Draw.

- LA 51205 – this is a scatter of prehistoric artifacts and historic artifact concentrations that are associated with the historic railroad siding at Aleman.
- LA 155962 – this is a scatter of prehistoric artifacts and features, and historic artifacts, representing use of the area from the Late Archaic Period through historic 1900s ranching, including Spanish Colonial use of El Camino Real (LA 80070), which extends through this site.

The District includes a portion of El Camino Real and is tied to the road throughout history, thus the historic features of the District are similar to those of El Camino Real. The artifacts, features, and buildings of these four properties contribute to the known history of this area and the people who have passed through or inhabited the District. The use of this area is tied to the presence of water and transportation routes, from prehistoric through historic times. The fact that water was available here and Paraje del Aleman became a regular stopping point along the road led to the eventual development of a permanent water source (John Martin's well), construction of a boarding house, development of a ranch that is still in operation today, and use as a post office and telegraph office. The water source eventually drew the railroad to the area. These properties and their historic features demonstrate the continued and varied use of this particular location. As with El Camino Real, the remote setting surrounding these properties is also considered an important feature of the District, contributing to the significance and interpretation of the four individual properties as well as the District.

The Spaceport America boundary, encompassing approximately 26 square miles, cuts through the District. The boundary would contain only a small portion of the Aleman Draw Historic District, specifically the southern portion of LA 51205, the southern portion of Road Segment #10 of LA 80070, and the eastern portion of LA 8871.

In the area of the District, the Physical APE is a corridor that runs through all four properties. Thus portions of all four properties that make up the Aleman Draw Historic District are located within the Physical APE. This part of the Physical APE includes historic water tanks, trash dumps, and drainage features associated with ranching, prehistoric and historic artifacts, hearth or cooking features, and visible traces of El Camino Real with associated artifacts and possibly a ramp on the south bank of Aleman Draw. No buildings or other structural features of the current working ranch headquarters are encompassed in the Physical APE corridor.

The entire Aleman Draw Historic District is located within the Setting APE of the proposed Project.

3.6 Air Quality

3.6.1 Definition and Description

The Earth's atmosphere consists of four main layers (i.e., troposphere, stratosphere, mesosphere, and ionosphere) that are 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). The characteristics of each layer are summarized below.

Troposphere: The troposphere is the lowest level of the atmosphere. It extends from the surface of the Earth to between 5 and 10 miles. While not the largest section of the atmosphere, the troposphere is the densest layer and represents about 75 percent of the atmosphere's mass. Troposphere gases are mainly molecular nitrogen (N_2), which constitutes 78 percent, and molecular oxygen (O_2), which constitutes 21 percent. Other trace gases such as argon (Ar), carbon dioxide (CO_2), methane (CH_4), nitrogen dioxide (NO_2), water (H_2O), and ozone (O_3) are also present in the troposphere. Due to the rotation of the Earth and the available moisture in the troposphere, this is the layer of the atmosphere where weather phenomena occur and climate patterns are experienced (FAA, 2005).

For the purposes of this EIS, the discussion of air quality within the lower troposphere presents the conditions that occur at or below 3,000 feet above ground surface (AGL), which the EPA accepts as the nominal height of the atmosphere mixing layer in assessing contributions of emissions to ground-level ambient air quality under the Clean Air Act (CAA) (EPA, 1992b).

Although launch vehicle emissions from operations at or above 3,000 feet AGL would occur, these emissions would not result in appreciable ground-level concentrations. The mixing layer (sometimes referred to as the boundary layer) is the layer of air directly above the Earth that is relatively well mixed. This layer extends to a height referred to as the mixing height, above which the free troposphere extends up to the tropopause. Typically, temperature and density decrease with altitude in the atmosphere up to the mixing height. However, at the mixing height, the temperature begins to increase with altitude and creates an inversion which prevents a parcel of air from spontaneously rising past the mixing height. Furthermore, since substances in the free troposphere above the mixing height tend to remain in the free troposphere rather than sink through the inversion layer into the mixing layer (due to the temperature and density trends) a parcel of air above the mixing height will spontaneously rise rather than fall with a decrease in temperature and density (Visconti, 2001).

Stratosphere: The stratosphere is the second major layer of the atmosphere and occupies the region from 6 to 31 miles above the Earth's surface. The stratosphere contains 90 percent of the O_3 and includes the area known as the ozone layer, which is located between 12 to 19 miles above the Earth. Stratospheric ozone shields the Earth from harmful levels of ultraviolet (UV) radiation by absorbing part 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. (Note that 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.)

The two potential air quality impacts of concern in the stratosphere are ozone depletion and climate change. These potential impacts are discussed further in Sections 3.6.2.6 and 3.6.2.7.

Mesosphere: The mesosphere is located between 31 and 50 miles above the Earth. The mesosphere is the coldest layer of the atmosphere, and the temperature in this region decreases as altitude increases. The air composition in this layer includes lighter gases that are stratified according to their molecular weight due to gravitational separation (FAA, 2005).

Ionosphere: The ionosphere (also known as the thermosphere) is located above the mesosphere and begins between 50 and 65 miles above the Earth and extends to around 1,243 miles, although the upper boundary of this region is not well-defined. The ionosphere accounts for only a small mass fraction of the atmosphere because gas molecules in this layer are extremely sparse. This portion of the atmosphere is known as the ionosphere because radiation causes the scattered gas molecules in this layer to become electrically charged (i.e., they become ions). The ionosphere is of practical importance because it is what enables long-distance radio communications on Earth, as the radio waves reflect off the ionosphere (FAA, 2005). The ionosphere would be reached by suborbital LVs.

3.6.2 Regulatory Setting

Ambient air quality is determined by the concentrations of air pollutants. The impact of exposure to these contaminants is a function of the pollutant involved, the pollutant concentrations, and the exposure duration. State and National Ambient Air Quality Standards (NAAQS) provide the comparative metrics to determine air quality. These standards represent the allowable pollutant concentrations at which public health and welfare are protected with a reasonable margin of safety.

The primary Federal legislation that addresses air quality is the CAA. Under the authority of the CAA and the CAA amendments, the EPA established a set of NAAQS for criteria pollutants: carbon monoxide (CO), NO_2, O_3, Particulate Matter (PM) with diameter 10 microns or less (PM_{10}) and 2.5 microns or less ($PM_{2.5}$), sulfur dioxide (SO_2), and lead (Pb). The NAAQS established "primary" standards to protect public health and "secondary" standards designed to protect the public welfare (i.e., the effects of air pollution on vegetation, soil, materials, visibility, etc.). In addition to the NAAQS, the CAA also authorizes EPA to regulate emissions of hazardous air pollutants (HAPs), also known as toxic air pollutants or air toxics. HAPs are pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects, birth defects, or adverse environmental and ecological effects.

3.6.2.1 Criteria Pollutants

Regulatory thresholds for criteria pollutants were selected based on years of research on the health effects of various concentrations of pollutants on biological organisms, as well as other potential impacts on the environment. The State of New Mexico Environment Department (NMED) implements and enforces the NAAQS. In addition to the criteria pollutants covered by the NAAQS, New Mexico has promulgated ambient air quality standards for total suspended particulate (TSP), hydrogen sulfide (H_2S), total reduced sulfur, and a 24-hour NO_2 standard. The State of New Mexico air quality regulations are provided in the NMAC Title 20, Chapter 2. National and New Mexico ambient air quality standards are shown in Exhibit 3.6-1.

The ambient concentrations of criteria pollutants are compared with the NAAQS to determine ambient air quality. The EPA applies several designations to characterize ambient air quality of a particular region and to establish a basis for regulatory review. An area that consistently demonstrates compliance with the NAAQS is designated as attainment. An area that fails to demonstrate compliance with the NAAQS is designated as nonattainment. Areas that were once nonattainment but later showed consistent compliance with the NAAQS are designated as maintenance areas. Areas where insufficient data are available to make an attainment status designation are designated as unclassifiable. Unclassifiable areas are treated as attainment areas for regulatory purposes.

The proposed Project would be located in Sierra County, which is designated as unclassifiable or attainment for all criteria pollutants.

Exhibit 3.6-1. National and New Mexico Ambient Air Quality Standards

Pollutant	National Primary Standard	National Secondary Standard	New Mexico Standard
Particulate matter (PM_{10})			
24-hour average	150 µg/m^3 [a]	150 µg/m^3	none
Particulate matter ($PM_{2.5}$)			
24-hour average	35 µg/m^3	35 µg/m^3	none
Annual mean[2]	15 µg/m^3	15 µg/m^3	none
Particulate Matter (TSP)			
24-hour average	none	none	150 µg/m^3
7-day average	none	none	110 µg/m^3
30-day average	none	none	90 µg/m^3
Annual geometric mean	none	none	60 µg/m^3
Sulfur dioxide (SO_2)			
Annual arithmetic mean	0.03 ppm	none	0.02 ppm
24-hour average	0.14 ppm[b]	none	0.10 ppm
3-hour average	none	0.50 ppm	none
Hydrogen Sulfide (H_2S)			
1-hr average	none	none	0.010 ppm
Total Reduced Sulfur			
1/2-hour average	none	none	0.003 ppm
Carbon monoxide (CO)			
8-hour average	9.0 ppm	none	8.7 ppm
1-hour average	35.0 ppm	none	13.1 ppm
Ozone (O_3) [c]			
8-hour average	0.08 ppm	0.08 ppm	none
Nitrogen dioxide (NO_2)			
24-hour average	none	none	0.10 ppm
Annual arithmetic mean	0.053 ppm	0.053 ppm	0.05 ppm
Lead (Pb)			
3-month average	1.5 µg/m^3	1.5 µg/m^3	none

Source: 40 CFR Part 50, 40 CFR Part 51, and 20.2.3 NMAC
[a] µg/m3 – micrograms per cubic meter
[b] ppm – parts per million by volume
[c] For New Mexico, the term "photochemical oxidants" is used rather than "ozone."

3.6.2.2 HAPs

In addition to criteria pollutants, the proposed Spaceport America will generate small amounts of HAPs. The EPA has developed National Emission Standards for hazardous air pollutants (i.e., NESHAP) for numerous source categories. However, the proposed facility will not involve any of the source categories for which NESHAPs have been proposed or promulgated under the provisions of the CAA.

The CAA amendments of 1990 established a new and fairly complex program to regulate emissions of 188 hazardous air pollutants from particular industrial sources. The amendments required the EPA to regulate emissions of these HAPs by developing and promulgating technology-based standards. New sources are subject to these requirements if they have the potential to emit HAPs in "major" amounts (i.e., 10 tons or more of an individual pollutant or 25 tons or more of a combination of pollutants). Two HAPs, hydrogen chloride (HCl) and chlorine (Cl_2) are sometimes components of rocket engine emissions, depending on the propellant type. In addition, 20.2.72.400-502 NMAC includes "aluminum metal & oxide" in its list of toxic air pollutants. Aluminum oxide (Al_2O_3) can also be a component of rocket engine emissions, depending on the propellant type.

3.6.2.3 New Source Review

New Source Review (NSR) requires stationary sources of criteria air pollutants to apply for a preconstruction air emissions permit and submit to certain preconstruction review requirements and mitigation. These preconstruction review regulations for new sources fall under two major programs: Prevention of Significant Deterioration (PSD) provisions for new major sources or a major modification to an existing major source in an attainment area; and nonattainment area provisions. The nonattainment area provisions do not apply to the proposed Project since the facility would be located in an attainment area for all criteria pollutants.

PSD requirements apply to major stationary sources. The CAA specifies 28 categories of stationary sources which are considered major sources if they emit or have potential to emit 100 tons per year or more of any pollutant subject to CAA 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 CAA is considered a major source and is subject to PSD requirements. In addition, PSD regulations identify specific pollutant emission rates to be significant if they exceed 40 tons per year for NO_2, SO_2, or volatile organic compounds (VOC); 100 tons per year for CO; or 15 tons per year for PM_{10}. As shown in Exhibit 2-4, the proposed Spaceport America facilities do not include any major stationary sources, so the PSD requirements do not apply to the proposed Project.

3.6.2.4 Regional Haze

The CAA requires a visibility analysis to evaluate impacts to each Class I area located within 62 miles of any new or modified major stationary source, in an attainment or nonattainment area, whose emissions exceeds PSD significant ground-level concentrations. Within New Mexico there are nine Class I areas: Carlsbad Caverns National Park; Bandelier National Monument; Bosque del Apache National Wildlife Refuge; the Gila, Pecos, Salt Creek, and San Pedro Parks; and the Wheeler Peak and White Mountain Wilderness Areas (40 CFR 81.421). Since the nearest Class I area to Spaceport America would be Bosque del Apache Wildlife Refuge, located about 66 miles from the proposed Project site, a visibility analysis is not needed.

3.6.2.5 General Conformity

The General Conformity Rule, promulgated by the EPA at 40 CFR Parts 51 and 93, requires that the Federal government may not engage, support, or provide financial assistance for permit or license, or approve any activity that fails to conform to the State Implementation Plan (SIP). To that end, a General Conformity Evaluation is a review process designed to ensure that Federal plans, programs, and projects are consistent with the SIP and the local clean air plan, and that they not contribute to air quality degradation that would adversely affect State efforts to attain or maintain the NAAQS. The EPA-approved SIP for New Mexico is described in 40 CFR 52, Subpart GG. Currently, the General Conformity Rule applies to all Federal Actions that are taken in nonattainment and maintenance areas (EPA, 2007c). As discussed in Section 3.6.2.1, the proposed Project would be located in an attainment area; therefore a general conformity evaluation is not required.

3.6.2.6 Stratospheric Ozone

The stratospheric O_3 layer protects the Earth from harmful ultraviolet radiation. O_3 is continually created and destroyed by natural photochemical processes. The concentration of ozone fluctuates both seasonally (by 25 percent) and annually (by 1 to 2 percent). O_3 is a molecule of three oxygen atoms and is generated by the action of sunlight to combine an oxygen molecule with an atom of oxygen. Atomic oxygen is produced by photolysis, or the use of radiant energy to produce chemical changes, of molecules of oxygen and nitrogen dioxide. Compounds that contain chlorine, fluorine, hydrogen, nitrogen, and others can deplete O_3. Aluminum oxide particulates and soot may also provide a reaction surface for the destruction of O_3. NO_2 functions as an important catalyst for O_3 destruction in the stratosphere (FAA, 2005). As the O_3 layer is depleted, more ultraviolet radiation can penetrate, resulting in potential health and environmental harm, including higher rates of certain skin cancers and cataracts, suppression of the immune system, damage to crops and aquatic organisms, and increased formation of ground-level O_3. Due to growing concerns on ozone depletion and ozone-depleting substances (ODS), leaders from many countries signed the *Montreal Protocol on Substances that Deplete the Ozone Layer* in 1987. The Montreal Protocol established legally binding controls on the national production and consumption of ODS (EPA, 2007d). To implement the Montreal Protocol in the United States, the U.S. Congress amended the CAA in 1990. The 1990 amendments address the protection of stratospheric ozone through a phase out of the production and sale of stratospheric ozone-depleting substances such as chlorofluorocarbons (CFCs).

3.6.2.7 Climate Change

The possibility of global climate change due to the increased introduction of greenhouse gases into the atmosphere through human activity is a widely publicized, global issue with potential major long-term implications for global climate and ecosystems. Common greenhouse gases include CO_2, CFCs, methane (CH_4), and nitrous oxide. No specific regulatory standards for climate change exist. Various international treaties and agreements have been developed. The U.S. is a party of the United Nations Framework Convention on Climate Change.

3.6.3 Region of Influence

The ROI for air quality includes the region around the proposed site potentially affected by air pollutant emissions caused by the Proposed Action and Alternatives. The area of the ROI depends on emission source characteristics, pollutant types, emission rates, and meteorological and topographical conditions. For the air quality analyses, impacts were evaluated at the site boundary.

3.6.4 Existing Conditions

3.6.4.1 Climate and Meteorology

The proposed Spaceport America Launch Site is located 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. The climate of this region is characterized by an extended summer season and a mild fall and winter. Data from the nearby Aleman Ranch meteorological tower from 1971 to

2000 shows the normal daily temperatures range from 23.7 to 54.9 degrees Fahrenheit in January to 62.5 to 92.6 degrees Fahrenheit in July (NCDC, 2003).

New Mexico has plenty of sunshine throughout the year – it receives 75 to 80 percent of the sunshine potential. This is particularly noticeable in winter, during which the State receives 70 to 75 percent of the potential sunshine (NCDC, 2005).

Average precipitation in the region is about 11.3 inches. Measurable precipitation occurs on an average of 46 days per year. Only 6 days each year receive more than 0.5 inches. More than half of the total annual precipitation occurs between July and October, on average, and the lowest totals generally occur in March and April. The region receives about 5.9 inches of snowfall annually, mostly in January and February (NCDC, 2005).

Wind speeds in the region are usually moderate, although relatively strong winds may accompany occasional frontal activities that occur in late winter and spring when thunderstorms form. When these storms appear, frontal winds may exceed 30 miles per hour for several hours, and can occasionally exceed 50 miles per hour. The average annual wind speed in the region is about 8.4 miles per hour, with monthly totals that range from a low of 7.1 miles per hour in December to a high of 10.5 miles per hour in April (NCDC, 2005).

Winds contribute to soil erosion and fugitive dust, especially during dry spells. In response to nonattainment PM_{10} levels in Doña Ana County (primarily due to fugitive dust), the NMED's Air Quality Bureau implemented a Natural Events Action Plan (NEAP) to address violations of the PM_{10} standard caused by natural high wind events (NMED, 2000). The NEAP is designed to mitigate health impacts from man-made sources of windblown dust where natural soils have been disturbed by human activities. The NEAP includes erosion control ordinances for the City of Las Cruces (Ordinance No. 1789) and Doña Ana County (Ordinance No. 194-2000). These ordinances stipulate that all ground-disturbing activities in jurisdictions subject to the ordinances use erosion control measures to mitigate visible fugitive dust.

3.6.4.2 Occurrence of Hazardous Weather Conditions

On rare occasions, a tropical hurricane may cause heavy rain in the central New Mexico region, but there is no record of serious wind damage from this type of event. Although relatively rare in Sierra County, tornadoes may develop occasionally and are most likely to occur in May through August. In the spring and summer months, thunderstorms accompanied by heavy rainfall and hail are occasionally observed. Minor localized floods may also occur during these storms (NCDC, 2005).

3.6.4.3 Site Air Quality

The proposed Spaceport America site is located in Sierra County. The northern boundary of Doña Ana County is about 9 miles south of the nearest Spaceport America facility (the vertical launch complex). Both counties are within the El Paso-Las Cruces-Alamogordo Interstate Air Quality Control Region (AQCR 153). All air quality impacts of the Project would be contained within and above Sierra County.

The New Mexico Environmental Department (NMED) concentrates its air quality monitoring efforts in geographical areas of the State that are most likely to challenge an air quality standard. Few stationary emission sources are located in the region of the proposed Spaceport America. Most emissions would come from mobile and natural sources such as:

- Motor vehicles (engine emissions and fugitive dust from unpaved roads);
- Rail traffic (engine emissions); and
- Wind (natural particulates).

The area of the proposed Spaceport America is in attainment of Federal and New Mexico Ambient Air Quality Standards. There is one Federal and New Mexico nonattainment area within AQCR 153 and one maintenance area within the adjacent Arizona-New Mexico Southern Border Interstate Air Quality Control Region (AQCR 012) (40 CFR 81.332):

- The Anthony area, in southern Doña Ana County, about 70 miles south of the proposed Spaceport America, is in nonattainment for the PM_{10} standard (respirable particulate matter). Nonattainment is thought to result primarily from non-anthropogenic sources and heavy traffic on unpaved roads in the area.
- A portion of Grant County, in AQCR 012, about 70 miles west of the proposed Spaceport America, was in nonattainment for SO_2. This was the result of copper smelting operations in Hurley, NM. The area was redesignated as a maintenance area for SO_2 on November 17, 2003 (68 FR 54672).

It is highly unlikely that any of the above sources would result in nonattainment of criteria pollutant standards at the proposed Spaceport America. In the proposed Spaceport America area, current vehicular traffic on unpaved roads is as low as 20 vehicles per day. The BNSF railroad line is about 2.55 miles west of the proposed Spaceport America, and paved roads that carry major traffic (including I-25) are about 18 miles to the west. These sources produce highly dispersed pollutants. Wind normally causes the release of large quantities of particulates only from highly disturbed land surfaces such as agricultural fields and unpaved roads. The NMED has not found it necessary to operate an air monitor near the proposed Spaceport America. The closest stations are in the Las Cruces area, about 40 miles south of the proposed site (NMED, 2006).

3.7 Water Quality, Wetlands, Wild and Scenic Rivers, Coastal Resources, and Floodplains

Each of the water types indicated in the title of this section is discussed for Spaceport America in the first sub-section below. Subsequent sub-sections discuss only the water types that are in the vicinity of, and therefore have the potential to be impacted by, the Proposed Action or alternatives.

3.7.1 Definition and Description

Water resources include freshwater, wetlands, wild and scenic rivers, coastal resources, floodplains, and ground water. No coastal resources, perennial surface watercourses, or wetlands exist in the Jornada del Muerto Basin in the vicinity of Spaceport America (Zia, 2007a). There are no river segments eligible for inclusion in the National Wild and Scenic River System in Sierra County (NPS, 2007). The water resources to be considered in this EIS are those related to ephemeral surface water (such as arroyos, draws, and other drainages that contain water only during and after precipitation events), floodplains, and ground water.

3.7.1.1 Surface Water and Floodplains

Floodplains consist of the low-lying areas adjacent to rivers and streams that are subject to natural inundations typically associated with precipitation. A 100-year floodplain represents the area that would be subject to storm water runoff sheet flow from a precipitation event that would be expected to occur once every 100 years. The most common regulatory definition concerning such an area is Special Flood Hazard Area (SFHA), which has been established for most U.S. rivers and streams by the Federal Emergency Management Agency (FEMA). By FEMA standards, a 100-year flood is a flood that has a one percent chance of being reached or exceeded in any given year.

3.7.1.2 Ground Water

Ground water is defined by the New Mexico Water Quality Control Commission as "interstitial water which occurs in saturated earth material and which is capable of entering a well in sufficient amounts to be utilized as a water supply" (New Mexico Statutes Annotated, 1978).

3.7.2 Regulatory Setting

3.7.2.1 Surface Water and Floodplains

Development, including federally funded or federally assisted projects that occur within a floodplain, must comply with local floodplain management ordinances, which are based on FEMA National Flood Insurance Program (NFIP) requirements.

The Clean Water Act regulates discharges to surface water and effects to surface water quality through Sections 402 and 404 of the Act. The National Pollutant Discharge Elimination System storm water program, as authorized in Section 402 of the Clean Water Act, controls water pollution by regulating storm water discharges of pollutants into waters of the United States. The U.S. EPA regulates the storm water permitting program in New Mexico, with assistance from the Surface Water Quality Bureau of the New Mexico Environment Department. Prior to any construction activities taking place, NMSA would consult with the EPA and the Surface Water Quality Bureau regarding proposed construction activities, prepare a Storm Water Pollution Prevention Plan, and acquire any necessary permits.

The purpose of the Section 404 program is to ensure that the physical, biological, and chemical quality of U.S. waters is protected from unregulated discharges of dredged or fill material that could permanently alter or destroy these valuable resources. The U.S. Army Corps of Engineers (USACE) regulates the Section 404 program. The FAA initiated consultation with the USACE Albuquerque District under Section 404. Because the Project site is located within a closed basin, the USACE has determined that the Spaceport America site contains isolated waters that are not jurisdictional waters of the United States. The USACE concluded, "the discharge of dredged or fill material into these waters will not require authorization under Section 404 of the Clean Water Act" (USACE, 2007).

3.7.2.2 Ground Water

New Mexico, which administers the Clean Water and Safe Drinking Water Acts, relies on several programs to protect and maintain ground water quality. These include programs established under the New Mexico Water Quality Act (§ 74-6-1 et seq., New Mexico Statutes Annotated, 1978), the major statute dealing with water quality management at State level, as well as other programs and actions taken under other State law and regulations. In addition, the State cooperates with the Federal government on various ground water pollution control programs derived from Federal mandates. Counties and municipalities also have broad authorities relevant to ground water quality.

The New Mexico Office of the State Engineer (NMOSE) has authority under several New Mexico statutes (New Mexico Statutes Annotated, 1978) to control activities affecting ground water quality. The NMOSE issues permits and requires filing of a completion report under existing Rules and Regulations Governing the Drilling of Wells (D'Antonio, 2006). The Office also oversees the appropriation and use of ground water in New Mexico per the New Mexico Administrative Code.

3.7.3 Region of Influence

The region influenced by the Spaceport America includes the water resources located within the spaceport boundaries plus ground water resources from which construction and operations water uses would be drawn.

3.7.4 Existing Conditions

3.7.4.1 Surface Water and Floodplains

Surface Water

No perennial surface watercourses exist in the Jornada del Muerto Basin in the vicinity of the proposed Spaceport America. The primary surface drainage at the site is Jornada Draw (Exhibit 3.7-1), which flows south from the northeast to southeast corners of the site. Aleman and Yost Draws, which run across the central and southern parts of the proposed Spaceport America 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 proposed Spaceport America site until it drains into Flat Lake.

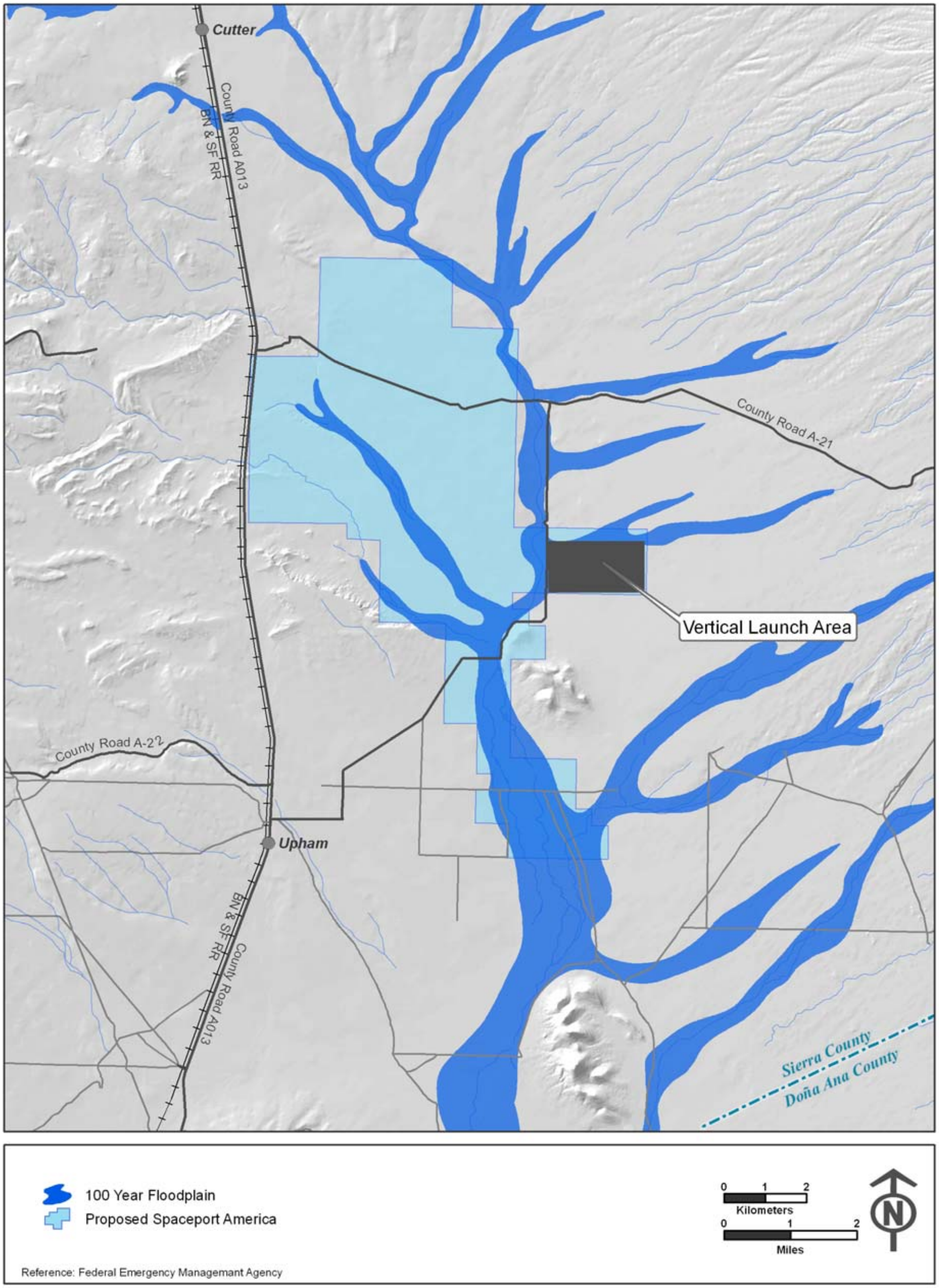
Floodplains

A 100-year floodplain, which represents the area that would be subject to storm water runoff sheet flow from a precipitation event that would be expected to occur once every 100 years. Portions of a 100-year floodplain are located in the proposed Project area, as designated by FEMA and the U.S. Army Corps of Engineers (see Exhibit 3.7-2). According to the National Oceanic and Atmospheric Administration (NOAA), 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 within the proposed Spaceport America region represents areas 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.

Exhibit 3.7-1. Photograph of Jornada Draw from the Northwest Base of Prisor Hill Looking North

Exhibit 3.7-2. 100-year Floodplain in the Proposed Spaceport America Vicinity



3.7.4.2 Ground Water Hydrology and Quality

Ground Water Hydrology

The proposed Spaceport America is located in the Lower Rio Grande Underground Water Basin.

The State of New Mexico considers Rio Grande water as fully appropriated. The proposed Spaceport America will therefore need to arrange (e.g., purchase) the transfer of water rights from existing rights holders (Shomaker, 2006).

The primary aquifer underlying the proposed Spaceport America site and vicinity occurs in near-surface unconsolidated alluvium and basin fill. Most ground water wells in the site area are completed in this alluvial aquifer. It has been suggested that the two formations underlying the alluvium, the Love Ranch and Palm Park, act as aquicludes (barriers to vertical water movement) with localized fracture intervals that can sustain significant yields (Shomaker, 2006).

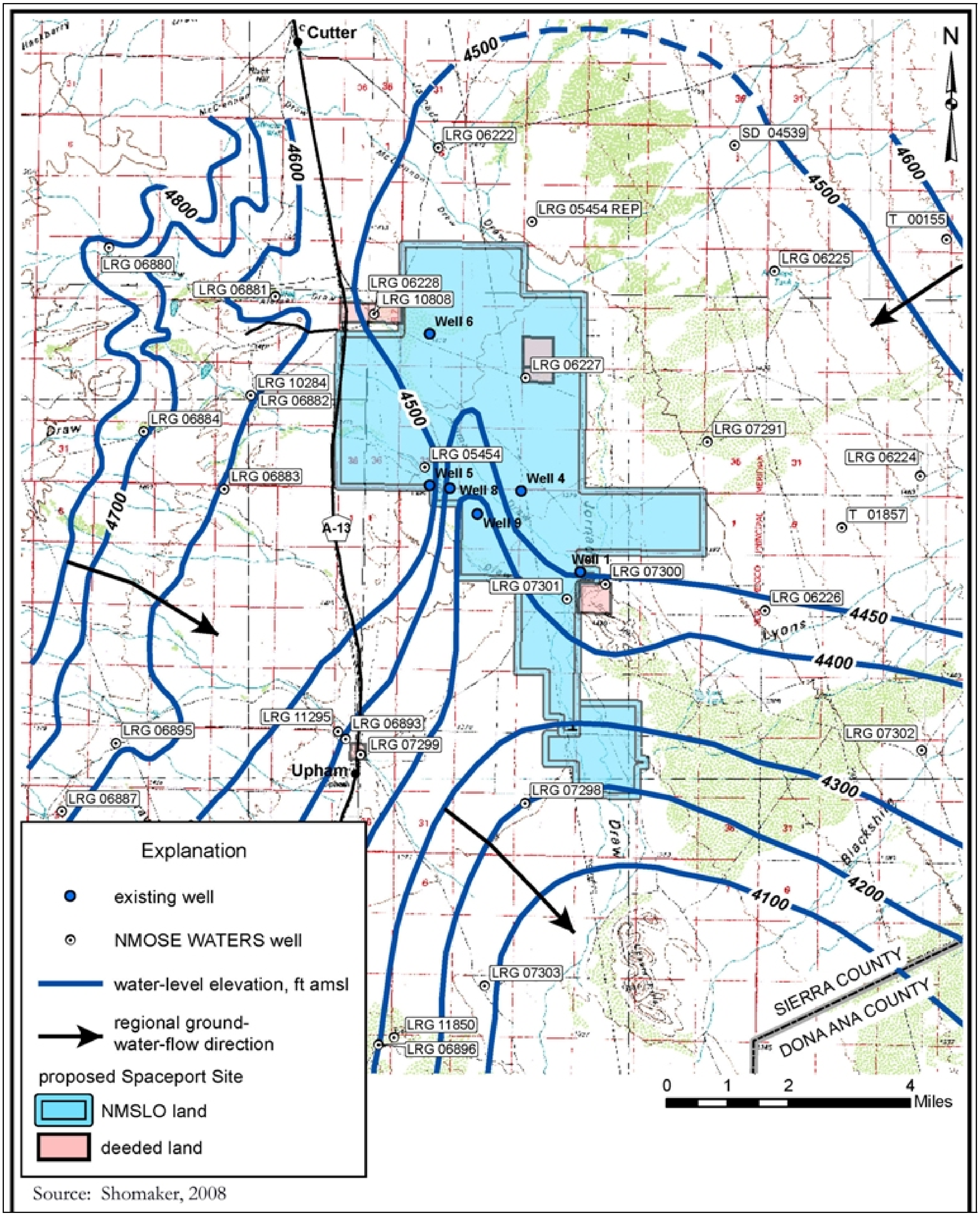
A pan evaporation rate is the rate at which water evaporates from a shallow pan which is typically about ten inches deep. Pan evaporation rates measured at two locations within 20 miles of the site to the west, the Caballo and Elephant Butte Dams, are greater than 100 inches per year; evaporation rates from shallow depressions or wet soils are 70 to 80 percent of the pan evaporation rate. Precipitation recharge is essentially zero over most of the Rio Grande Aquifer system because of the high evapotranspiration rates and small annual precipitation. Ground water recharge in the central Jornada Basin occurs primarily as a mountain-front recharge from the Caballo and San Andres Mountains. A recharge estimate for the entire Jornada Basin is about 5,200 acre-feet per year (Shomaker and Finch, 1996).

The State has water records of approximately 30 wells within about a 5-mile radius of the proposed Spaceport America (Exhibit 3.7-3). All of the wells are declared for domestic or stock use. Completion depths of the wells range from 60 to 800 feet below ground surface with a median of completion depth of 200 feet below ground surface. Depth to water in those wells range from 24 to 330 feet below ground surface with a median depth to ground water of 93 feet below ground surface. Historical water-level data for wells in or near the proposed Spaceport America site show that, except for one well along Yost Draw, there has been very little change in water levels over three decades (Shomaker, 2008).

Within the spaceport site, there are six declarations filed with the State for seven wells, five stock wells and two domestic wells. The nearest off-site wells to the site boundary are the southernmost well on a nearby ranch, 2 miles from the proposed Spaceport America site's northern boundary, and a well at the New Mexico State University Chihuahuan Desert Rangeland Research Center located more than 3 miles south of the spaceport's southern boundary (King et. al., 1996).

A ground water elevation contour map from Shomaker (2008) indicates that regional ground water flow in the Jornada Basin in the area of the proposed Spaceport America is from the west and east and then south towards Jornada Draw (Exhibit 3.7-3). This exhibit incorporates data not only from the State water record wells described above, but also from six water-test wells drilled at the site.

Exhibit 3.7-3. Ground Water Elevation Map of the Proposed Spaceport America and Vicinity



Source: Shomaker, 2008

In Appendix D, Exhibits D-3 and D-4 depict southwest-to-northeast and northwest-to-southeast geologic cross sections, respectively, across the Jornada del Muerto Basin. Exhibits D-3 and D-4 indicate that the depth to ground water in the primary alluvial aquifer near Spaceport America ranges upwards from about 100 feet along the eastern side of the proposed site. Exhibit 3.7-4 (Shomaker, 2008) depicts more recent information, incorporating data from the test wells. The exhibit indicates depth to ground water of 50 to 150 feet throughout most of the site with greater depths to ground water, up to approximately 300 feet, in the southernmost portion of the site.

The reported yields of the wells located within the 5-mile radius of the proposed Spaceport America ranged from 4 to 25 gallons per minute with a median well yield of ten gallons per minute. There is a general trend for wells west of Jornada Draw to have greater yields, and for wells on the piedmont on the San Andres Mountains to have deeper depths to water and lower yields.

Three wells (LG-10808, LRG-07300, and LRG-07301) located within the proposed Spaceport America site have reported yields of 20 to 25 gallons per minute (Shomaker, 2006). Spaceport test wells 4, 5, and 9 were tested at 18, 12, and 30 gallons per minute respectively (Shomaker, 2008).

Site-specific transmissivity found for test wells 4 and 9, both completed in the shallow alluvium, was 508 and 668 square feet per day (Shomaker, 2008), with specific capacities of 1.1 to 1.5 gallons per minute per foot of drawdown. Transmissivity from wells drawing from the fractured Love Ranch Formation were as low as 65 square feet per day (Well 5), suggesting that the alluvium is an order of magnitude more transmissive (i.e., transmits more water) than the underlying fractured formation. Locally, there may be significant fracture permeability. Ground water gradients are about 0.006 to the north of Prisor Hill and 0.016 to the south of Prisor Hill. Storativity is a measure of the volume of water contained in an aquifer and is expressed as an absolute number (volume of water in storage per unit surface area per unit head). Site soils storativity values range from 0.0001 to 0.01 (Shomaker, 2006).

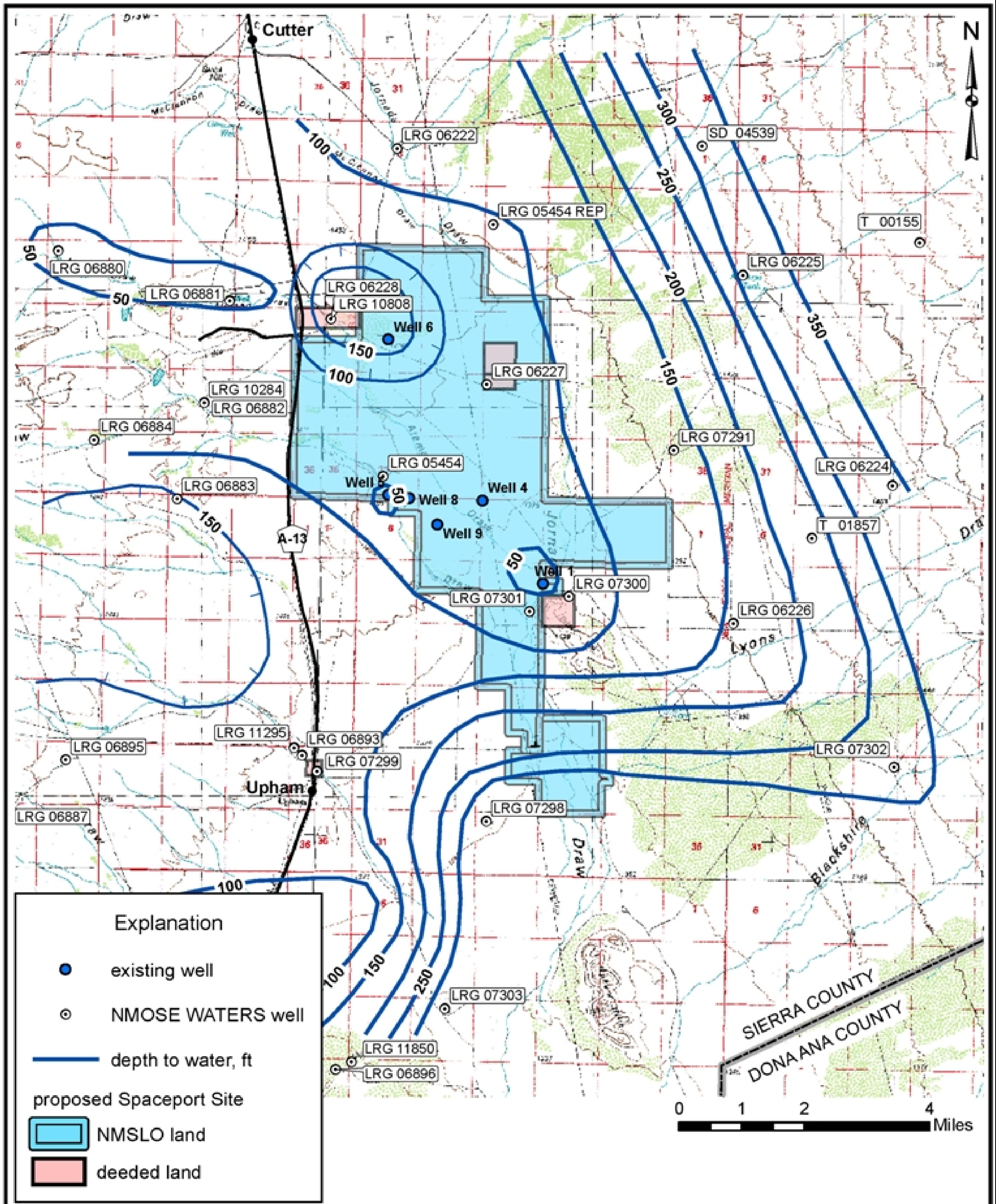
Few wells are completed in the Love Ranch and Palm Park Formations and all are reported to provide small quantities of water primarily for stock watering use. Based on the well data evaluated by Shomaker (2006, 2008), there appears to be ground water available in the alluvial aquifer and possibly in the underlying Bell Top and Love Ranch Formations for the proposed Spaceport America. A rough estimate of ground water stored in the alluvium is 45,000 acre-feet (Shomaker, 2006), which indicates an adequate volume for long-term supply at the proposed Spaceport America.

Ground Water Quality

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 ground water can migrate upward.

In May 2006, Shomaker (2006) collected ground water samples from three wells located near the proposed Spaceport America. Water quality data were collected from Well LRG-06288, which is located at the Bar Cross Ranch Headquarters; from Well LRG-07300, which is located near the Lewis Cain Ranch on the north end of Prisor Hill; and Well LRG-07299, which is located near Upham. Two of the Spaceport America test wells (#4 and #5) were sampled in July 2007. A summary of the water quality data is provided in Exhibit 3.7-5.

Exhibit 3.7-4. Depth to Ground Water Contour Map of the Proposed Spaceport America & Vicinity



Source: Shomaker, 2008

Exhibit 3.7-5. Summary of Water Quality Data for Wells On and Near the Proposed Spaceport America

	Well Identification					
Parameter	**LRG-06228**	**LRG-07299**	**LRG-07300**	**Well #4**	**Well #5**	**EPA MCL**
Fluoride (mg/L)	3.3	1.9	**4.9**	3.7	3.0	4.0
Chloride (mg/L)	39	110	**400**	150	26	250*
Nitrogen, Nitrate [as N] (mg/L)	0.95	**13**	6	2.5	1.8	10
Sulfate (mg/L)	190	**570**	**1,400**	**790**	210	250*
Calcium (mg/L)	27	69	76	42	16	NS
Total Iron (mg/L)	<0.10	**6.6**	**7.2**	0.067	**0.59**	0.3*
Total Magnesium (mg/L)	13	33	65	30	9.2	NS
Total Manganese (mg/L)	<0.0020	**0.051**	**0.11**	0.002	0.013	0.05*
Potassium (mg/L)	1.4	2.6	7.9	2.3	1.3	NS
Sodium (mg/L)	170	290	850	410	180	NS
Total Alkalinity [CaCO3] (mg/L)	290	140	260	150	250	NS
Carbonate (mg/L)	<2.0	<2.0	<2.0	<2.0	<2.0	NS
Bicarbonate (mg/L)	290	140	260	150	250	NS
pH (standard)	8.02	7.89	8.05	8.06	8.15	6.5 to 8.5
Total Dissolved Solids (mg/L)	**680**	**1,300**	**3,200**	**1500**	**650**	500*
Turbidity (NTU)	0.68	35	58	2.5	16	NS
Total Arsenic (mg/L)	0.003	0.007	**0.016**	0.004	0.004	0.01
Total Uranium (mg/L)	0.019	0.017	**0.05**	0.023	0.015	0.03
Total Hardness [CaCO3] (mg/L)	120.8	307.8	456.5	230	77	NS
Gross Alpha (pCi/L)	na	na	na	11.6	12.4	15
Gross Beta (pCi/L)	na	na	na	3.8	5.8	NCS

Notes:
Samples collected by Shomaker & Associates, Inc. in May 2006 and July 2007.
EPA MCL = Environmental Protection Agency Maximum Contaminant Level for Drinking Water.
* = Aesthetic Standard.
NMOSE = New Mexico Office of the State Engineer.
mg/L = Milligrams per liter.
na = Not analyzed.
NCS = No concentration standard. Standard is 4 mrem per year of exposure, which depends on the specific NTU = Nephelometric turbidity units.
NS = No standards have been established for this parameter.
pCi/L = Picocuries per liter.
BOLD = Concentration exceeds the EPA MCL.

3.8 Fish, Wildlife, and Plants

Multiple biological surveys have been performed in the area of the proposed Spaceport America. The first was performed in 1994-1996 as part of the NEPA process for the previously-proposed Southwest Regional Spaceport (SRS) (Exhibit 3.8-1) (Sullivan et al., 1996). A second survey was performed in late 2005 and early 2006 for the proposed Spaceport America (Exhibit 3.8-2), focusing on threatened and endangered species (North Wind, 2006). Zia Engineering and Environmental Consultants (Zia EEC) produced two biological surveys in 2007 (Exhibit 3.8-2) for this Spaceport America EIS, one concerning a portion of the Project area not covered in the North Wind biological survey (Zia EEC, 2007a) and a second covering the proposed off-site transmission and fiber optic corridors (Zia EEC, 2007b). Finally, a biological survey of the proposed well field has been completed by Zia EEC (Zia EEC, 2008c). Information from each of these biological surveys is incorporated in this EIS and referenced accordingly.

3.8.1 Definition and Description

Biological resources include terrestrial and aquatic plants and animals, including threatened and endangered species and environmentally sensitive habitats. Special status species include those that are federally-listed as endangered or threatened; sensitive species and/or species of concern; candidates for Federal listing; endangered or threatened fauna that is listed by the NMDGF; and endangered or threatened flora that is listed by the New Mexico Department of Energy, Minerals, and Natural Resources (NMEMNR).

The area of the proposed Spaceport America is an arid desert environment with no perennial water to support fish or other aquatic organisms. Therefore, issues such as Essential Fish Habitat are not applicable or discussed further in this EIS. Many terrestrial plants and animals are found in the Project area, which is also in the migratory path of some bird species. The analysis of impacts to biological resources addresses only terrestrial wildlife and plants.

3.8.2 Regulatory Setting

The U.S. Fish and Wildlife Service (USFWS) and two State agencies (NMDGF and NMEMNR) are responsible for the protection and conservation of special-status species. The *Endangered Species Act* (ESA) of 1973 (16 U.S.C. §1531 et seq.) is the primary law that addresses federally-listed species. The USFWS administers the ESA, which states that all Federal departments and agencies shall seek to conserve endangered and threatened species. Included with the protection of the animals and plants themselves is a concern for their designated critical habitat. Critical habitat is defined as specific area within the geographical area occupied by a species at the time it is listed and includes areas that are essential to conservation of the species. State-listed threatened and endangered species are afforded protection in accordance with State-specific regulations which are presented below.

Other Federal regulations designed to protect the nation's inland biological resources include:

- 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. 703-712), protects migratory birds by prohibiting actions such as hunting, capturing, or killing the adults or destroying or gathering the nests and eggs of many species listed at 50 CFR 10.13.

Exhibit 3.8-1. Location of the 1996 Biological Survey Conducted for the Southwest Regional Spaceport

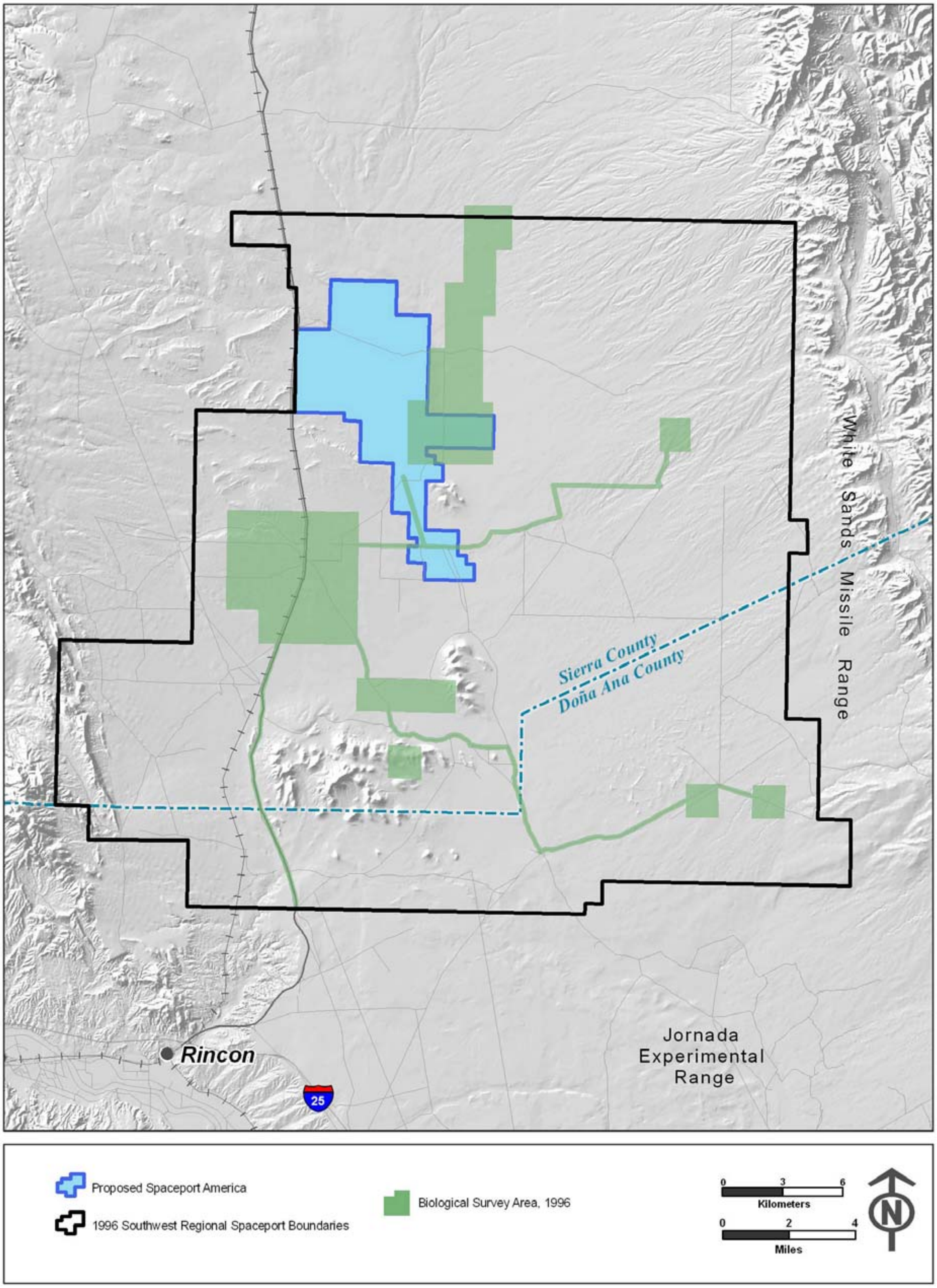
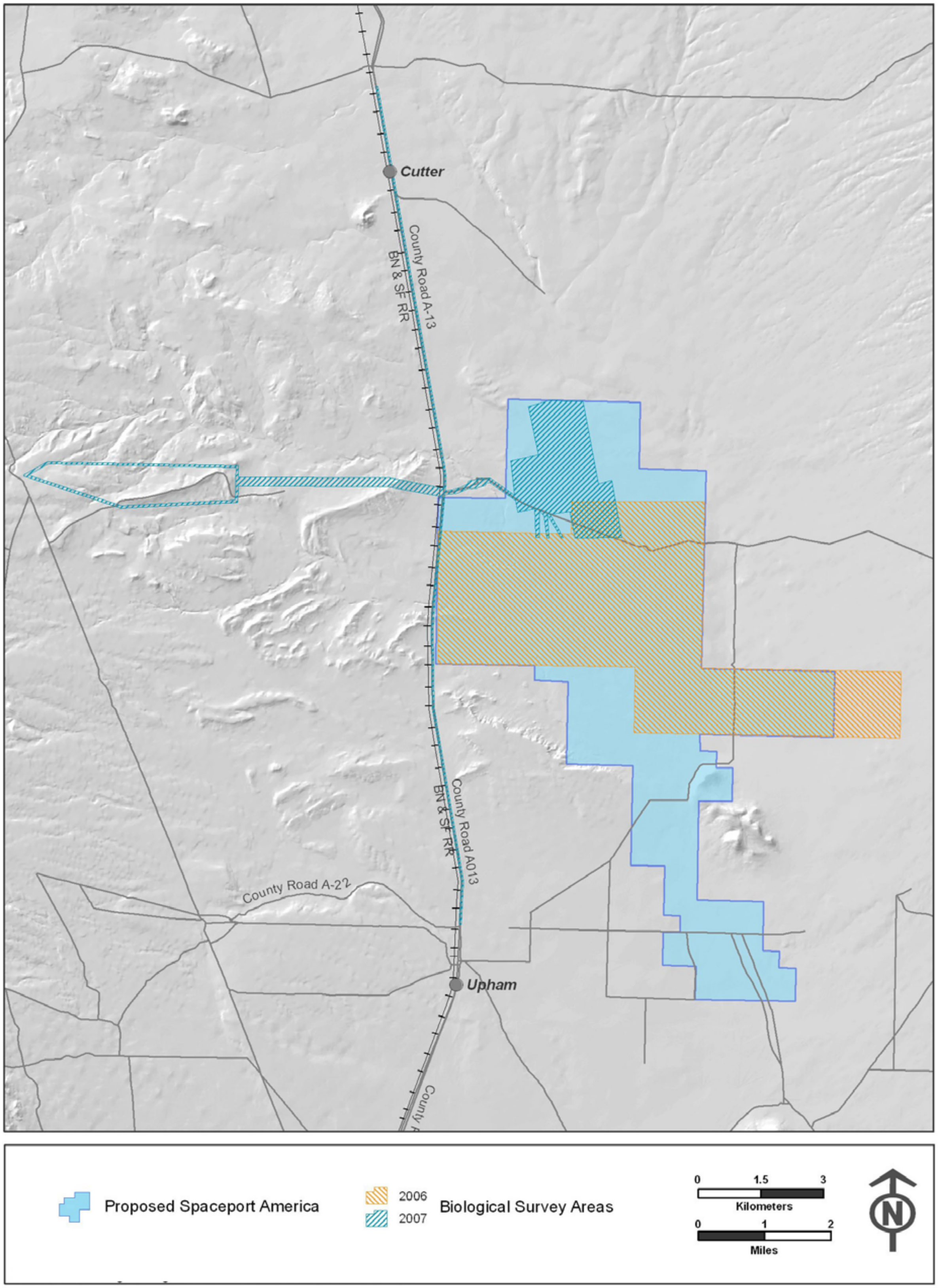


Exhibit 3.8-2. Location of the 2006 and 2007 Biological Surveys Conducted for the Spaceport America EIS



- 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. If any action that might disturb the eagles is foreseeable, the USFWS would be notified for appropriate mitigation measures.

There are two sets of State regulations that protect biological resources:

- The *New Mexico Wildlife Conservation Act* (NMSA §17-2-37 to 46) provides that species of wildlife indigenous to the State that are found to be "endangered" or "threatened" will be managed to maintain and, to the extent possible, enhance their numbers within the carrying capacity of the habitat.
- The *New Mexico Endangered Plants Act* (NMSA §75-6-1) provides that the Department of Energy, Minerals, and Natural Resources shall establish a list of endangered plant species and that penalties be imposed for taking, possession, transportation, and other prohibited acts in regards to listed plants and plant materials.

Finally, portions of the transmission and fiber optic corridors and areas adjacent to the proposed site would be located on land managed by the BLM within Sierra County. BLM and USFWS maintain lists of sensitive species or species of concern, respectively, for those species which have conservation concerns, and avoidance of unnecessary impacts to them is recommended. These species are listed for Project planning purposes to prevent their further decline to threatened or endangered status and may be subject to agency discussions relative to Project activities.

3.8.3 Region of Influence

The region of influence of the proposed Spaceport America Project includes the entire site and associated transmission and fiber optic corridors, due to construction impacts, and extends approximately 8 miles beyond the site boundary due to vehicular travel and noise associated with take-offs and landings.

3.8.4 Existing Conditions

The approximately 26 square-mile area of the proposed Spaceport America site is an arid desert environment with no natural perennial water. It has been used for cattle grazing for at least the last 100 years. The existing conditions of biological resources are presented in this section and are summarized from the previously described five biological surveys (Sullivan et al., 1996; North Wind, 2006; Zia EEC, 2007a, 2007b, and 2008c).

3.8.4.1 Vegetation Communities

The proposed Spaceport America site encompasses three major vegetation types: semi-desert grassland, plains-mesa sand scrub, and Chihuahuan desert scrub. In species composition, these three vegetation types correspond to the Chihuahuan desert scrub biotic community and the semi-desert grassland biotic community (Lomolino et al., 1989; Dick-Peddie, 1993). Semi-desert grassland dominates the central portions of the Project area, Chihuahuan desert scrub vegetation lies along the western and eastern portions of the Project area, and Plains-Mesa sand scrub separates semi-desert grassland and Chihuahuan desert scrub vegetation in the central portion of the Project area.

Only a single noxious plant has been reported for the Project area. Salt cedar (*Tamarix chinensis*) is a New Mexico Class C noxious plant that was reported in the fiber optic/transmission line biological study (Zia EEC, 2007b) and the well field study (Zia EEC, 2008c), but was not reported for other portions of the Project area (Zia EEC, 2007a, North Wind, 2006). By definition, Class C weeds are widespread throughout the State. Management decisions for this plant would be made at the local level (New Mexico Department of Agriculture or BLM), based on feasibility of control and level of infestation.

Semi-Desert Grassland

The semi-desert grassland biotic community is primarily Chihuahuan desert grassland that surrounds low-elevation Chihuahuan desert scrub (Dick-Peddie, 1993). At its lower boundary, grassland habitat merges with desert scrub, creating a complex landscape mosaic. Grama grasses, tobosa grass, fluff grass, bush muhly, and alkali sacoton dropseed – an indicator of saline soils – are the most diagnostic grasses within this community. In areas with low precipitation, annual forbs are abundant. 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.

NMDGF considers semi-desert grasslands to be a "key terrestrial habitat" in need of preservation and restoration (NMDGF, 2006a). Much of this habitat has suffered from historical over-grazing by livestock, resulting in loss of grasslands and encroachment by shrub species of lower value to wildlife (BLM, 2007a). BLM, in cooperation with the New Mexico State Land Office, NMDGF and various livestock operators, have implemented grassland restoration on nearly 100,000 acres of rangelands located adjacent to the proposed site as part of the Jornada del Muerto Wildlife Habitat Management Plan (BLM, 1982) and Jornada del Muerto Grassland Restoration projects (BLM, 2007a). These efforts to restore and/or enhance these desert grassland habitats typically involve various levels of shrub removal and include portions of the Project site.

Plains-Mesa Sand Scrub

Much of this area is covered by post-Pleistocene deep sands, which are dominated by plant species that are deep-sand tolerant (Dick-Peddie, 1993). Absence of sand-adapted plant species on mesquite dunes (coppice dunes) indicates a recent origin of these dunes. In most situations, major plants associated with mesquite dunes are disturbance type plants such as broom snakeweed and forbs such as tansy mustard and Russian thistle. Major shrubs associated with plains-mesa sand scrub areas include fourwing salt bush, long-leaf ephedra, snakeweed, mesquite, and desert sumac. The most common forbs are annual buckwheat and sand verbena. Major grasses include purple three-awn, bush muhly, and alkali sacaton.

Chihuahuan Desert Scrubland

Major vegetation in the Chihuahuan Desert scrub community includes a combination of woody and herbaceous shrubs (Dick-Peddie, 1993). Upper elevation boundaries are dynamic and ecotonal with the lower boundary of semidesert grassland community. Ecotones are transition areas of vegetation between two communities, having some of the characteristics of each bordering community and occasionally having unique species not found in the overlapping communities. On the proposed Project site, Chihuahuan Desert scrublands are composed of two primary vegetation types—Chihuahuan broadleaf evergreen desert scrub and Chihuahuan broadleaf deciduous desert scrub (Sullivan et al., 1996).

Chihuahuan Broadleaf Evergreen Desert Scrub. These scrublands are dominated by drought tolerant broadleaf evergreen shrubs. The major cover type is creosote bush. Common sub-dominant shrub associates are mariola tarbush, purple prickly pear, cholla, and honey mesquite. Herbaceous cover is variable, ranging from sparse to grassy. Herbaceous species include buckwheat, desert verbena, bahia, and desert holly. Characteristic grasses are fluffgrass and black grama. This habitat is distributed extensively throughout the Project area. It primarily occurs along the western and eastern boundaries of the site.

Chihuahuan Broadleaf Deciduous Desert Scrub. Honey mesquite-dominated Chihuahuan broadleaf deciduous desert scrub occurs extensively throughout the Project area and on the adjacent Jornada del Muerto. This scrubland is dominated by broadleaf deciduous shrubs that are cold and drought tolerant. Major shrub types are tarbrush, honey mesquite, whitethorn and ocotillo. Other common sub-dominant shrubs are fourwing saltbush, broom snakeweed, sotol, desert sumac, tree cholla, and Christmas cactus. Herbaceous cover tends to be sparse or grass-dominated. Common grasses are fluffgrass, mesa dropseed, alkali sacaton, and the forb globemallow.

Wetland and Riparian Habitat

No jurisdictional wetlands exist on the proposed Spaceport America site (Zia EEC, 2007a; USACE, 2007). Although the site is considered a "non-wetland" site, a large ephemeral floodplain extends through the southernmost portion. This area has saturated soils only for brief periods of the growing season and supports a prevalence of vegetation typically adapted for life in aerobic soils. No construction or operational activities are planned for this area.

Arroyo habitats associated with the dry washes in the proposed Spaceport America site are not considered riparian areas by definition (BLM, 1992). However, because they can contain diverse vegetation that often occurs in stark contrast to surrounding desert scrub and grassland habitat, they are considered important areas that may warrant special management attention. Also, these habitats can serve as travel corridors for wildlife species.

3.8.4.2 Wildlife

Migratory and Protected Bird Species

The Project area is within the Jornada del Muerto region, which has a high degree of biological diversity in comparison to other regions of the U.S./Mexican Chihuahuan Desert with similar elevation, climate, topography, and water resources (Sullivan, et al., 1996). This diversity is presumably due to the large numbers of birds that use the Rio Grande Flyway, which is 15 to 25 miles west of the proposed Spaceport America site. This is the major bird migration route in the area and is used seasonally by neotropical migrants traveling en route between the northern and southern parts of the hemisphere. It follows the Rio Grande and generally extends only a few miles on either side of the river's riparian area. However, large numbers of these migratory birds have been observed in a playa area near Engle, New Mexico, approximately 10 miles north of Spaceport America site, during migration season after heavy rain.

Forty avian species were observed during recent biological surveys of the Project area and associated corridors (Exhibit 3.8-3). Although relatively few of the bird species observed in the 1996, 2006, 2007, and 2008 biological surveys were Federal or State-listed endangered, threatened, sensitive or candidate species, most of the observed birds are protected under the provisions of the Migratory Bird Treaty Act and New Mexico statutes. Four avian species (see

Exhibit 3.8-3) observed during site surveys are considered priority (migratory bird) species for local habitats (NMPIF, 2007). Additionally, all raptors have protected status under New Mexico statutes. Game birds observed within the Project area included Gambel's quail, (*Callipepla gambelii*), scaled quail (*C. squamata*), and mourning dove (*Zenaidura macroura*).

Exhibit 3.8-3. Wildlife Species Observed on the Spaceport America Site and Associated Corridors during Biological Surveys in 2006 and 2007

Common Name	Scientific Name
BIRDS	
Sage Sparrow	*Amphispiza bellii*
Black-throated sparrow	*Amphispiza billneata*
Cassin's sparrow	*Amphispiza cassini*
Golden eagle	*Aquila chrysaetos*
Red-tailed hawk	*Buteo jamaicensis*
Swainson's hawk*	*Buteo swainsonii*
Lark bunting	*Calamospiza melanocorys*
Gambel's quail	*Callipepla gambelii*
Scaled quail*	*Callipepla squamata*
Cactus wren	*Campylorhynchus brunneicapillus*
House finch	*Carpodacus mexicanus*
Turkey vulture	*Cathartes aura*
Northern harrier*	*Circus cyaneus*
Chihuahuan raven	*Corvus cryptoleucus*
Horned lark	*Eremophila alpestris*
Prairie falcon	*Falco mexicanus*
American kestrel	*Falco sparverius*
Greater roadrunner	*Geococcyx californianus*
Bald eagle	*Haliaeetus leucocephalus*
Scott's oriole	*Icterus parisorum*
Loggerhead shrike*	*Lanius ludovicianus*
Song sparrow	*Melospiza melodia*
Northern mockingbird	*Mimus polyglottos*
Brown-headed cowbird	*Molothrus ater*
Ash throated flycatcher	*Myiarchus cinerascens*
Sage thrasher	*Oreoscoptes montanus*
Osprey	*Pandion haliaeetus*
Ladder-backed woodpecker	*Picoides scalaris*
Canyon towhee	*Pipilo fuscus*
Vesper sparrow	*Pooecetes gramineus*
Ruby-crowned kinglet	*Regulus calendula*
Western bluebird	*Sialia mexicana*
Brewers sparrow	*Spizella brewerii*
Chipping sparrow	*Spizella passerine*
Eastern meadowlark	*Sturnella magna*

Exhibit 3.8-3. Wildlife Species Observed on the Spaceport America Site and Associated Corridors during Biological Surveys in 2006 and 2007 (cont'd)

Common Name	Scientific Name
BIRDS	
Western meadowlark	*Sturnella neglecta*
Thrasher	*Toxostoma spp.*
Western kingbird	*Tyrannus verticalis*
Mourning dove	*Zenaida macroura*
White-crowned sparrow	*Zonotrichia leucophrys*
MAMMALS	
Pronghorn	*Antilocapra americana*
Coyote	*Canis latrans*
Pocket mice	*Chaetodipus spp.*
Kangaroo rats	*Dipodomys spp.*
Mountain lion	*Felis concolor*
Black-tailed jackrabbit	*Lepus californicus*
Bobcat	*Lynx rufus*
Desert mule deer	*Odocoileus hemionus*
Pocket mice	*Perognathus spp.*
Desert cottontail rabbit	*Silvilagus audubonii*
REPTILES	
Common checkered whiptail lizard	*Aspidoscelis tesselata*
Greater earless lizard	*Cophosaurus texanus*
Collared lizard	*Crotaphytus collaris*
Texas horned lizard	*Phrynosoma cornutum*
Round-tailed horned lizard	*Phrynosoma modestum*

Sources: North Wind, 2006; Zia EEC, 2007a, b, and c, 2008c
* Indicates "priority species" designated by New Mexico Partners in Flight (NMPIF, 2007).

Big Game and Other Wildlife Species

The 1996 biological survey (Sullivan et al., 1996) summarized the existing conditions for big game species at that time as follows:

> Four big game species occur within the boundaries of the proposed Spaceport America site: mule deer (*Odocoileus hemionus*), pronghorn (*Antilocapra americana*), mountain lion (*Felis concolor*), and African oryx (*Oryx gazella*). The population of oryx, a non-native species, is increasing in the proposed 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 WSMR along the eastern boundary of Spaceport America. No bighorn sheep habitat occurs within the proposed site. This species occurs as lone individuals or in scattered small bands. The population of desert bighorn sheep in the San Andres Mountains primarily occupies areas above approximately 6,000 feet with an average slope of 62 percent. The only seasonal change in locations inhabited by sheep bands is movement of some rams out of established

> herding areas following the end of the rutting season during winter months (Sandoval, 1979). Ewes continue to inhabit the same general herd areas during lambing, although there apparently is some habitat selection by ewes for cliff-associated sites with more eastern exposures (Sandoval, 1979). Individual sheep often descend to lower elevations for short periods of time to drink water at canyon springs; they seldom venture more than 1.5 miles from water (Sandoval, 1979). (Sullivan et al., 1996)

These conditions have not changed significantly since the 1996 biological survey was published and the Project area in that study was much larger (387 square miles) than the proposed Spaceport America site evaluated in this EIS (26 square miles). Ten mammal species were observed during recent biological surveys of the Project area and associated corridors (Exhibit 3.8-3). A variety of big- and small-game species are hunted within and around the Project area, which is part of NMDGF's Game Management Unit 20, including pronghorn antelope and mule deer. Pronghorn antelope utilize dessert grasslands and thus are a focal species for desert grassland restoration within the region (BLM, 1982 and 2007a). Mule deer, whose statewide population numbers have varied considerably over recent decades (NMDGF 1999), occupy drainages and arroyo habitats in the Project area and prefer to forage on certain forbs and shrubs common to disturbed habitats (Heffelfinger et al., 2006). The African oryx or gemsbok, a species of antelope originally found in southern Africa, was introduced onto WSMR in the late 1960s by the NMDGF and has successfully expanded its range since that time (NPS, 2002). Further discussions of desert bighorn sheep occur under "Special Status Species (Subsection 3.8.4.3).

Five species of reptiles were observed during recent biological surveys of the Project area and associated corridors (Exhibit 3.8-3).

3.8.4.3 Special Status Species

Endangered, threatened, and sensitive species and candidate species listed by USFWS, BLM, and the State for Sierra and Doña Ana Counties are shown in Exhibit 3.8-4. Doña Ana County was included because its boundary is relatively close (7.8 miles) to the Spaceport site and to be consistent with some of the biological surveys. Twelve federally-listed species (endangered, threatened or candidate species) occur or have the potential to occur within Sierra and Doña Ana counties, including five bird, two mammal, two plant, one amphibian, and two fish species. Currently, there is no permanent water within the Project area to provide suitable habitat for the two fish species, so they are not discussed in this EIS. Although none of the other federally-listed species were observed in the proposed Spaceport America Project areas during the 1994-1996, 2005-2006 and 2007 biological surveys, presumably due to lack of suitable habitat, the potential of each species to use the Project area will be briefly described below. It should be noted that State and Federal web sites present listed species differently, with some sites including all counties within the historical range of the species and other sites only counties with sightings. Also, not all web sites are maintained or updated as frequently as others. As a conservative approach, species in both counties from all listings were included. Also, it must be acknowledged that these listings reflect only recorded or historical occurrences and the possibility exists that other (un-recorded) rare species might occur in these counties. Finally, both bald (*Haliaeetus leucocephalus*) and golden (*Aquila chrysaetos*) eagles, while not listed under the ESA, are protected by the Bald and Golden Eagle Protection Act and may occur in these counties.

Exhibit 3.8-4. Federal and State Endangered and Threatened Species Listed for Sierra and Doña Ana Counties, New Mexico[a]

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
Gray vireo	*Vireo vicinior*	-	T
FISH			
Longfin dace	*Agosia chrysogaster*	S	T
Desert sucker	*Catostomus clarki*	SOC	-
Sonora sucker	*Catostomus insignis*	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

Exhibit 3.8-4. Federal and State Endangered and Threatened Species Listed for Sierra and Doña Ana Counties, New Mexico[a] (cont'd)

Common Name	Scientific Name	Federal Status	State Status
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	-
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

Exhibit 3.8-4. Federal and State Endangered and Threatened Species Listed for Sierra and Doña Ana Counties, New Mexico[a] (cont'd)

Common Name	Scientific Name	Federal Status	State Status
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	-
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	-

Sources: BISON (2007b), NMDGF (2006b), NMRPTC (1999), USFWS (2007c).
[a] Species Status: C=candidate, DL=delisted, E=endangered, S=sensitive (BLM, Forest Service), SOC=species of concern (USFWS & NM), T=threatened, - = no status.

The ten federally-listed species that occur or have the potential to occur within Sierra and Doña Ana counties are described here:

- The yellow-billed cuckoo (*Coccyzus americanus*) is a candidate species for Federal listing and as such does not yet receive the protection of the ESA. In New Mexico, it breeds in lowland deciduous woods but has been occasionally observed in Chihuahuan Desert scrub habitat.
- The northern Aplomado falcon (*Falco femoralis septentrionalis*) is designated as endangered throughout its historic range (southern Arizona, New Mexico, and Texas). It was presumed to be extirpated from New Mexico by the 1950s, but may have begun a

natural re-colonization of the State in the 1990s (NMDGF, 2006b). Federal legislation to reintroduce the species in various regions of the southwest was recently passed (USFWS, 2006) and releases into the region are occurring (BLM, 2007b). Aplomado falcons were not observed on the proposed Spaceport America site during the 1996 general biological surveys. Surveys specific for Aplomado falcons found no falcons in the proposed Project area in 2006 and 2007 (North Wind, 2006; Zia EEC, 2007a, b, and c). The falcons prefer habitat that includes expansive grasslands with nearby perches (trees), which does not occur on the proposed Spaceport America site. Small open grassland areas observed at the site are adjudged as marginally suitable for the falcons (Zia EEC, 2007a and b), although continued efforts to increase grasslands and reduce shrub coverage would likely improve habitat suitability.

- The southwestern subspecies of the willow flycatcher (*Empidonax traillii extimus*) is designated as endangered throughout its entire range. It nests in riparian habitat, near open water or moist soils associated with intermittent streams. No riparian habitats are located at the proposed Spaceport America site and the species has not been observed during any of the biological surveys.
- Mexican spotted owls (*Strix occidentalis lucida*) are currently listed as threatened throughout their entire range. Their preferred habitat is best described as old-growth (less than 200 years old) mixed conifer forest, characterized by high canopy closure and stand density. Critical habitat for this species is found in Sierra County west of Spaceport America site in the Gila Mountains (USFWS, 2004). Such habitat is not found on the proposed Spaceport America site and the birds have not been observed in this region during the biological surveys.
- Interior populations of least terns (*Sterna antillarum*) are listed as endangered throughout their range. In New Mexico, they breed in low numbers, nesting on alkali flats, and also are present as migratory and vagrant birds. They typically feed over water and thus should not be expected at the Spaceport America site.
- The black-footed ferret (*Mustela nigripes*) is currently listed as endangered throughout its range. It prefers extensive short prairie grasslands containing prairie dog complexes. Neither habitat nor its primary prey (prairie dogs) is found in the study area. It is considered extirpated from New Mexico and was not observed on the proposed Spaceport America site during the biological surveys.
- Mexican gray wolves (*Canis lupus baileyi*) are a southwestern subspecies of the gray wolf and are listed as endangered throughout their range. They were essentially eliminated from their historic range by the 1970s by aggressive predator control programs. The few captive Mexican wolves were entered into a captive breeding program which eventually resulted in the release of several wolves on to public lands in eastern Arizona. Recovery actions continue and this species has been documented in Sierra County, New Mexico (USFWS, 2007a), presumably in the western mountains.
- The Chiricahua leopard frog (*Rana chiricahuensis*) is listed as threatened throughout its range. They breed in and inhabit a wide variety of wetlands, mainly those that are permanent with moderate depth. There are no permanent wetlands on the site and these frogs have not been seen during the biological surveys.

- Todsen's pennyroyal (*Hedeoma todsenii*) is an erect perennial herb that is designated as endangered throughout its entire range. It generally occurs in Great Basin conifer woodland communities dominated by piñon pine (*Pinus edulis*) and one seed juniper (*Juniperus monosperma*). Critical habitat for this species is found east of the proposed Spaceport America site at WSMR (USFWS, 1981). No conifer-woodland habitat is found on the proposed Spaceport America site.
- Sneed's pincushion cactus (*Escobaria sneedii* var. *sneedii*) is a cactus that grows in clumps to form small dense clusters and is designated as endangered throughout its range. They reside primarily in cracks in the limestone, in areas or broken terrain, and on steep slopes within Chihuahuan desert scrub. These habitats are not found on the Spaceport America site.

The bald eagle (*Haliaeetus leucocephalus*) was de-listed as a federally-threatened species in 2007 (USFWS, 2007b), but remains under the protection of the Bald and Golden Eagle Protection Act. It is generally associated with aquatic habitats for nesting and foraging, but will forage on terrestrial species. Bald eagles have been observed scavenging in the Project area and surrounding areas, but these are presumed to be transient birds due to lack of nesting and open water habitats (North Wind, 2006). Golden eagles (*Aquila chrysaetos*) also have been observed flying over the Project area (Zia EEC, 2007c)

In Sierra and Doña Ana counties there are 66 animals and plants listed as Federal species of concern or sensitive (Exhibit 3.8-4), including 30 species of plants, 11 species of birds, 15 species of mammals, 5 species of fishes, 3 species of invertebrates and one each species of amphibians and reptiles. Many of these species are associated with either rocky, cliff-like habitat not found on the Spaceport site or aquatic habitats, also not found on the site. Below we discuss those species observed on-site and/or with potential habitat on site.

- The night-blooming cereus cactus (*Peniocereus greggii* var. *greggii*) grows in gently broken to level terrain in desert grassland or Chihuahuan Desert shrub, typically growing up through and supported by shrubs. This habitat is found in the Spaceport area, but this cryptic species has not been observed on-site during surveys.
- Loggerhead shrikes (*Lanius ludovicianus*) inhabit grasslands, open areas with scattered trees and desert habitat. Individual birds and suitable habitat have been observed in the Project area (Sullivan et al., 1996; Zia EEC, 2007a, 2007b).
- Burrowing owls (*Athene cunicularia hypugaea*) nest in burrows in the ground in desert scrub, grassland, and coppice dune habitats. Although not observed during recent surveys, potential habitat is available and the owls may occur in the Project area.
- American peregrine falcons (*Falco peregrinus anatum*) typically nest on cliffs near forested habitats. These habitats do not occur in the Project area, but these falcons may use the site occasionally while foraging or during migration.
- Bell's vireo (*Vireo bellii*) nests in lowland scrub habitats and use grasslands during their migration to the tropics. This species has been observed on the Project lands (Sullivan, et al., 1996). Some suitable habitats (grasslands) exist within the Project area.

- Baird's sparrow (*Ammodramus bairdii*) is a migratory species that breeds in north-central states and Canada, but also uses grasslands in New Mexico during their fall migration. Suitable habitats exist within the Project area.
- Mountain plovers (*Charadrius montanus*) are found on arid plains, heavily-grazed prairies, and fallow fields. While suitable habitat exists within the Project area, this species has not been observed in Sierra County.
- The Texas horned lizard (*Phrynosoma cornutum*) is wide-bodied with long spines on its head and considered ubiquitous to Chihuahuan desert scrub habitat. Individuals were observed during surveys for transmission and fiber optic corridors (Zia EEC, 2007b) and, although not observed, they presumably inhabit portions of the main facility site.
- Desert pocket gophers (*Geomys arenarius arenarius*) are medium-sized gophers found in desert scrub habitats with deep, sandy soils. Potentially suitable habitat exists within the Project area, but lacks the deep, sandy soils.
- Several species of bats are listed for this region: Allen's big-eared bat (*Idionycteris phyllotis*), Allen's big free-tailed bat (*Nyctinomops macrotis*), fringed myotis bat (*Myotis thysanodes thysanodes*), long-eared myotis bat (*Myotis evotis evotis*), long-legged myotis bat (*Myotis volans interior*), Pale Townsend's big-eared bat (*Corynorhinus townsendii*), spotted bat (*Euderma maculatum*), Western red bat (*Lasiurus blossevilli*), Western small-footed myotis bat (*Myotis ciliolabrum melanorhinus*), and Yuma myotis bat (*Myotis yumanensis yumanensis*). They tend to roost in man-made structures (bridges, buildings, mines), cliff crevices, and caves and forage in a variety of habitats including desert scrubland. Little is known about the use of desert scrub habitat on the Project area by these bats.

There are 14 state-listed animals and no state-listed plants for Sierra and Doña Ana Counties (Exhibit 3.8-4). None of the state-listed species was observed during the 1996, 2005-2006, 2007, and 2008 biological surveys. Two birds have potential habitat within the Project area and desert bighorn sheep may migrate through the area.

- The common ground dove (*Columbina passerine pallescens*) is a small bird that occasionally inhabits Chihuahuan Desert grassland and desert scrub. The population in New Mexico consists of a few birds in Hidalgo County. Although potential habitat exists on the Project area, the species has not been observed in the area.
- Varied buntings (*Passerina versicolor*) are found in dense desert brush and Chihuahuan Desert scrub habitats in the southern portion of New Mexico. Potential habitat exists within the Project area, but no individuals have been observed.
- A population of approximately 90 desert bighorn sheep inhabits the Fra Cristobal Mountains (NMDGF, 2007a), which are about 30 miles north-northeast of the proposed Spaceport America site. More recently, sightings of approximately 10-20 bighorn sheep have been confirmed in the Caballo Mountains, about 12 miles west of the proposed Spaceport America site, and an estimated 90 sheep now inhabit the San Andres Mountains (NMDGF, 2007a). The San Andres population is a remnant of the original New Mexico herd, whereas the Fra Cristobal population was established by translocation from a captive breeding center (NMDGF, 2003a). The Caballos population established

naturally (were not stocked) prior to 2006, presumably migrating from the Fra Cristobal population (NMDGF, 2007a). The populations within these three mountain ranges are considered a "metapopulation," with possible inter-population movements (NMDGF, 2003a).

3.9 Hazardous Materials, Pollution Prevention, and Solid Waste

3.9.1 Definition and Description

The FAA considers hazardous material, pollution prevention, and solid waste impacts in NEPA documentation. The FAA Order 1050.1E, Appendix A, Section 10 defines the terms hazardous material, hazardous waste, and hazardous substance as follows:

Hazardous Material -- A 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 Part 172, table 172.101) is considered a hazardous material. This includes hazardous substances and hazardous wastes.

Hazardous Waste -- Under the Resource Conservation and Recovery Act (RCRA) a waste is considered hazardous if it is listed in, or meets the characteristics described in, 40 CFR Part 261, including ignitability, corrosivity, reactivity, or toxicity.

Hazardous Substance -- 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 Part 302 is considered a hazardous substance. If released into the environment, hazardous substances may pose substantial harm to human health or the environment.

The FAA and CEQ guidance encourages consideration of opportunities for pollution prevention in the Proposed Action and its alternatives. The FAA actions for terminal area development may also require consideration of solid waste impacts. The Proposed Action and Alternatives analyzed in this document do not involve terminal area development.

3.9.2 Regulatory Setting

The primary laws governing the handling and disposal of hazardous materials, chemicals, substances, and wastes are: the RCRA (as amended by the Federal Facility Compliance Act of 1992); and the CERCLA, as amended by both the Superfund Amendments and Reauthorization Act of 1986 (SARA or Superfund) and the Community Environmental Response Facilitation Act of 1992. RCRA governs the generation, treatment, storage, and disposal of hazardous wastes. CERCLA provides for consultation with natural resources trustees and cleanup of any release of a hazardous substance (excluding petroleum) into the environment. Executive Order 12088, as amended, directs Federal agencies to: (1) comply with "applicable pollution control standards," in the prevention, control, and abatement of environmental pollution; and (2) consult with the EPA, State, interstate, and local agencies concerning the best techniques and methods available for the prevention, control, and abatement of environmental pollution.

The State of New Mexico has adopted regulations governing hazardous materials and waste. With few exceptions, the NMED, Hazardous and Radioactive Materials Bureau regulations on hazardous waste, 20 NMAC 4.1, incorporate by reference the Federal EPA RCRA regulations in 40 CFR Parts 260-272. Solid waste regulations are found at 20 NMAC 9.1. In addition, the New Mexico Hazardous Chemical Information Act, §§74-4E-1 through 74 - 4E-9 NMSA 1978, provides authority for New Mexico to implement the Federal Emergency Planning and Community Right-Know Act of 1986 (EPCRA), Title III of CERCLA, requiring notification of the release of a chemical substance at or above "reportable quantities."

Permit application requirements for generators of hazardous waste in New Mexico are given at NMAC 20.4.1. However, Spaceport America is not expected to generate hazardous waste in quantities high enough to warrant such a permit, and would qualify as a Conditionally Exempt Small Quantity Generator (CESQG). New Mexico solid waste management regulations allow the disposal of hazardous waste generated by CESQGs in municipal waste landfills permitted by the State of New Mexico (NMAC 20.9.1). CESQGs are defined as those facilities that produce:

Less than 100 kilograms (220 pounds) of hazardous waste per calendar month

OR

Less than 1 kilogram (2.2 pounds) of acutely hazardous waste per calendar month.

The CESQG requirements additionally limit the facility's waste accumulation quantities to less than 1,000 kilograms (2,200 pounds) of hazardous waste, 1 kilogram (2.2 pounds) of acute hazardous waste, or 100 kilograms (220 pounds) of any residue from the cleanup of a spill of acute hazardous waste at any time.

The regulations governing solid waste management are found at NMAC 20.9.1. The regulations address disposal of commercial solid waste, construction and demolition debris, industrial solid waste such as waste resulting from water and wastewater treatment processes, and special waste which includes industrial solid waste, spill cleanups, and petroleum-contaminated soils, and other wastes. Municipal landfills permitted by the State of New Mexico may receive commercial solid waste, non-hazardous sludge, CESQG hazardous waste, industrial solid waste, construction and demolition debris, and other special wastes. A municipal landfill may be publicly or privately owned.

3.9.3 Region of Influence

The ROI is the surrounding area that could be impacted from construction and operation of the proposed Spaceport America. The ROI includes waste management facilities and the suppliers of hazardous materials used in construction such as paints, adhesives, cleaning materials, and some building materials used during operations such as solvents used in maintenance shops and unused or off-specification fuels. The extent of the ROI varies by material and waste type. The ROI for hazardous materials includes local area, national markets, and perhaps international ones given the proximity of an international border; the ROI is dependent on whether the cost or value of the commodity makes it economical to transport over distances or not. The hazardous materials used in construction and operations are available in local, national, and international markets. The ROI for solid waste disposal facilities is within Sierra and the surrounding counties. Storage, treatment, and disposal facilities for hazardous wastes are less common and the associated ROI includes New Mexico and western Texas.

3.9.4 Existing Conditions

Local government or private enterprise manages solid waste in the area of the proposed Spaceport America. The region encompasses municipal landfills operated by the Otero-Lincoln Counties Solid Waste Authority; the South Central Solid Waste Authority (Las Cruces and Doña Ana County); Deming; Grant County Solid Waste Authority; and Waste Connections, Inc. (Doña

Ana). In addition, another private company, Rhino Environmental Services, Inc. has applied for a permit to construct and operate a landfill in southwestern Otero County. The City of Deming has applied for a permit to construct and operate a landfill near Cambray, 25 miles east of Deming near Interstate 10. The projected disposal capacity of these 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 with the availability of Camino Real Landfill and the Corralitos landfills operated by Waste Connections, Inc. The Camino Real Landfill, located in Sunland Park, receives the bulk of its waste from Texas and Mexico and has a life expectancy of more than 80 years (NMED, 2007).

Commercial hazardous waste facilities are available in the region. The Rinchem Company is permitted to store hazardous waste in containers in its Albuquerque and Chaparral facilities (NMED, 2001). The nearest hazardous waste disposal facility is Waste Control Specialists, LLC, located in Andrews, Texas, approximately 280 miles from the proposed Spaceport America site. The permitted disposal capacity of the facility is more than 5 million cubic yards (TCEQ, 2005).

Spaceport America Site

The proposed location for Spaceport America is currently used for cattle grazing and associated agricultural purposes on a combination of New Mexico State Trust Land and small private ranch sites. BLM-managed lands leased for grazing and used for outdoor recreation purposes such as hunting and hiking surround it. Currently no hazardous materials are handled and no hazardous wastes are produced within the proposed Spaceport America area, except for very small quantities associated with ranching machinery maintenance and operations at the two ranches currently operational within 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 (i.e., Superfund sites) in the proposed area.

3.10 Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks

This section describes the existing socioeconomic environment, environmental justice environment, and environment to evaluate children's health and safety risks of the areas in the vicinity of the proposed Spaceport America site. Socioeconomic issues are discussed in Section 3.10.1. Variables addressed in this section include demographics (population, educational attainment, income and poverty, and housing), employment/labor force characteristics, worker commuting patterns, and community services (emergency response and suppression services, medical facilities, and public schools). The environmental justice discussion, Section 3.10.2, presents data on minority populations and low-income populations. The third section details the existing environment to evaluate risks to children's health, Section 3.10.3.

3.10.1 Socioeconomics

3.10.1.1 Definition and Description

Socioeconomics include the social and economic indicators that are specific to the human environment. For the purposes of this document, social indicators include statistical data related to population (growth rates, race and ethnic classifications, educational attainment, and rates of poverty). Economic indicators are used to describe the economic health of a community. Key economic indicators include employment characteristics, unemployment rates, per capita and household income levels, and housing inventory characteristics.

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 area or community is available from the U.S. Census Bureau (USCB) on a national, State, or regional level. Specific socioeconomic data are available from the USCB for smaller geographical areas including cities, counties, and Census tracts. Detailed information regarding a community's educational institutions, medical services, and emergency response and suppression services is typically available from Federal, State or county/municipal sources.

3.10.1.2 Regulatory Setting

Many of the variables or proxies used to analyze the socioeconomic environment, such as educational facilities and housing for example, are regulated though a host of Federal programs that provide for equal opportunity, anti-discrimination, and accessibility.

3.10.1.3 Region of Influence

The ROI for the proposed Spaceport America Project is defined as the area in which the principle direct and secondary or indirect effects on socioeconomic variables arising from the proposed Project's actions are likely to occur. For the Spaceport America socioeconomic analysis, the ROI is defined as Doña Ana, Otero, and Sierra Counties in New Mexico.

Three factors were considered in determining the geographic area that defines the socioeconomic ROI. The first was the degree of linkage among the economies of the various communities in the region, including worker commuting county-to-county flow patterns. The second factor was the residential distribution pattern of an existing labor force within reasonable commuting distance to the proposed site. The third factor was the self-determined potential economic impact as measured by the willingness of each county's government to place on the public ballot an item to support development of Spaceport America via an increase in the county's gross receipts tax rate. Doña Ana, Otero, and Sierra counties met this third criterion. After examining the three factors, the socioeconomic ROI for Spaceport America was determined to be Doña Ana, Otero, and Sierra counties.

3.10.1.4 Existing Conditions

The U. S. Census 2000 reports a total population of 250,250 persons for the three-county ROI of the proposed Spaceport America. The population within Doña Ana, Otero, and Sierra Counties represents 14 percent of New Mexico's population in 2000.

Population density varies considerably within the ROI. Doña Ana County has 45.9 persons per square mile, Otero County has 9.4 persons per square mile, and Sierra County, the host county for the proposed Spaceport America Project, has 3.2 persons per square mile. Exhibit 3.10-1 presents the population and population density figures from the 2000 Census.

Exhibit 3.10-1. Population and Population Density, 2000

Jurisdiction/Region	Population	Population Density (persons per square mile)
United States	281,421,906	79.6
New Mexico	1,819,046	15.0
Doña Ana County	174,682	45.9
Otero County	62,298	9.4
Sierra County	13,270	3.2
ROI Total	250,250	-

Source: USCB, 2008

Population

Exhibit 3.10-2 shows the 2005 population estimates and population growth rates for the United States, the State of New Mexico, and for each of the three counties in the ROI. The USCB estimates that the population growth rate in the ROI was 6.2 percent from 2000 to 2005. This rate is slightly greater than the estimated population growth rate for New Mexico and is greater than the growth rate for the United States. Among the three counties in the region of influence, Doña Ana County is estimated to have gained 14,762 people, Otero County is estimated to have gained 1,240 residents, and Sierra County, the proposed location of Spaceport America, is estimated to have 455 fewer residents in 2005 than in 2000.

Exhibit 3.10-2. Estimated Population and Population Growth Rates, 2000 - 2005

Jurisdiction/Region	Population 2005 Estimate	Growth 2000 – 2005
United States	296,410,404	5.3 %
New Mexico	1,928,384	6.0 %
Doña Ana County	189,444	8.5 %
Otero County	63,538	2.0 %
Sierra County	12,815	-3.4 %
ROI Total	265,797	6.2 %

Source: USCB, 2006.

Educational Attainment

Exhibit 3.10-3 depicts a profile of the highest educational attainment of people 25 years and older, as reported in the 2000 Census. Residents of the ROI have an educational attainment level reflective of the nation and New Mexico. Approximately 50 percent of the residents in each county in the ROI have a high school diploma or less formal education and just less than half of the residents 25 years old or older have at least some college.

Exhibit 3.10-3. Educational Attainment by Percentage of Population 25 Years and Over, 2000

Jurisdiction	No High School Diploma or Equivalent	High School Graduate or Equivalent	Some College, No Degree	Associate Degree	Bachelor's Degree	Graduate or Professional Degree
United States	19.6%	28.6%	21.0%	6.3%	15.5%	8.9%
New Mexico	21.1%	26.6%	22.9%	5.9%	13.6%	9.8%
Doña Ana County	29.9%	22.4%	19.9%	5.4%	13.1%	9.2%
Otero County	19.0%	29.2%	27.9%	8.5%	9.2%	6.3%
Sierra County	23.9%	31.4%	25.9%	5.7%	7.8%	5.4%

Source: USCB, 2000a

Income and Poverty

Exhibit 3.10-4 presents a comparison of per capita income, median household income, and rates of poverty for individuals for the United States, New Mexico and the counties in the ROI. The information indicates that the ROI has a lower median household income and a lower per capita income than the United States or New Mexico. In addition, the ROI has a higher percentage of its population living in poverty than is the case in the United States. 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 rate of poverty. All three counties have poverty rates that are 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.

Exhibit 3.10-4. Income and Poverty by Jurisdiction

Jurisdiction	Per Capita Income (1999)	Median Household Income (2004)	Individuals Living Below Poverty (2004)
United States	$21,587	$44,334	12.7%
New Mexico	$17,261	$37,838	16.7%
Doña Ana County	$13,999	$30,740	23.0%
Otero County	$14,345	$32,400	15.2%
Sierra County	$15,023	$23,821	20.4%

Source: USCB, 2008.

Housing

As shown in Exhibit 3.10-5, Doña Ana County has the majority of housing units in the ROI. The home ownership rate in the county is slightly higher than that of the United States, but lower than that of New Mexico. The home ownership rate in Otero County reflects national data, but is slightly lower than the home ownership rate in New Mexico. The home ownership rate in Sierra County is higher than that for both the United States and New Mexico. The median value of owner-occupied housing units in all three counties was significantly lower than that of the nation or New Mexico.

Exhibit 3.10-5. General Housing Profile

Jurisdiction	Total Housing Units (2006)	Vacant Housing Units (2000)	Home Ownership Rate (2000)	Housing Units in Multi-Unit Structures (2000)	Median Value of Owner-Occupied Housing (2000)
United States	126,316,181	10,424,540	66.2%	26.4%	$119,600
New Mexico	850,095	124,120	70.0%	15.3%	$108,100
Doña Ana County	74,654	5,654	67.5%	16.3%	$90,900
Otero County	30,612	6,288	66.9	7.6%	$78,800
Sierra County	9,151	2,614	74.9%	9.6%	$77,800

Source: USCB, 2008.

Temporary housing options in the ROI include the numerous commercial campgrounds and full-service recreational vehicle parks in the ROI. There is also some camping and recreational vehicle hook-ups in State parks. All three counties have recreational vehicle parks with full services.

Other temporary or short-term housing options include motels/hotels in the ROI. The majority of the hotel/motels are in Alamogordo and Las Cruces area. There are several extended stay hotel/motels in the area.

Employment and the Labor Force

Exhibit 3.10-6 summarizes the employment statistics for the nation, New Mexico and the counties in the ROI. In February 2007, the unemployment rate in each county in the ROI was higher than the rate for New Mexico, but lower than the national rate.

Exhibit 3.10-6. Employment Profile, February, 2007

Jurisdiction	Civilian Labor Force	Number Employed	Number Unemployed	Unemployment Rate
United States	151,879,000	144,479,000	7,400,000	4.9%
New Mexico	934,110	899,083	35,027	3.7%
Doña Ana County	85,956	82,110	3,846	4.5%
Otero County	26,156	25,169	987	3.8%
Sierra County	5,392	5,151	241	4.5%

Source: NMDL, 2008

Exhibit 3.10-7 identifies employment sectors and the percent of workers employed in those sectors. Employment in the ROI reflects patterns similar to State of New Mexico employment profiles. Otero and Sierra counties have lower rates of persons working in Managerial and Professional positions and higher rates of workers in Services and in Construction, Extraction, and Maintenance. Many more Sierra County workers are employed in the Farming, Fishing, and Forestry sector, as a percentage, than are workers in the United States or in New Mexico. Occupations of workers in Doña Ana County are reflective of sector employment trends in New Mexico.

Exhibit 3.10-7. Percent of Workers Employed by Occupation, 2000

Jurisdiction	Management Professional	Service	Sales, Office	Farming Fishing, Forestry	Construction, Extraction, Maintenance	Production, Transportation, Moving
United States	33.6%	14.9%	26.7%	0.7%	9.4%	14.6%
New Mexico	34.0%	17.0%	25.9%	1.0%	11.4%	10.7%
Doña Ana County	32.3%	18.3%	25.1%	1.8%	11.0%	11.6%
Otero County	28.3%	18.8%	22.4%	1.1%	16.3%	13.1%
Sierra County	26.85	22.7%	21.75	3.2%	16.3%	9.4%

Source: USCB, 2000b.

County-to-County Worker Commuting Patterns

There are economic linkages between the three counties in the ROI. The 2000 Census determined that 231 Doña Ana County workers commute to a workplace in Sierra County. These workers represent 5.4 percent of the workforce in Sierra County. There are 163 Sierra County residents who commute to a workplace in Doña Ana County. No Otero County residents commute to Sierra County, the location of the proposed Spaceport America site, and no Sierra County resident commuted to Otero County for work in 2000 (USCB, 2000c)

Emergency Response and Suppression Services (Police and Firefighters)

For this subsection, White Sands Missile Range (WSMR) is included as part of the socioeconomic study area or ROI because the emergency response personnel at WSMR would assist the county responders, if called upon. Exhibit 3.10-8 summarizes various emergency response and suppression services in the ROI.

Exhibit 3.10-8. Law Enforcement and Firefighters in ROI

Region	Law Enforcement Officers[1]	Firefighters (Paid) [2]	Firefighters, (Volunteer) [2]
New Mexico	5,373	Not available	No official count
Doña Ana County	429	107	380
Otero County	26	0	215
Sierra County	29	0	170
WSMR	Military & contract	652	0

Source: [1] FBI, 2005; [2] U S Fire Administration, 2008

Most firefighting and law enforcement units in the ROI share Mutual Aid Agreements that allow cross-coverage for emergencies.

Medical Facilities

The residents of the ROI are served by the following hospitals/health centers (AHA, 2007).

- Gerald Champion Regional Medical Center (Otero County); 99 staffed beds
- Sierra Vista Hospital (Sierra County); 25 staffed beds
- Memorial Medical Center (Doña Ana County); 177 staffed beds
- Mesilla Valley Hospital (Doña Ana County); 125 staffed beds
- Mountainview Medical Center (Doña Ana County); 142 staffed beds
- Peak Behavioral Health Services (Doña Ana County); 36 staffed beds
- Rehabilitation Hospital of Southern New Mexico (Doña Ana County); 40 staffed beds
- U.S. Public Health Service Indian Hospital (Otero County); 11 staffed beds

Public Schools

School districts in New Mexico do not follow county boundary lines. There are seven school districts that lay at least partially within counties in the ROI. During the 2006-2007 school year, these districts served 48,585 students or approximately 15 percent of the students in New Mexico public schools that year. Students residing in Doña Ana County attend schools in the Hatch Valley, Las Cruces, and Gadsden school districts; students residing in Otero County attend schools in Tularosa, Cloudcroft, Alamogordo, and Gadsden school districts; and students residing in Sierra County attend schools in the Truth or Consequences school district. Exhibit 3.10-9 provides a profile of seven school districts located, at least in part, within the ROI.

Exhibit 3.10-9. Public School District Profile, 2006 – 2007 school year

School District	Number of Schools (K-12) [1, 2]	Total Student Enrollment [1, 3]	Teacher-Student Ratio [1,4]
New Mexico, all districts	818	325,731	1:15.5
Alamogordo	17	6,521	1:16.0
Cloudcroft	3	470	1:13.3
Gadsden	21	13,898	1:16.8
Hatch	5	1,408	1:14.4
Las Cruces	37	23,798	1:14.8
Truth or Consequences	6	1,474	1:14.6
Tularosa	4	1,016	1:12.6

[1] Excludes Charter Schools

Source: [2] NMPED, 2007a; [3] NMPED, 2007b; [4] NMPED, 2007c

Taxes

New Mexico has a personal income tax, corporate income and franchise tax, gross receipt tax (instead of a sales tax), real property tax, and numerous special taxes. The personal income tax rate ranges from 1.7 to 5.3 percent of taxable income and corporate income tax rate ranges from 4.8 to 7.6 percent of net taxable income. Gross receipts taxes are levied on the sale on most goods, both tangible and intangible. Unlike many other states, New Mexico collects gross receipts taxes (sales tax) on the sale and performance of services. The gross receipt taxes contribution ranges from 5.125 to 7.875 percent because the total rate includes the State rate (which is determined by State law) in addition to varying rates imposed by counties (up to 4.3125 percent) and municipalities (up to 4.0625 percent). Real property, but not personal property, rates vary substantially and depend on the type of property and location. New Mexico properties are subject to one of about 500 tax rates, depending on property type and location. Exhibit 3.10-10 presents data on the gross receipt tax and property tax rates by municipalities in the three-county ROI (New Mexico Taxation & Revenue, 2007).

3.10.2 Environmental Justice

3.10.2.1 Definition and Description

Environmental justice has been defined as 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. Concern that minority and/or low-income populations might be bearing a disproportionate share of adverse health and environmental impacts led to Executive Order 12898 in 1994 to address these issues. When conducting NEPA evaluations, the FAA incorporates environmental justice considerations into both its technical analyses and its public involvement program in accordance with U.S. EPA and CEQ regulations.

Exhibit 3.10-10. Gross Receipt and Property Tax Rates by Municipalities in the ROI, 2007

County/Municipality	Gross tax Receipt Rate	Rate per $1,000/Net Taxable Value [1, 2]
Doña Ana County		
Hatch	7.0000	28.315
Las Cruces	7.1250	26.985
Mesila	7.3750	21.901
Sunland Park	7.0000	30.563
Remainder of County	5.9375	NA
Otero County		
Alamogordo	7.2500	27.229
Cloudcroft	7.0000	17.162
Tularosa	7.0000	26.711
Remainder of County	5.8125	NA

Exhibit 3.10-10. Gross Receipt and Property Tax Rates by Municipalities in the ROI, 2007 (cont'd)

County/Municipality	Gross tax Receipt Rate	Rate per $1,000/Net Taxable Value [1, 2]
Sierra County		
Elephant Butte	6.8750	22.53
Truth or Consequences	7.2500	21.683
Williamsburg	7.1875	21.768
Remainder of County	5.9375	NA

Source: New Mexico Taxation & Revenue, 2007
1 Net taxable value is the property market value divided by 3
2 Rates stated are for New Mexico residents; out-of-state residents have a higher rate
NA = not applicable

3.10.2.2 Regulatory Setting

The CEQ, which oversees the Federal government's compliance with EO 12898 and NEPA, developed guidelines (CEQ, 1997) to assist Federal agencies in incorporating the goals of EO 12898 into the NEPA process. The CEQ guidance does not provide a standard approach or formula for identifying and addressing environmental justice issues. Instead, it offers Federal agencies general principles for conducting an environmental analysis under NEPA, including that Federal agencies should consider the population structure in the ROI to determine whether minority populations, low-income populations, or Indian tribes are present, and if so, whether there may be disproportionately high and adverse human health or environmental effects on any of these groups.

3.10.2.3 Region of Influence

The ROI for environmental justice analysis consists of the three counties in the ROI and more specifically, the three Census tracts surrounding the proposed Spaceport America site. Census tracts are smaller geographical units than counties. These Census tracts were analyzed independently of the counties of which they are a part because they represent the area most likely to experience any potential impacts caused by the construction and operation of the Proposed Action. The State of New Mexico serves as the geographic region for comparative analysis.

3.10.2.4 Existing Conditions

Minority Populations

For the purpose of this evaluation, minority refers to people who identified themselves in the Census as Black or African American, Asian or Pacific Islander, American Indian or Alaskan Native, other non-White races, or as being of Hispanic or Latino origin. Persons of Hispanic and Latino origin may be of any race (CEQ, 1997). The CEQ identifies these groups as minority populations when either (1) the minority population of the affected area exceeds 50 percent or (2) the minority population percentage in the affected area is meaningfully greater than the minority population percentage in the general population or appropriate unit of geographical analysis. The term "meaningfully greater" is 20 percent greater than the geographic region of comparison (most often the State in which the affected area is a part). The geographical unit for comparison in this analysis is the State of New Mexico.

Demographic information from the 2000 decennial Census was used to identify minority populations in the three-county region of influence and in the three Census tracts, which are a part of two of these counties, surrounding the proposed Spaceport America site. The location of the three Census tract boundaries is shown in Exhibit 3.10-11.

As shown in Exhibit 3.10-12, persons of a minority race or ethnicity were approximately 68 percent of the population in Doña Ana County in 2000. The two Census tracts in Doña Ana County adjacent to the Spaceport America site, Census Tract 13.01 and Census Tract 14, had 57 percent and 82 percent racial or ethnic minority persons, respectively. Persons of Hispanic or Latino origin accounted for 63 percent of the total Doña Ana County population. Non-Hispanic, White persons accounted for 32.5 percent of the total County population. The aggregate minority populations for neither of the two Census tracts in Doña Ana County were meaningfully greater than the corresponding minority population in Doña Ana County. The Hispanic or Latino Origin populations in Census Tract 13.01 and Census Tract 14 exceeded 50 percent of the total populations for those Census tracts. However, the concentration of the Hispanic populations in these Census tracts was similar to the concentration of the Hispanic population in Doña Ana County.

Otero County had an aggregate minority population of 44 percent which is less than the New Mexico aggregate population of 55 percent. No Census tract in Otero County is adjacent to the Spaceport America site.

Census Tract 9824 in Sierra County had an aggregate minority population of 29.9 percent, which is virtually identical to the Sierra County aggregate minority population of 29.5 percent. Persons of Hispanic or Latino Origin accounted for 26.2 percent of the aggregate minority population in Census Tract 9824 and 26.3 percent of the aggregate minority population in Sierra County. White non-Hispanic persons accounted for approximately 71 percent of the Sierra County population.

Low-Income Populations

Environmental justice guidance defines low-income using statistical poverty thresholds used by the USCB. Exhibit 3.10-13 identifies the three Census tracts adjacent to the Spaceport America site and provides poverty information about the three counties in the ROI. Approximately 21 percent of individuals residing in Sierra County are living below the poverty level. Approximately 25 percent of individuals in Doña Ana County are living below the poverty level. Approximately 19 percent of the Otero County residents live below the poverty line. Individuals living in Doña Ana Census Tract 14 have a greater, but not statistically meaningful greater, rate of poverty. Approximately 37 percent of residents in Doña Ana Census Tract 14 lived below the poverty line in 2000 and approximately 16 percent of the individuals in Census Tract13.01 of Doña Ana County lived below the poverty line. Sierra County's Census Tract 9824 has about 19 percent of the population living below the poverty line, a rate similar to the County and to the State of New Mexico.

Exhibit 3.10-11. Census Tracts Containing the Proposed Spaceport America Site

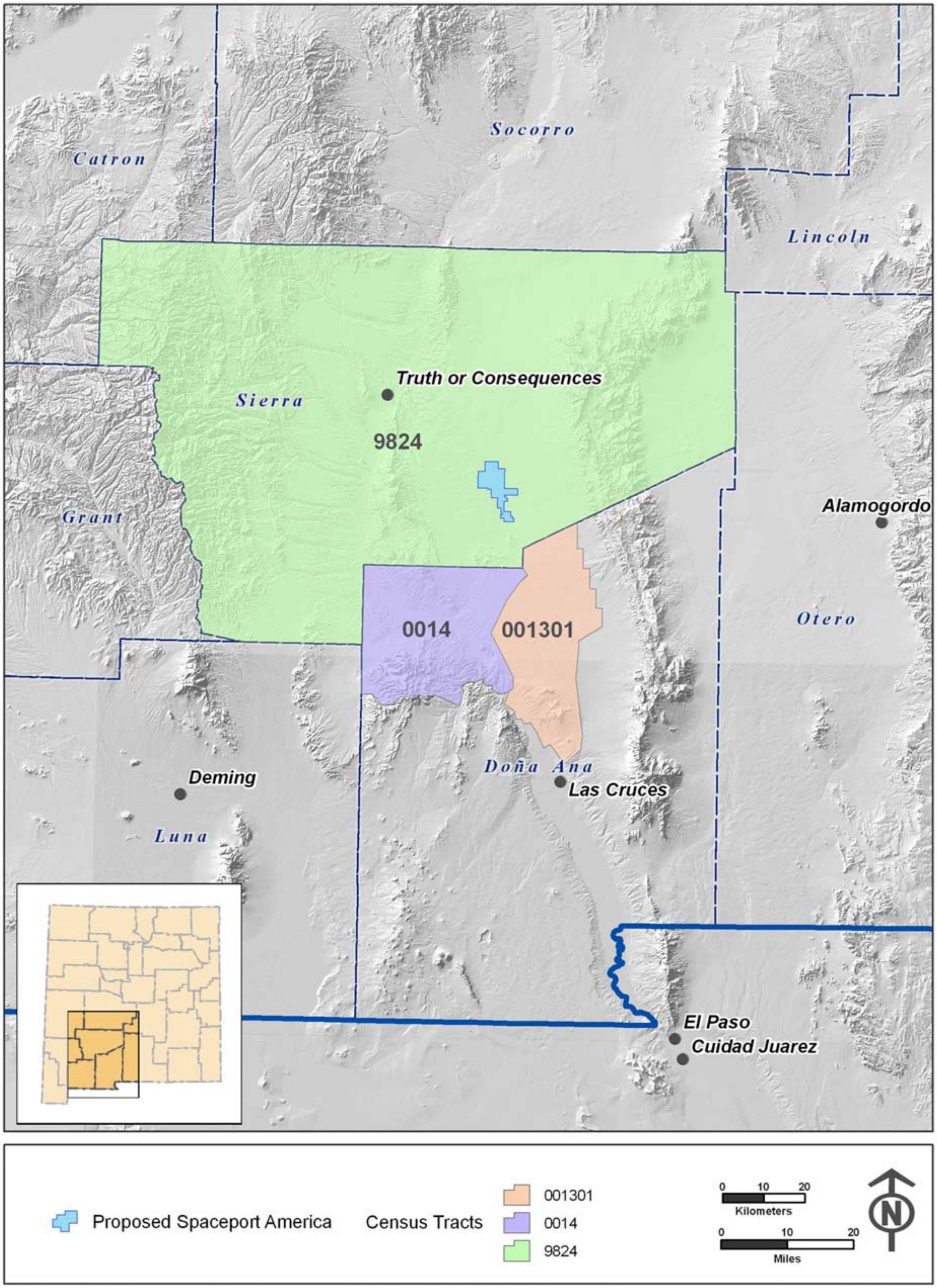


Exhibit 3.10-12. Racial and Ethnic Characteristics

Subject	USA	New Mexico	Doña Ana County	Census Tract 13.01 (Doña Ana County)	Census Tract 14 (Doña Ana County)	Otero County	Sierra County	Census Tract 9824 (Sierra County)
Total Population	281,421,906	1.819,046	174,682	9,806	5,587	62,298	13,270	5,477
Minority Races								
Black or African American	12.3%	1.9%	1.6%	1.1%	0.0%	3.9%	0.5%	0.2%
American Indian, Alaskan Native	0.9%	9.5%	1.5%	0.7%	0.5%	5.8%	1.5%	1.2%
Asian	3.6%	1.1%	0.8%	0.5%	0.1%	1.2%	0.2%	0.2%
Native Hawaiian, Pacific Islander	0.1%	0.1%	0.1%	0.0%	0.1%	0.1%	0.1%	0.1%
Some other race	5.5%	17.0%	24.7%	0.1%	0.1%	11.7%	8.3%	7.5%
Two or more races	2.4%	3.6%	3.6%	1.0%	0.4%	3.6%	2.5%	2.2%
Minority: Hispanic or Latino								
Hispanic or Latino (any race)	12.5%	42.1%	63.4%	53.1%	80.9%	32.2%	26.3%	26.2%
Aggregate Minorities	**30.9%**	**55.3%**	**67.5%**	**56.5%**	**82.0%**	**44.3%**	**29.5%**	**29.9%**
White, non-Hispanic	69.1%	44.7%	32.5%	43.5%	18.0%	55.7%	70.5%	71.1%

Source: USCB, 2000d and 2000e

Exhibit 3.10-13. Persons below Poverty Level, 2000

	Total Number of Persons [1]	Persons below Poverty Level	Percent Persons Below Poverty Level
United States [2]	273,882,232	33,899,812	12.4
New Mexico [2]	1,783,907	328,933	18.4
Doña Ana County [2]	174,682	43,054	25.4
Census Tract 13.1 [3]	9,753	1,571	16.1
Census Tract 14.0 [3]	5,581	2,082	37.3
Otero County [2]	60,893	11,737	19.3
Sierra County [2]	13,270	2,706	20.9
Census Tract 9824 [3]	5,458	1,013	18.6

[1] The U S Census Bureau does not determine poverty status for all individuals, therefore total population numbers cited in this table may not agree with Total Population numbers appearing elsewhere in this document.
Source: [2] USCB, 2000b; [3] USCB, 2000e

Migrant Workers and Transient Populations

Transient populations include persons traveling from outside the area, for reasons other than work, that might reasonably be expected to stay overnight in the area. Those passing through the area, without an overnight stay, are not included in the migrant and transient population discussion. The 2002 Census of Agriculture determined that there were 272 farms in New Mexico that employ migrant labor. There are 45 farms in Doña Ana County, 2 farms in Otero County, and eight farms in Sierra County that employ migrant workers (USDA, 2000). Transient populations also include visitors to hotels, motels, bed & breakfast inns, hunting lodges, spas, and camps and recreational vehicles parks. The New Mexico Tourism Department (2008) reports that Las Cruces in Doña Ana County has 2,200 rooms and Truth or Consequences in Sierra County has 300 rooms (NMTD, 2008). The New Mexico Lodging Association (2008) lists one hotel with 91 rooms in Alamogordo in Otero County. Examples of big annual events that attract transients to the ROI include the Hatch Chile Festival in Doña Ana County and The Whole Enchilada Festival in Las Cruces, also in Doña Ana County (NMTD undated).

3.10.3 Children's Environmental Health and Safety Risks

3.10.3.1 Definition and Description

Agencies must ensure that their policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks. EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, requires proposed actions to be examined for their tendency to disproportionately affect children and pose a greater risk to the safety and health of children.

3.10.3.2 Regulatory Setting

EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, directs Federal agencies, as appropriate and consistent with the agency's mission, to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children.

3.10.3.3 Region of Influence

The ROI for children's environmental health and safety risks consists of three Census tracts surrounding the proposed Spaceport America site. These Census tracts were included because they are the areas most likely to experience any potential impacts of the Proposed Action.

3.10.3.4 Existing Conditions

The immediate area surrounding the proposed site is nearly vacant of human population for a radius of 17 miles. Three cattle and livestock ranches operate within this radius and report a combined population of fewer than 20 persons. The nearest public school to the Spaceport America site is Truth or Consequences Elementary in the City of Truth or Consequences, which is located approximately 18 miles northeast of the proposed Spaceport America site.

Exhibit 3.10-14 summarizes the distribution of population by age for these three Census tracts, for the three counties in the ROI, the State of New Mexico, and for the U.S. The data indicate that the age distribution of Doña Ana County as a whole closely tracks age distribution in New Mexico and the United States. The same is true for Census Tract 13.01. Census Tract 14, also in Doña Ana County, has a slightly higher population of children under 5 years old and about 10 percent higher population of 5 to 19 year olds. Data is presented for Otero which has no Census tract adjacent to the Spaceport America site. The data for Sierra County and for Census Tract 9824, which is the location of the proposed Spaceport America site, reports a lower percentage of children under the age of 5, as well as children aged 5 through 19, than the populations in New Mexico and the United States.

Exhibit 3.10-14. Distribution of Population by Age, 2000

Region	Under 5 years	5 - 19 years	20 - 44 Years	45 – 64 Years	65 and Older
United States	6.8%	21.8%	36.9%	22.0%	12.4%
New Mexico	7.2%	23.9%	35.1%	22.2%	11.7%
Doña Ana County	7.8%	26.2%	36.1%	19.2%	10.6%
Census Tract 13.01	8.1%	23.4%	36.4%	21.7%	10.5%
Census Tract 14	9.2%	32.7%	30.2%	17.6%	10.3%
Otero County	7.4%	24.7%	35.2%	21.0%	11.7%
Sierra County	4.8%	17.2%	23.0%	27.3%	27.7%
Census Tract 9824	4.6%	17.8%	22.3%	30.7%	24.4%

Source: USCB, 2000f

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4. ENVIRONMENTAL CONSEQUENCES

This Chapter describes the potential environmental consequences of the Proposed Action and the Alternatives, as described in Chapter 2. The analyses are based on information from Chapter 2, descriptions of the existing environment in Chapter 3, and other information described or referenced in this chapter. Both direct and indirect impacts are considered in the EIS. Direct impacts are those caused by the Proposed Action or Alternatives that occur at the same time and place (or immediately thereafter). Direct impacts of a large development project could include construction-related impacts such as soil erosion and disturbance of wildlife or operations-related impacts such as emissions of air or water pollutants. Indirect impacts are reasonably foreseeable effects of the action that are likely to be manifested in the future or at some distance from the site. Indirect impacts could include strains on infrastructure, resources or public services associated with a large development project or new regional development.

4.1 Compatible Land Use

Impacts on land use are determined by comparing established land uses with the changes that would result from the Proposed Action or Alternatives, including induced effects. The significance of impacts is determined by assessing the degree that the proposed conflicts with established land uses in the area disrupts or divides established land use configurations, represents a substantial change in existing land uses, or is inconsistent with adopted land use plans. The analysis addresses both the proposed Project site and adjacent areas, and secondary effects such as growth-inducing effects that projects can have locally and regionally. For spaceport or airport operations, change in noise conditions is generally an important indicator in determining compatibility with existing land uses especially in areas where there are many sensitive receptors.

The screening process for potential locations, and infrastructure planning associated with the development of a commercial spaceport in New Mexico, are described in Chapter 2. Over the past ten years, the NMSA has worked and continues to work with public and private entities to develop a location and Project that considers retention of the traditional and designated land uses in the area. Examples of Project changes and commitments pertaining to compatible land use include the following:

- The NMSA has issued a letter to BLM establishing a policy of not seeking to close access to the public lands surrounding the proposed location (Sumpter, 2006).
- The NMSA has committed to working with BLM, other government agencies, and landowners to allow current uses to coexist with Spaceport America. A ranch management plan is being developed that will outline measures to ensure that the current grazing, habitat restoration, and other activities consistent with the multiple use philosophy of these land management agencies will continue to the extent that is practical.
- The NMSA intends to place security fencing only around the facilities and infrastructure associated with launch and launch support activities (approximately 1,400 acres), which would minimize habitat fragmentation and loss of grazing and wildlife habitat areas.
- With regard to the land and cultural landscapes associated with the El Camino Real de Tierra Adentro NHT and the Aleman Draw Historic District (described in detail in Section 3.3), the NMSA is committed to:

- Improving and using a single existing road that already crosses the NHT rather than developing new crossings;
- Placing infrastructure along existing roads and/or rights of way rather than developing previously undisturbed lands for utilities;
- Placing utilities underground where appropriate and feasible;
- Using van pooling and bussing to reduce traffic and minimize the need for parking facilities; and
- Using color, texture, height and distance measures at facility locations to minimize visual impairment of the setting including the NHT.

In designing and siting facilities, the NMSA has committed to minimizing the amount of change to existing land uses to the extent possible. The total land area disturbed by Spaceport America development and operations is a very small fraction of the State-owned land area available in the geographic region, and the impacts on Federal land use and lands with special designations in the surrounding areas would be reduced or eliminated by the actions described above and other measures to be developed. Potential induced effects include the development of visitor and construction support services on private land, most likely in the I-25 corridor. Current local land use plans do not account for the expected changes in land use, but the affected counties and the State have been actively involved with the development and planning for Spaceport America. The environmental consequences of the Proposed Action and Alternatives on compatible land uses are not considered significant.

4.1.1 Proposed Action

4.1.1.1 Construction

About 970 acres of the total of approximately 16,000 acres of New Mexico State Trust Lands within the proposed Spaceport America Project area would be disturbed for Spaceport America facilities and operations. Direct land use impact from facility and infrastructure development on land cover would be limited to about 6 percent of the total Project area. All of the construction except a portion of the entrance road and some utility lines would be on State lands. Of the total area in the Jornada del Muerto Basin (approximately 3,344 square miles) (NMSU, 2008), an insignificantly small percentage would be directly affected. The size of the final footprint of all Spaceport America roads and facilities would be approximately 145 acres.

Indirect land use impacts could occur to the 94 percent of lands within the proposed Spaceport America Project area that are not physically disturbed; and to the BLM-administered lands surrounding the proposed Spaceport America Project area. Although high quality wildlife habitat would be lost, fragmentation of existing wildlife habitat and effects on the adjacent Jornada del Muerto Wildlife Habitat Area would be minimized by measures developed in cooperation with the BLM and the NMDGF. The BLM is also conducting restoration on public and private lands to increase grassland habitat in the Jornada del Muerto. Fenced areas would not enclose water sources for wildlife, but their proximity to spaceport activities may discourage use and require development of new sources. This would be determined in the ranch/allotment development plan being prepared by NMSA, the ranchers, NMSLO, and BLM. New fencing would not result in significant habitat fragmentation, considering the large amount of similar habitat elsewhere within the proposed Spaceport America boundaries and in adjacent lands.

Barbed wire fencing both between and within grazing allotments is already present and extensive in the Spaceport America area.

In the developed area, the land use would be changed from current open space and grazing use to an operational spaceport. Agreements for the lease of lands for spaceport development are designed to allow the private ranching operations to co-exist with the spaceport to the extent that it is practical. There would be a direct loss of land available for grazing because of this development, however compensation would be provided for the expected impact, including impacts to ranch infrastructure and evacuation, if required. Because the State grazing leases provide some of the base property or base water for the BLM grazing lease areas, adjustments to both State and adjacent BLM grazing lease permits and allotments may be needed. Planned grassland habitat restoration treatments on public and private lands are not intended to increase livestock numbers, so lands outside of the developed area would not be used to compensate for the loss of grazing on the 1,400 acres. These lands outside of the developed area, however, would continue to be available for grazing, except during times of required rest during the growing season after the grassland projects are completed.

The NMSLO would be compensated for not exercising rights to develop minerals, construct roads or grant other easements that might impair the operation of the spaceport.

During construction there would be a temporary increase in workers, heavy equipment use, truck traffic, emissions, fugitive dust, and potential for hazardous material, and erosion. Off-site there may be some growth inducing effects and development of construction support facilities and services on private land, most likely in the I-25 corridor.

During construction, recreational uses of the State Trust Lands would continue on a permit basis and access to recreation on adjacent BLM land would be maintained. In some areas access would be restricted to protect facilities and for safety concerns, but recreational use would continue. Construction traffic and noise in the vicinity of the NHT could interfere in the short-term with the quality of the rural setting and recreational experience that current Trail visitors enjoy.

The amount of land that would be disturbed or otherwise affected by the construction of Spaceport America is relatively small in comparison to the total land area in the Jornada del Muerto Basin, approximately 0.045 percent. However, some of this land is high quality grassland wildlife habitat and grazing land. The physical impacts during the construction phases on the site and adjacent land would be temporary in duration. The total land use impact by construction is not considered significant.

4.1.1.2 Operations

Operations are described in Section 2.1.3, which outlines the types of vehicles, activities, and launch profiles for the 5-year period of the Launch Site Operator license. Non-launch operations include airspace operations, fuel and propellant transport and storage, ground-based tests and static firings, training, X Prize Cup events, and support services.

The primary types of vehicles are expected to be reusable, but expendable suborbital vehicles are also anticipated. The vehicles and their components are designed to return safely to Spaceport America or WSMR lands. These missions are expected to be performed for public exhibition, space tourism, commercial payloads, and developmental flights to obtain flight experience and data for the purpose of obtaining additional launch licenses.

Direct land use impacts from launch operations would be limited to those lands converted from rangeland to vertical and horizontal launch and support facilities, and areas already designated on WSMR for landing. Because the actual land area disturbed for launch operations is less than 6 percent of the total of more than 16,000 acres of land within the proposed Spaceport America Project area, the direct land use impact of launch operations is considered minimal.

Recreational uses of the State Trust Lands would continue under terms to be developed in the ranch management plan in cooperation with the NMSLO, NMDGF and the BLM. In some areas access would be restricted to protect facilities and for safety concerns, but recreational use would continue. Access to recreation on adjacent BLM land would be maintained. Spaceport America would not affect the development of interpretive and recreational sites for the NHT. The presence of Spaceport America and X Prize Cup events may increase visitor knowledge and interest in the NHT 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.

Indirect impacts of operations could come from noise, air emissions and visual effects generated by vertical or horizontal launch activities and non-launch activities. Effects would be minor and intermittent and would not result in a substantial impairment of current land uses.

Noise consequences are discussed in Section 4.3. There would be an increase in infrequent noises from aircraft and launches and an increase in levels of background noise, traffic noise, and occasional loud noise associated with these activities. Noise could affect current recreational, residential, and wildlife conservation land uses. It is possible that inhabitants of the nearby dwellings and occasional visitors to the lands around Spaceport America could be annoyed by the increase in noise above the current background levels and occasional loud noise. Residential and recreational users would be few and the levels and frequency of noise would not result in a substantial impairment of current land uses. Increased noise could also startle wildlife and grazing animals, but studies have failed to detect observable effects of noise on mammal behavior near airports and military training areas, places where noise sources are similar to those at a spaceport. Noise effects would not impair grazing and wildlife conservation land uses.

Air emissions from the proposed launch operations at Spaceport America are discussed in Section 4.6. Consideration of deposition from a ground cloud near a launch site is found in Geology and Soils, Appendix D. These analyses indicate that normal vertical launch activities present no major air quality issues that would result in a substantial impairment of current land uses. These analyses do indicate, however, that a potential health threat from HCl (and perhaps Al_2O_3) potentially could exist around and downwind from an accident site involving an LV using solid propellants (e.g., small Concept V1 LV's). A Launch Operator's License would specify measures to protect the public against toxic release hazards. Launches may be rescheduled if conditions warrant and areas may be cleared for safety reasons, but these effects on land use and access would be temporary and would likely involve very few people. The potential for effects on livestock and forage would need to be considered in determining range locations in the ranch/allotment management plan. Fugitive dust associated with travel on unpaved surfaces would increase, especially during special events. Dust may be an annoyance for residents and recreational users.

Visual impacts and light emissions are discussed in Section 4.4. Changes to the visual environment would occur due to horizontal and vertical launches, operation of conventional aircraft from the airfield, fugitive dust, and the use of security and safety lighting. The use of security and safety lighting would be minimal and would be in compliance with the New Mexico Night Sky Protection Act to avoid unnecessary light emissions.

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.

4.1.1.3 Summary of Impacts from the Proposed Action

The construction and operation of Spaceport America would retain most current land uses, while permanently changing land use in a small portion of the total Project area from rangeland to spaceport use and support facilities. There would be a direct loss of 1,400 acres of rangeland used by wildlife and livestock due to fencing and facilities. Livestock grazing opportunities on adjacent lands may be reduced due to loss of base waters or temporarily due to required land resting during the growing season after the grassland projects are completed. Cooperative efforts have been initiated and would be developed to continue economic, recreation, and habitat land uses and to reduce or offset any losses. Indirect impacts could come from increased noise, air emissions, vehicle use, visual effects, recreation and induced growth in adjacent areas. Temporary indirect impacts would be greatest during construction and special events. Effects on land use are not expected to be significant.

4.1.2 Alternative 1 – Horizontal Launch Vehicles Only

Environmental impacts to land use in the area of the proposed Spaceport America would be somewhat less if vertical launches were not supported at the facility. No construction of permanent vertical launch facilities would occur; the amount of change in land use and disturbed acreage would be reduced. There would be fewer direct and indirect impacts from construction and operation than under the Proposed Action.

4.1.3 Alternative 2 – Vertical Launch Vehicles Only

Eliminating horizontal launch activities from Spaceport America operations would result in fewer airfield facilities being constructed, reduced airspace operations, and elimination of the horizontal launches. Construction impacts from road improvements would only be marginally reduced, however, as road improvements would still be made as would internal access roads to the vertical launch area. There would be fewer direct and indirect impacts from construction and operation than under the Proposed Action due to fewer facilities and lower levels of launch and non-launch operations.

4.1.4 No Action Alternative

Under the No Action Alternative, the proposed Spaceport America would not be developed and no new licensed launch activity would occur in the area. Existing amateur launches and current land uses would continue in the foreseeable future, both on the Project site and in adjacent areas.

4.2 Section 4(f) Lands and Farmlands

Section 4(f) lands include publicly owned parks, recreational areas, wildlife or waterfowl refuges, or cultural resources that are listed on or are eligible for listing on the NRHP regardless of ownership. Potential impacts on Section 4(f) lands include physical taking of these lands in conjunction with a project on a permanent or temporary basis, and adverse indirect or proximity impacts (constructive use). When there is no physical taking, but there is the possibility of constructive use, the FAA must determine if the impacts would substantially impair the 4(f) resource. Substantial impairment occurs only when the protected activities, features or attributes are substantially diminished by the proposed Project. If there is no substantial impairment, the action does not constitute a constructive use and does not invoke Section 4(f).

Potential Section 4(f) lands in the vicinity of the proposed Spaceport America site include the publicly owned portions of the Jornada del Muerto Wildlife Habitat Area, the Aleman Draw Historic District, and any cultural resources that are eligible for inclusion on the NRHP and that warrant preservation in place. According to the National Trails System Act, designated protected components of the NHT, or sites or lands adjacent to historic trails that are independently determined eligible for the NRHP, may be subject to Section 4(f) if use would occur.

Impacts on farmlands are determined for Federal actions that have the potential to convert farmland to non-agricultural uses. The analysis of farmlands evaluates the impacts on agricultural production in the area; compatibility with State, local and private programs and policies to protect farmland; any disruption of the farming community either as a direct result of the construction or by changes in land use associated with the action; and non-viability of farm support services in the area as a result of farmland conversion. If prime or unique farmland land of statewide or local importance would be lost, the significance of the impact would be assessed using a standard scoring system for farmland conversion impacts developed by the NRCS (NRCS, 2007b). There is no Federal, State or locally-designated farmland within the Spaceport America Project site that is protected under the FPPA.

The siting and planning process for Spaceport America included measures to reduce land disturbance and loss of soils, minimize environmental, cultural, and visual impacts, and to maintain traditional and current land uses.

Aspects of the Proposed Action and measures pertaining to potential Section 4(f) lands include the following:

- The ranch/allotment management plan will address continuing measures to improve grassland habitat in the vicinity of Spaceport America and the Jornada del Muerto Wildlife Habitat Area.
- The NMSA intends to place security fencing only around the facilities and infrastructure associated with launch and launch support activities (approximately 1,400 acres), which would minimize habitat fragmentation.
- The NMSA is conducting surveys, NRHP evaluations, and impact analysis and is working with consulting parties on an agreement to avoid, minimize, or mitigate impacts on cultural resources.

- The NMSA would improve and use a single existing road that already crosses the NHT near the Aleman Draw Historic District, rather than developing new crossings.
- Infrastructure would be placed along existing roads and/or rights of way rather than developing previously undisturbed lands for utilities. Utilities would be placed underground where appropriate and feasible.
- Traffic associated with Spaceport America activities and events would be minimized by utilizing van pooling and bussing to the extent practicable.
- The NMSA would minimize the visual impairment to the setting of the potential Section 4(f) lands by minimizing exterior lighting and by using color, texture, height and distance measures at facility locations.

4.2.1 Proposed Action

Construction of the proposed Spaceport America, supporting facilities, and utility infrastructure would occur in phases, as described in Section 2.1.2. The total land area directly disturbed by Spaceport America development and supporting transportation and utility infrastructure is a very small fraction of the land base in the geographic region. Impacts on potential Section 4(f) lands in the surrounding areas would be avoided by the actions described above and additional measures described in Chapter 6. There are no prime or unique farmlands within the Spaceport America Project site, thus it is not discussed further in this analysis. The environmental consequences of the Proposed Action on potential Section 4(f) lands are not considered significant.

4.2.1.1 Construction

There would be no physical taking or any permanent or temporary use of the Jornada del Muerto Wildlife Habitat Area and thus no direct impacts on this potential Section 4(f) resource resulting from construction under the Proposed Action.

Direct impacts on cultural resources resulting from the construction of Spaceport America are described in detail in Section 3.5. Ground disturbance from construction activities would result in physical damage to resources in the physical APE. There is also the potential for undiscovered and buried cultural resources to be present in the physical APE. If identified and determined to be eligible for listing on the NRHP, Section 4(f) may be applicable to use of these historic properties. However, to be subject to Section 4(f), archaeological sites must also warrant preservation in place. Directly-affected historic properties include portions of the Aleman Draw Historic District, the NHT, and archaeological sites that are eligible for listing on the NRHP.

Improvements to the spaceport access road would straighten and divert the current dirt road away from the main ranch compound of Aleman Draw Historic District. However, realigning the road would permanently impact the southern portion of the district (which includes contributing and non-contributing elements of the historic property) and would cross the NHT route. There would also be a likely temporary use of the district during construction. It has not been determined whether this portion of the district warrants preservation in place or whether it is important chiefly because of what could be learned by data recovery as an archaeological site. Impacts are expected on the resource, but whether they would substantially impair the resource’s historical integrity and trigger a Section 4(f) use not been determined. If Section 4(f) use is determined, then the FAA must conduct an analysis to determine if there are any feasible and prudent alternatives to the use of this portion of the property. All other directly affected historic properties are archaeological sites that are significant for their information potential and are important because of what could be learned by data recovery. National historic trails are exempt from the provisions of Section 4(f) except where lands or sites adjacent to the Trail are listed or are eligible for listing on the NRHP.

Constructive use involves the evaluation of indirect or "proximity impacts" to a 4(f) resource. Associated with the construction phases would be a temporary increase in workers, heavy equipment use, truck traffic, equipment noise, emissions, fugitive dust, and potential for hazardous material, and erosion. The specific environmental consequences of this construction activity related to these resources are described in other sections of this EIS. Anticipated impacts on potential Section 4(f) lands would be localized and temporary. Effects would be minimized or avoided through measures described in Chapter 6. No constructive use or substantial impairment to potential Section 4(f) lands is anticipated. Substantial impairment occurs only when the protected activities, features or attributes of the Section 4(f) resource are substantially diminished.

4.2.1.2 Operations

There would be no physical taking or any permanent or temporary use of potential Section 4(f) lands and thus no direct impacts resulting from launch and non-launch operations under the Proposed Action.

Indirect impacts of launch operations on potential Section 4(f) lands could come from noise, air emissions and visual effects generated by vertical or horizontal launch activities and are similar to those described in Section 4.1 for compatible land use. Proximity effects would be minor and intermittent, and would not result in a substantial impairment.

Noise impacts are discussed in Section 4.3. Infrequent noises from aircraft and launches and an increase in noise above the current background levels would be expected. The levels and frequency of noise would not result in a substantial impairment of any potential Section 4(f) lands.

Air emissions from the launch operations at Spaceport America are discussed in Section 4.6. Consideration of deposition from a ground cloud near a launch site is found in the discussion on Geology and Soils (Appendix D). These analyses indicate that normal vertical launch activities present no major air quality issues that would result in a substantial impairment of potential Section 4(f) lands. An accident involving solid propellants could lead to the release of toxins but a Launch Operator's License would specify measures to protect against toxic release hazards and no effects on potential Section 4(f) lands would be anticipated.

Visual impacts are discussed in Section 4.4. Horizontal LV's departing the proposed airfield could fly over visually sensitive areas, and rocket exhaust plumes and/or contrails could be visible. Operation of vertical and horizontal LV's would be infrequent and would not be expected to result in significant visual impacts. Visual effects would not substantially impair the activities, features or attributes of potential Section 4(f) lands.

Non-launch operations at the proposed Spaceport America are described in Section 2.1.3.5 and include airspace operations, transport and storage of propellants and fuels, ground-based tests and static firings, training, X Prize Cup events and support services. Indirect impacts of non-launch operations on potential Section 4(f) lands are similar to those described in Section 4.1 for compatible land use.

Generally non-launch operations would result in an increase from current levels of background noise, traffic noise and occasional loud noise. Visual impacts could include increases in vehicle use and bus use on the regional roads, operation of conventional aircraft from the airfield, and the use of security and safety lighting. Visual impacts of aircraft and launches would be low because of their low frequency. Effects of security and safety lighting would be kept at less-than-significant levels by minimizing use and by using only lighting products and designs that meet the standards of the International Dark-Sky Association. During the 7-day X Prize Cup activities there could be a temporary influx of up to 20,000 visitors per day to the area. This could result in additional visual, noise, air quality, fugitive dust and traffic impacts as a result of visitors and vehicles. Impacts would be temporary, and would not result in a substantial impairment of any potential Section 4(f) lands.

4.2.1.3 Summary of Impacts from the Proposed Action

The Aleman Draw Historic District is an NRHP-eligible property that would be crossed by the proposed improvements to the spaceport access road. It has not been determined whether this portion of the district warrants preservation in place or whether it is important chiefly because of what could be learned by data recovery as an archaeological site. Whether this use would substantially impair the resource's historical integrity has not been determined. If the FAA determines that a substantial impairment constituting a use under Section 4(f) would occur, then the agency would conduct an analysis to determine if there are any feasible and prudent alternatives to the use of this portion of the property. All other potential Section 4(f) lands are either avoided by construction or are archaeological sites that are significant only for their information potential. Segments of the NHT that are not designated protected components of the Trail are not subject to the provisions of Section 4(f) except where lands or sites adjacent to the Trail are on or eligible for listing on the NRHP. No indirect or proximity impacts would meet the standard of constructive use or substantial impairment to potential Section 4(f) lands.

No protected farmlands are present and no impacts are expected.

4.2.2 Alternative 1 – Horizontal Launch Vehicles Only

Direct environmental impacts to potential Section 4(f) lands in the area of the proposed Spaceport America would be unchanged from the Proposed Action if vertical launches were not supported at the facility. No indirect or proximity impacts meeting the standard of constructive use or substantial impairment to potential Section 4(f) lands would be anticipated. Because permanent vertical launch facilities would not be needed, there would be fewer associated potential construction, launch and non-launch impacts. Construction impacts from road improvements would be only marginally reduced and the proposed improvements at the Aleman Draw Historic District would still be needed. The potential for visual and noise impacts would also be reduced. No impacts to farmlands would be expected.

4.2.3 Alternative 2 – Vertical Launch Vehicles Only

Direct environmental impacts to potential Section 4(f) lands in the area of the proposed Spaceport America would be unchanged from the Proposed Action. No indirect or proximity impacts meeting the standard of constructive use or substantial impairment to potential Section 4(f) lands would be anticipated. Eliminating horizontal launch activities from Spaceport

America operations would result in fewer airfield facilities being constructed, reduced airspace operations, and reduction in the frequency of launches. Construction impacts from road improvements would be only marginally reduced and the proposed improvements at the Aleman Draw Historic District would still be needed. There would be a reduction in the potential for visual impacts due to fewer facilities and lower levels of launch and non-launch operations. No impacts to farmlands are expected.

4.2.4 No Action Alternative

Under the No Action Alternative, the proposed Spaceport America would not be developed and no licensed commercial launch activity would occur in the area. There would be no impacts on potential Section 4(f) lands. Because land use would not change, no impacts to farmlands would be expected.

4.3 Noise

4.3.1 Proposed Action

4.3.1.1 Construction Noise

Construction activities would include excavation, digging and pouring of foundations, erection of buildings, and construction of roads and utilities. These activities would temporarily increase the ambient noise levels at the proposed site. Such activities could potentially create multiple, individual noise sources ranging from 70 to 100 dBA at 100 feet from the activities (Golden et al., 1980).

To estimate the maximum noise level likely to be encountered, it was assumed that one bulldozer, one scraper, one loader, and one truck would be in use at nearly the same point. At a building site, other types of equipment would be used, but the noise level would be similar. The composite noise level would be 95 dBA 50 feet from the source (Spalding and Gutman, 2008). The sound intensity would decrease as it moves away from the source and noise levels would be 75 dBA at 500 feet and 69 dBA at 1,000 feet without accounting for the sound dampening effect from air temperature, pressure, and relative humidity (i.e., atmospheric absorption) (Spalding and Gutman, 2008). Workers would be protected from noise in accordance with OSHA regulations. Therefore, workers in the immediate vicinity, especially those operating heavy equipment, would require hearing protection.

At greater distances, there is a likelihood that additional pieces of equipment would be within the specified distance from a receptor. Therefore, two additional trucks were assumed to be 1 mile from a receptor for the purpose of estimating the sound level at that distance. The result is an estimated level of 56 dBA at 1 mile from the major activity (Spalding and Gutman, 2008). The noise level would continue to decrease with distance as the sound moves away from the source and is absorbed by the atmosphere. The closest single residences are approximately 4 miles from the proposed site and the closest residential area to the proposed site is Hatch, New Mexico, approximately 25 miles south.

DNL values were calculated assuming that construction takes place for 10 hours at any single point, with no work taking place between 10 p.m. and 7 a.m., which incurs a 10 dBA penalty. The DNL associated with this activity would be 91 dBA at 50 feet and 71, 65, and 52 dBA at 500 feet, 1,000 feet, and 1 mile respectively (Spalding and Gutman, 2008). At the closest residence, which is about 4 miles from the major construction effort (runway, Terminal and Hangar

Facility, Aircraft Rescue and Fire-Fighting Facility), the noise level would be expected to be no higher than the existing background level.

Vehicles traveling to and from Spaceport America would also be a source of noise during construction. Appendix H details the roadway network at the proposed site and the estimated traffic from commuting workers and construction materials including water delivery. Section 4.10 describes the assumptions with regard to where in-migrating and local workers are expected to reside and therefore, what direction commuters would be coming from. It was further assumed that the average speed of all vehicles traveling to and from the proposed site during both phases of construction would be 40 miles per hour.

Sound levels produced by vehicular traffic were estimated using the Federal Highway Administration's (FHWA) "Traffic Noise Model® Version 2.5 Look-Up Tables" software (TNM). The noise of interest is that along the main north/south county road system between I-25 at the south (Southern Route) and the city of Truth or Consequences to the north, including State Route 51 between Engle and Truth or Consequences (Northern Route). The sound levels produced by this analysis are characterized in two ways. The total hourly equivalent sound level in dBA per hour is the output of TNM and does not include ambient noise. The DNL values were calculated by averaging the hourly equivalent sound levels at peak (7 to 8 a.m. and 5 to 6 p.m.) and off-peak hours (8 a.m. to 5 p.m.) adding an ambient sound level and using the ambient level for the remaining hours of the 24 hour day. This was done for the upper and lower range of the ambient sound level, 31 and 41 dBA, estimated for the proposed Spaceport America site. The estimated ambient sound levels of the four locations at the proposed Spaceport America are presented in Exhibit 3.3-2.

The results, shown in Exhibits 4.3-1 and 4.3-2, show the Northern Route traffic noise slightly higher than the Southern Route. Traffic noise at 50 feet from the road would peak at 58.2 dBA, which EPA characterizes as the sound level that a person would experience 10 feet from a television (EPA 1974). The DNL levels at greater than 200 feet from the road are near the ambient level except for levels during peak construction activity during Phase 1 of 43.6 dBA, which EPA (1974) characterizes as the noise level of a small town. Residences are 300 feet or more away from the road except at the stop sign intersection in Engle, so the noise level experienced by most residents while outside of their houses would be less than the traffic noise of a small town. The traffic noise heard inside the houses would be even less since the noise would be dampened by the house's structure. If water were trucked in (Water Scenario 3), then traffic noise levels would increase slightly due to the additional vehicle traffic, two extra trucks per hour.

Exhibit 4.3-1. Hourly Equivalent Sound Levels and DNL Values Resulting from Construction Traffic, Northern Route

Sound Type	Distance from Road (feet)	Hourly Equivalent Sound Level[1] or 24-hour DNL[2] (dBA)							
		Average Traffic				Highest Traffic			
		Construction Phase 1		Construction Phase 2		Construction Phase 1		Construction Phase 2	
		Peak (2 hours)	Off-peak (9 hours)	Peak (2 hours)	Off-peak (9 hours)	Peak (2 hours)	Off-peak (9 hours)	Peak (2 hours)	Off-peak (8 hours)
Hourly Equivalent Sound Level	50	56.2	52.6	51.0	47.9	58.2	52.9	52.1	48.0
	100	50.4	47.2	45.1	42.3	52.3	47.5	46.1	42.4
	200	45.0	42.5	39.5	37.2	46.5	42.6	40.4	37.3
	500	38.1	36.0	32.4	30.6	39.4	36.1	33.2	30.6
	984	32.7	30.2	27.2	25.0	34.1	30.4	28.0	25.1
		Average Phase 1		Average Phase 2		Highest Phase 1		Highest Phase 2	
DNL	50	50.2 – 50.6		45.4 – 46.6		51.1 – 51.5		45.8 – 47.0	
	100	44.8 – 46.2		40.1 – 43.4		45.6 – 46.8		40.5 – 43.5	
	200	40.2 – 43.4		36.0 – 41.8		40.7 - 43.6		36.2 – 41.9	
	500	35.2 – 41.6		32.6 – 41.2		35.5 – 41.7		32.7 – 41.2	
	984	32.6 – 41.2		31.5 – 41.2		32.8 – 41.2		31.6 – 41.1	

Source: Spalding and Gutman, 2008.

[1] Total A-weighted hourly equivalent sound level (dBA) of traffic noise with no addition of ambient noise.

[2] DNL (dBA) for 24-hour period. Lower end of range based on ambient sound level of 31 dBA and upper end is based on ambient sound level of 41 dBA. Ambient sound level was estimated for four locations at and near the proposed Spaceport America site, with the range being from 31 to 41 dBA (see Exhibit 3.3-2).

Exhibit 4.3-2. Hourly Equivalent Sound Levels and DNL Values Resulting from Construction Traffic, Southern Route

Sound Type	Distance from Road (feet)	Hourly Equivalent Sound Level[1] or 24-hour DNL[2] (dBA)							
		Average Traffic				Highest Traffic			
		Construction Phase 1		Construction Phase 2		Construction Phase 1		Construction Phase 2	
		Peak (2 hours)	Off-peak (9 hours)	Peak (2 hours)	Off-peak (9 hours)	Peak (2 hours)	Off-peak (9 hours)	Peak (2 hours)	Off-peak (8 hours)
Hourly Equivalent Sound Level	50	54.9	52.5	49.6	47.6	56.5	52.8	50.7	47.6
	100	49.3	47.2	43.8	42.1	50.7	47.4	44.9	42.1
	200	44.2	42.2	38.4	37.1	45.3	42.6	39.3	37.1
	500	37.5	35.9	31.5	30.5	38.4	36.0	32.3	30.5
	984	32.0	30.2	26.2	24.9	33.0	30.3	27.0	24.9
		Average Phase 1		Average Phase 2		Highest Phase 1		Highest Phase 2	
DNL	50	49.7 – 50.2		44.8 – 46.2		50.4 – 50.8		45.1 – 46.4	
	100	44.5 – 46.0		39.7 – 43.2		45.0 – 46.3		40.0 – 43.3	
	200	39.9 – 43.2		35.8 – 41.8		40.4 – 43.5		35.9 – 41.8	
	500	35.0 – 41.6		32.5 – 41.2		35.2 – 41.7		32.6 – 41.2	
	984	32.5 – 41.2		31.5 – 41.1		32.6 – 41.2		31.5 – 41.1	

Source: Spalding and Gutman, 2008

[1] Total A-weighted hourly equivalent sound level (dBA) of traffic noise with no addition of ambient noise.

[2] DNL (dBA) for 24-hour period. Lower end of range based on ambient sound level of 31 dBA and upper end is based on ambient sound level of 41 dBA. Ambient sound level was estimated for four locations at and near the proposed Spaceport America site with the range being from 31 to 41 dBA (see Exhibit 3.3-2).

4.3.1.2 Operation

The major sources of noise during operations are rocket engines during launch and recovery, static rocket testing, sonic booms, normal airport operations, and traffic noise.

Spaceport workers would normally be at least 2 miles away at the specific launch control center during launches. It is unlikely that these workers would be exposed to sound levels greater than 115 dBA, the OSHA 15-minute standard. However, any workers potentially exposed to noise greater than any OSHA standard would wear hearing protection. The subsequent subsections focus on public noise exposure.

Vertical Launch and Recovery

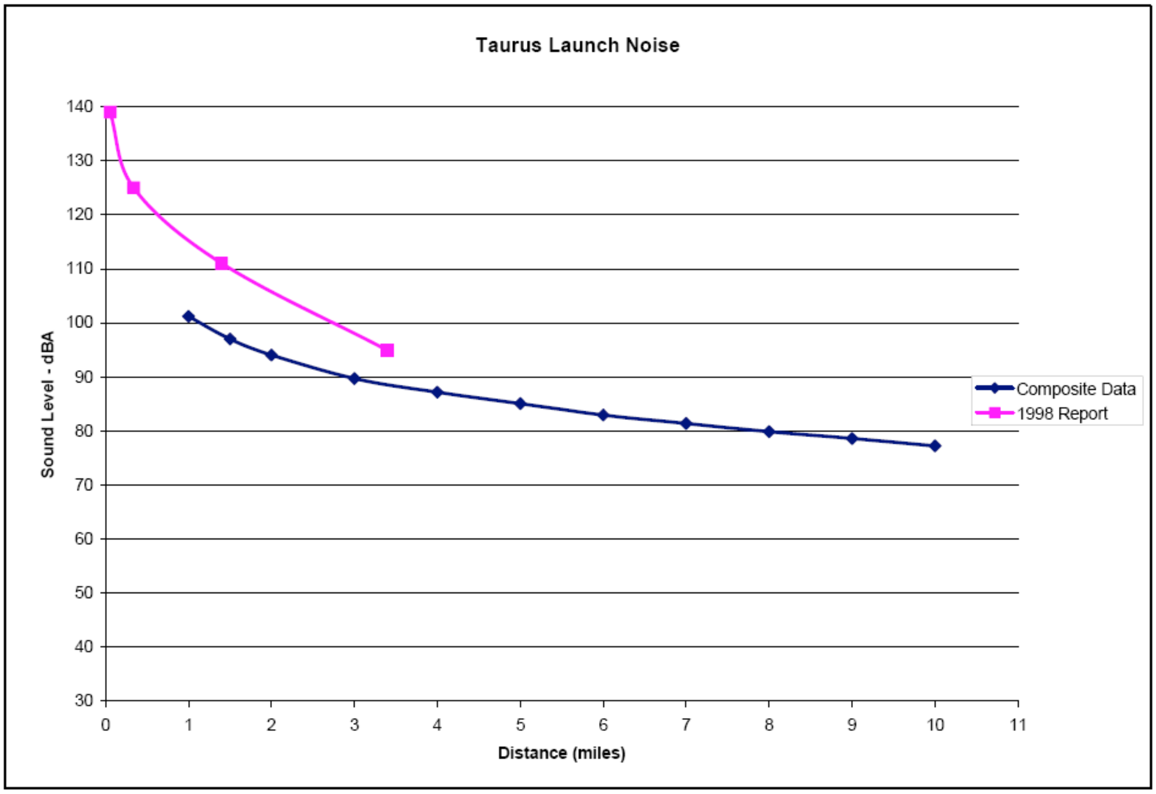
Rocket noise is a result of the interaction of the exhaust jet with the atmosphere, and to a lesser extent, the combustion of the fuel. The sound pressure from a rocket is related to the engine's thrust level and other design features. Given the variety of new LV's that could be used at Spaceport America, it is not possible to specify the parameters affecting noise. The FAA has selected the Castor-120 rocket motor as a conservative bound for the noise levels expected from potential Spaceport America launches. The Castor-120 motor has an average thrust of approximately 366,000 pounds force and a maximum thrust of 435,000 pounds force. The rockets that would be launched at Spaceport America are expected to be of a much smaller thrust. Therefore, the Taurus rocket, which uses the Castor-120 motor, is used in this analysis as a surrogate for evaluation of launch noise impacts at the proposed site.

The sound from Taurus launches has been extensively studied. The Kodiak Launch Complex EA (FAA, 1996) provided a composite of three noise studies. One study consisted of actual sound level measurements of two static tests. Another data set for sound level resulted from computer modeling of a launch by Thiokol, the manufacturer of the Castor-120 motor. The third study was from the Taurus EA. Exhibit 4.3-3 presents a composite curve of these three studies of the instantaneous sound level exposure at various distances after launch, as reported in the Kodiak EA. The sound level from a Taurus launch was again measured in October 1998 at Vandenberg Air Force Base (SRS Technologies, 1998) and the instantaneous sound level exposure measured from this is also depicted in Exhibit 4.3-3. The frequency distribution of Taurus rocket noise peaks around 70 hertz, which is typical of the very low frequency noise from rocket engines. At frequencies above 200 hertz, the sound pressure level is greatly decreased.

Using the following graph and extrapolating from it for noise levels at greater distances, the following interpretations can be made:

- Persons within 0.25 mile and who are fully exposed to the sound would need to wear hearing protection devices.
- Workers, visitors, and other persons within 3 miles would be exposed to moderate to very loud but not damaging sound levels.
- Persons on the County Road A013 at the west edge of the Spaceport, at the El Camino Real, or at the Yost Escarpment Key Observation Point (KOP) would be exposed to brief sound levels of 85-86 dBA (86 dBA is the typical noise level ¾ of a mile from touchdown at a major airport).
- Persons at the nearest residence, which is approximately 4 miles away from the launch area, would experience sound levels of approximately 88 dBA.

Exhibit 4.3-3. Predicted Sound Levels from a Hypothetical Taurus Launch



- The few residents in nearby ranches (not including the Bar Cross and Lewis Cain Ranches) and very small communities (7.4-18 miles distant) would be exposed to sound levels of 75-83 dBA (80 dBA is typical of a propeller plane flyover at 1,000 feet).
- More distant communities would experience sound levels typical in urban environments.

Community DNL values would not be increased significantly by vertical launches. The expected number of vertical launches per year (125 in 2013) equates to approximately one launch every 3 days. Also, vertical launches and test firings would not take place between 10 p.m. and 7 a.m.

Even if it is assumed that high sound levels would have duration of 2 minutes, this is a very small part of the 4,320 minutes in 3 days. The following calculation demonstrates this. If it is assumed that the DNL for a community is 65 dBA, and it is exposed to a sound level of 90 dBA for 2 minutes every 3 days, the DNL is increased to 65.6 dBA, well under the FAA's significance threshold of an increase of 1.5 dBA in noise sensitive areas. It is not expected that any community would be exposed to 90 dBA. If a more realistic, but still very conservative, value of 80 dBA for 2 minutes is used, the DNL is increased to only 65.1 dBA. Vertical launch sound levels in the communities of Truth or Consequences, Rincon, and Hatch are estimated to be much lower than 80 dBA. Also, the communities of Hatch and Truth or Consequences would be shielded from the launch and test firing sites by the Caballo Mountains and not be exposed to peak noise levels.

Recovery of vertical LV's would involve vehicles (cars and trucks) being driven to the landing site in WSMR, and would not produce significant levels of sound. Only the Concept V3 vehicles (powered, vertical landing), would produce rocket noise on landing. Maximum thrust during landing would be considerably less than the thrust at liftoff and begins at a height of approximately ½ mile. The thrust gradually decreases as the vehicle approaches the ground surface and the landing noise is substantially less than launch noise and lasts less than 20 seconds.

Static Rocket Testing

To present bounding noise level estimates for static firings, a rocket motor of 50,400 pound thrust whose static test firing data was presented in Section 5.7 of the Final EA for the Oklahoma Spaceport (FAA, 2006c) was used. Using the noise data, the sound level for a particular distance from the static test was estimated by the following equation:

$$L2 = L1 - 20\ \mathrm{Log}_{10}\ (D2/D1)$$

where L1 = known sound level at distance D1 from the source, and L2 = estimated sound level at distance D2 from the source. For example, if a source produces a sound level of 80 dBA at a distance of 1 mile, that sound is attenuated to 74 dBA at a distance of 2 miles. The results of the analysis are presented in Exhibit 4.3-4.

Exhibit 4.3-4. Predicted Static Test Firing Noise Levels for the Spaceport America and Nearby Locations

Location	Distance from Launch Site (miles)	Estimated Sound Level[1] (dBA)
Truth or Consequences	30	46
Hatch	25	48
San Andres National Wildlife Refuge	25	48
Rincon	22	49
Engle	18	51
County Road AO13 to west	5.9	61
Four miles, nearest residence	4.0	64
Three miles	3.0	66
Two miles	2.0	70
Lewis Cain Ranch Headquarters	1.8	71
One mile	1.0	76
One half mile	0.5	82
One quarter mile	0.25	88
One eighth mile	0.125	94

Source: Spalding and Gutman, 2008

[1] The duration of the noise for static test firings would be less than 2 minutes.

Horizontal Launches

The horizontal launch Concept vehicles all take off under either jet (Concept H1 and H3) or rocket power (H2). The rocket engines in the H2 Concept vehicles may not be at full thrust on takeoff and are estimated at two launches per year. The great majority of horizontal launches (750 of 757 in 2013) are expected to be of Concept H3 vehicles, which are carried aloft by jet powered assist aircraft. Since these launch operations would occur at the airfield, they are considered in a following section, Normal Airport Operations. That analysis also includes the landings of the Concept H1 vehicles and H3 assist aircraft, since they would have powered landings at the runway.

Sonic Booms

In addition to the noise of the rocket engine, sonic booms are possible. A sonic boom is a sound that is produced by a shock wave that forms around a vehicle that is traveling faster than the speed of sound. The effects of sonic booms are startle response in humans and biota, and, in extreme cases, damage to structures. The potential for, and the intensity of, a sonic boom being heard on the surface of the Earth are dependent on the vehicle length, the vehicle shape, the trajectory of the launch, the vehicle velocity, and weather conditions. Sonic booms are discussed in more detail in the Programmatic EIS for Licensing Launches, Section 5.2 (FAA, 2001).

The standard method for determining sonic boom footprints for supersonic vehicles is the method of geometrical acoustics, or ray tracing (Plotkin, 1989). The theory states that the acoustic disturbance generated by a supersonic vehicle in steady flight at a particular instant propagates along a cone of rays opening forward of the aircraft's velocity vector. For a supersonic aircraft in horizontal flight, this ray cone will eventually intersect the ground at a future time, forming the hyperbolic boom footprint at ground level. The vehicles launched from Spaceport America would not attempt an orbital trajectory and as a result, their trajectories would be vertical or near vertical, i.e., no pitch over as in orbital types of launches. Consequently, during the ascent portion of a launch, the ray cone and the corresponding sonic boom from the LV's would not intersect the ground. Instead, it would propagate away from the Earth's surface and not be heard. While the possibility exists that a boom propagating into free space may reflect off the thermosphere and back to the ground (referred to as an "over-the-top" boom), such booms are generally inaudible (Plotkin, 1989).

Estimates of Sonic Boom Impacts at the Spaceport

The upward part of the flight would not cause perceptible sonic booms on the ground because the shock waves from the vertical trajectories of Spaceport America LV's would propagate away from the ground. The "pitch over" of a vehicle on an orbital trajectory (such as the space shuttle), which becomes more horizontal at higher altitudes, can produce shock waves that move toward the ground; however, vehicles that would be launched from the spaceport would fly almost vertically and not pitch over until they reach space. All classes of vehicles to be flown from the proposed spaceport would undergo the transition back to subsonic flight at relatively high altitude. This would have the effect of reducing the magnitude of the shock wave because of geometric attenuation.

The Space Shuttle Orbiters are known to produce an overpressure on reentry of no more than 1.5 pounds per square feet (psf) (NASA, 1995). An overpressure of 1.5 psf corresponds to an impulsive sound level of 131 dBC[5]. This value is well below the level that causes hearing damage and structural damage to buildings. Because the Orbiters are much larger that any of the vehicles currently envisioned for the proposed Spaceport America, this value can be taken as a very conservative upper bound on the overpressure produced by reentry of a space vehicle at the proposed spaceport. Some vehicles may, however, separate into two distinct pieces, each of which would produce a separate sonic boom.

An additional point of reference is the launch of an amateur class Concept V1 vehicle that was conducted from the amateur launch facilities within the proposed spaceport on April 28, 2007. The vehicle separated into two parts during reentry and participants claim to have heard a sound similar to a double sonic boom. The sound pressure level was not measured, but launch participants who are familiar with the impulsive sounds associated with small arms gunfire estimated the level to be no more than 90 dBC, which would correspond to an overpressure of approximately 0.013 psf. People inside the temporary launch control building, a trailer of wood frame construction, did not hear the sonic boom. Wood frame walls reduce sound intensity by 25-30 dB (DA, 1978). A level of 90 dBC attenuated to 60-65 dBC is consistent with the sonic boom not being heard by persons in the control center.

Likewise, it is believed that all vertical launches would take place during daytime hours. Following the methodology presented in Planning in the Noise Environment (DA, 1978), the maximum estimated C-weighted day-night average sound level (CDNL) for a day with three sonic booms would be 86.4 dBC. A less conservative approach would be to assume an overpressure from each event equal to the geometric mean of 1.5 and 0.013 psf or approximately 0.14 psf. This level corresponds to an impulsive sound level of 110 dBC. The CDNL for a day with three such events would be 66.4 dBC. Areas subject to 0.013 psf overpressure would experience a CDNL of 40 dBC. The nighttime penalty for DNL calculation would not apply because there would be no nighttime launch operations.

Normal Airport Operations

Appendix A, Section 14.6 of FAA Order 1050.1E (FAA, 2004), states that low-volume airport operations such as those anticipated at Spaceport America do not need a detailed noise analysis. Nevertheless, the FAA analyzed operations at the Spaceport America airfield. The FAA's Integrated Noise Model (INM) Version 7 was used to model the noise that would be produced by spaceport airspace operations. Noise was modeled for two levels of airspace operations. Normal operations were estimated as maximum daily numbers of aircraft that would be taking off and landing at the spaceport airfield on non-X Prize Cup days. X Prize Cup operations were estimated by adding normal operations to the maximum of additional operations that might take place during any single day of the event.

The INM requires several types of inputs, including the locations of runways, the numbers and types of aircraft using the airfield each day (fleet mix), the approach and departure tracks for each runway, and the frequency at which aircraft use each runway. The fleet mix is shown in Exhibit 4.3-5 for normal operations and Exhibit 4.3-6 shows the additional aircraft pertinent to modeling X Prize Cup noise contours. Other INM inputs are summarized below. For purposes

[5] Sonic booms are low frequency noise sources. Low frequency noise is often presented as C-weighted sound pressure level because it causes more annoyance than would be expected from a noise source with the A-weighted measurements.

Exhibit 4.3-5. Aircraft Fleet Mix for Normal Operations

User	Aircraft	MTOW (lbs)	Annual Departures	Aircraft In INM?	Substitution Aircraft	MTOW (lbs)	Departures		INM Aircraft Used
							Annual	Daily	
Tenant 1	Boeing 757	240,000	1,200	Yes			750.0	2	Boeing 757-200/pw2037
Tenant 2	150,000 DWG	150,000	600	No	Boeing 737-400	150,000	5.0	0.014	Not modeled because the small number of flights annually (7) would make no significant contribution to DNL average sound; included in X Prize Ops
Tenant 3	150,000 DWG	150,000	300	No	Boeing 737-400	150,000	2.0	0.005	
Global Express	100,000 DWG	100,000	500	No	Boeing 737-100	108,000	180.2	0.5	Boeing 737/JT8D-9QN [substitution]
Gulfstream V	90,500 DWG	90,500	500	Yes			180.2	0.5	Gulfstream GV/BR 710
Gulfstream IV	73,200 DWG	73,200	500	Yes			180.2	0.5	Gulfstream GIV-SP/TAY 611-8
Gulfstream III	68,700 DWG	68,700	500	Yes			180.2	0.5	Gulfstream GIIB/GIII-SPEY 511-8
Eclipse 500	7,000 SWG	7,000	1,000	No	550 Citation II	15,000	360.5	1.0	MU3001 [substitution]
Citation X	35,700 DWG	35,700	500	Yes			180.2	0.5	Citation X/RR Allison AE 3007C
Other	30,000 SWG	30,000	1,000	No	Learjet 60	23,500	360.5	1.0	Learjet 60 [LEAR 35 substitution]

Source: Spalding and Gutman, 2008.

Exhibit 4.3-6. Aircraft Fleet Mix for Additional X Prize Operations

Aircraft	Purpose	Departures Daily	INM Aircraft Used	
			ID	Description
550 Citation II	Carry passengers or chase plane	4	CNA550	MU3001 [substitution aircraft]
Boeing 737-400	Horizontal LV flights	2	737400	Boeing 737-400/CFM56-3C-1
Boeing 727-200	Zero-gravity flights	3	727D17	Boeing 727-200/JT8D-17
Learjet 25	Rocket Racers	96	LEAR25	LEAR 25/CJ610-8

Source: Spalding and Gutman, 2008.

of this analysis, the south runway is designated Runway 34 and the north runway is designated Runway 16.

The following location and weather inputs apply to all flights:

- Runway length and elevations: length is 10,000 feet; the end elevations are 4,618 feet for Runway 16 end and 4,584 feet for Runway 34 end; the center elevation was calculated as average of ends to be 4,601 feet.
- Runway location: The center location of 32° 59' 24.3'' N, 106 ° 58' 10.2'' W (decimal units of 32.99008, -106.96951).
- Runway orientation: Orientation is input into INM in the form of XY distances in nautical miles to each runway end from the runway center; positive distances are north and east, negative south and west; the XY distances are south end (Runway 34) 0.142894073, -0.810392556 and north end (Runway 16) -0.142894073, 0.810392556.
- Study average temperature: 58.3 °F (average of average minimum and average maximum temperatures from Aleman Ranch weather data).
- Study average relative humidity: 44 percent (from Census data for Albuquerque).
- Study average head wind: default of 8 knots.

The following INM flight operations inputs were used:

- Flight tracks: All (except for X Racers) are straight in (approach) or straight out (departure) along the runway directions to 1 nautical mile (nm) from each runway end. The INM "disperse tracks" option was then applied to each "backbone" track to produce five tracks with a dispersion of 0.25 nm at 5 nm from each runway end. The X Racer "race course" was modeled as a "touch and go" flight track, originating and completing on Runway 16.
- Airport Operations: For normal operations the number and type of aircraft (except those associated with Tenants 2 and 3) would fly each day. For X Prize Cup, the number and type of aircraft would fly each day in addition to the normal operations flights; all flights would take place during the day.
- Group Percents: This option disperses the above airport operations flights (except X Racers) among the runways by percent; options were set such that approaches and departures would use Runway 16 56 percent of the time and Runway 34 44 percent of the time.
- Civil Flight Operations: This option specifies how aircraft would use specific runways and tracks and was used only to model rocket racing for X Prize Cup. All X-Racers (modeled as Learjet 25 aircraft) would use the Rocket Racing "race course" track located southwest of the runaway for 96 flights of two laps (laps were reduced to model racers that are under rocket power 40 percent of the time during a race) each day. [Additional detail is provided by Spalding and Gutman (2008).] The INM default maximum altitude for this type of track (touch and go closed loop) is 1,500 feet above ground level (AGL) for jet aircraft; since X-Racers are expected to reach an altitude of 5,000 feet AGL, but

fly most of the time at 1,200 feet or less, the use of 1,500 feet AGL as the maximum altitude is reasonable.

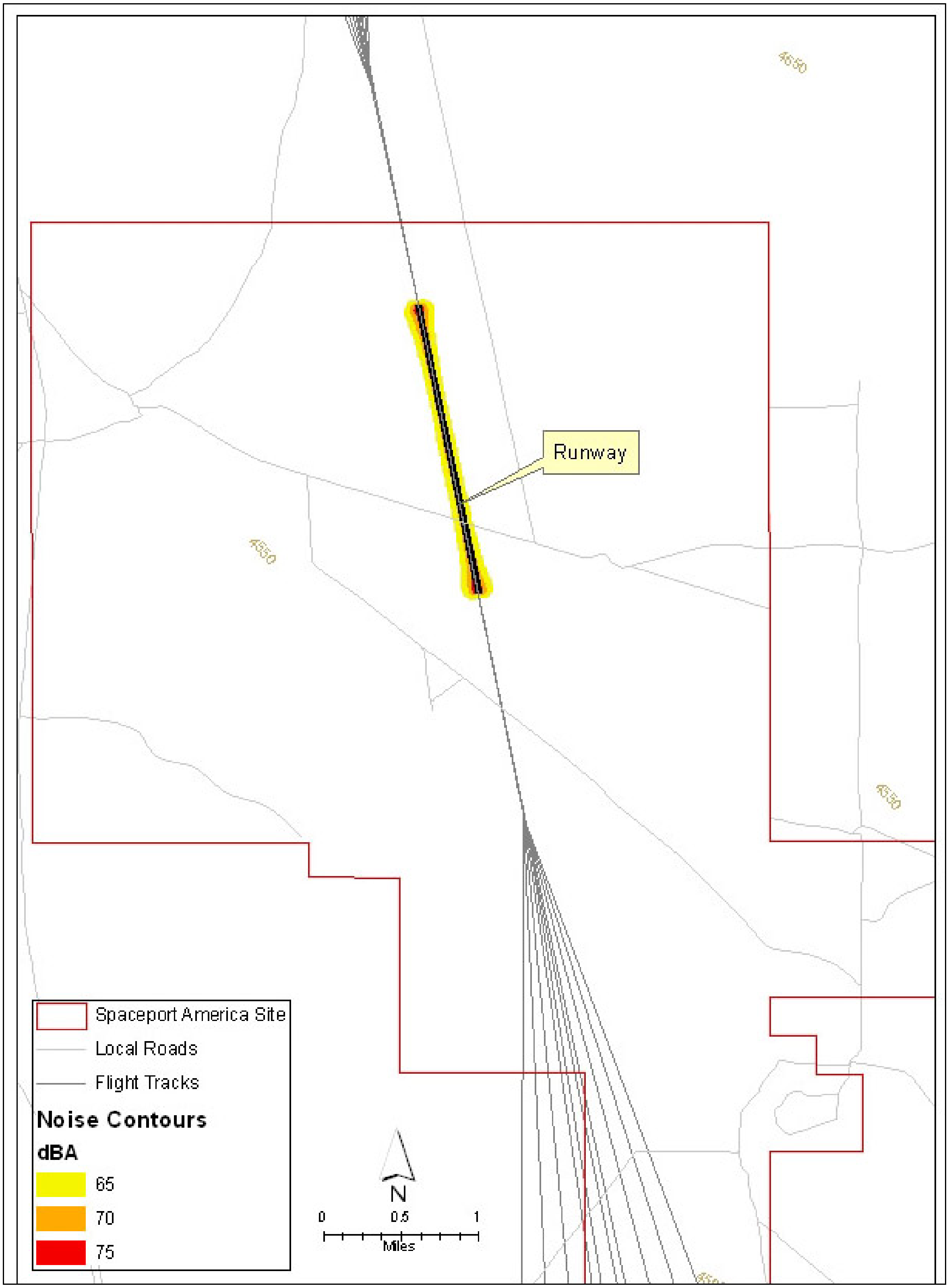
The INM output information required by FAA Order 1050.1E is at minimum the noise exposure contours at DNL values of 75, 70, and 65 dBA and an analysis within the DNL 65 dBA contour to identify noise sensitive areas where noise would increase by DNL 1.5 dBA. If no such increase is determined, no further analysis is required. Noise contouring at these DNL values was performed in INM for both normal and X Prize Cup and the results are shown in Exhibits 4.3-7 and 4.3-8. There are no noise sensitive areas within the DNL 65 dBA contour for either type of operations so no further analysis was performed.

Noise measurements taken at the 2006 X Prize Cup also support the INM results that receptors away from the event area experience higher noise levels at the time of launch but not at levels that are damaging to hearing and that the DNL is near ambient levels. The FAA took noise measurements of the X Prize Cup event that occurred October 20-21, 2006, at the Las Cruces International Airport (ICF, 2007). Monitoring station number 1 was near the spectators closest to the events. Monitoring station number 3 was placed at the nearest residence, approximately 2.5 miles from the event. At station 1, one-minute-average sound pressure levels ranged from 56 to 108 dBA. At station number 3, the sound levels ranged from 22 to 74 dBA. The DNL at station 1 was 75 dBA, while the DNL at station 3 was 48 dBA.

To estimate noise exposures from airspace operations, INM was used as described above with the addition of four "location points." This option allows the output of noise levels at specific locations. The DNL noise metric was used, as in the previous section. INM does not add ambient noise levels. Rather, the DNL values assume no ambient noise, and there is no way within INM to add ambient noise levels for the DNL metric. Ambient noise therefore was added to the INM DNL. Ambient noise levels of 31 and 41 dBA were used to include the range of ambient noise levels under existing conditions, which were estimated by Gutman (2007). The DNL values output by INM and with the addition of 31 and 41 dBA are shown in Exhibit 4.3-9 for both normal and X Prize Cup operations.

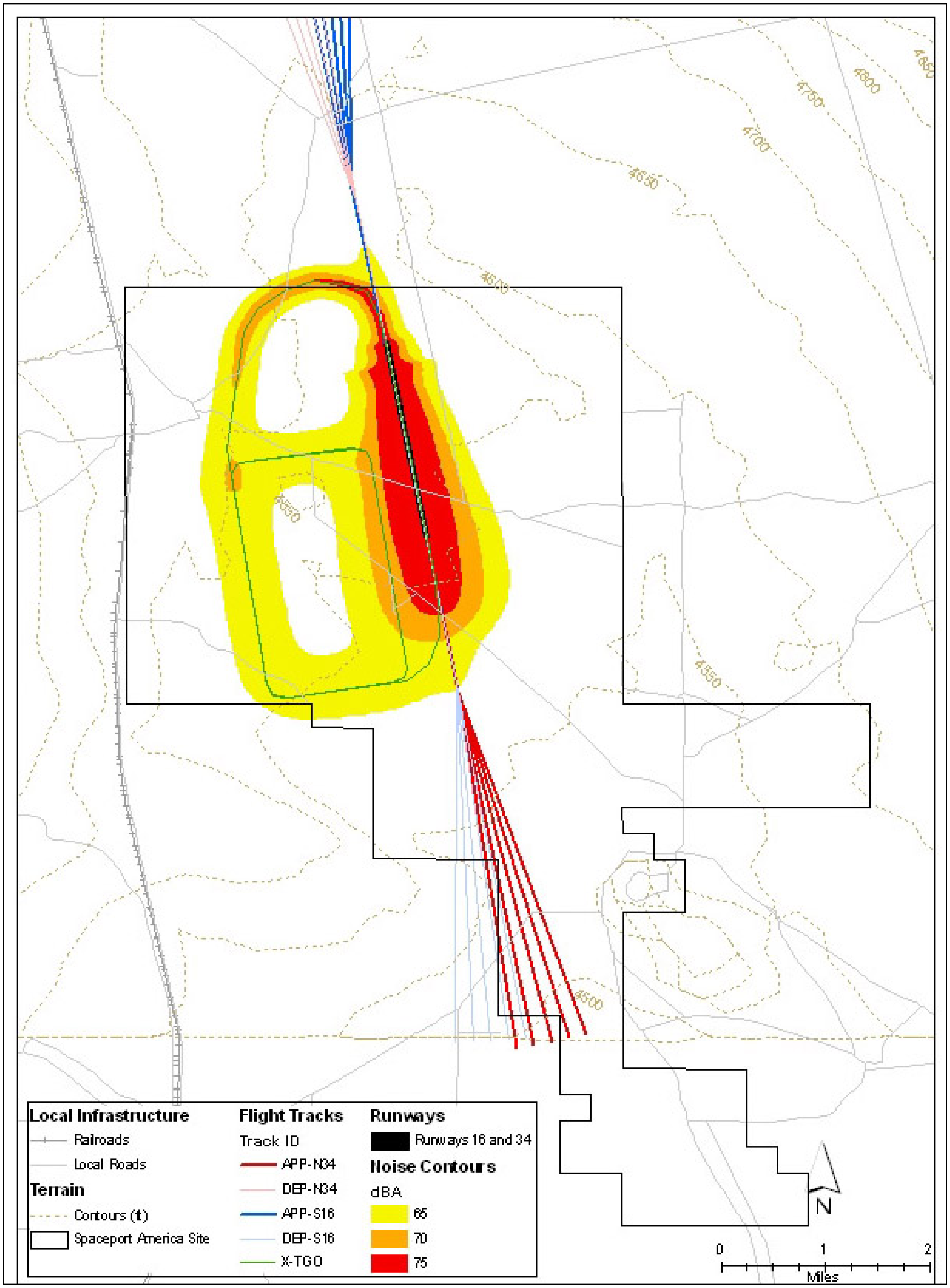
Noise level contours that included the four points of interest were also generated in INM. The results are shown in Exhibit 4.3-10 for normal airspace operations and Exhibit 4.3-11 for X Prize Cup operations. Exhibit 4.3-10 shows that horizontal launch noise would extend beyond the proposed Spaceport America boundaries, but at minimal levels. The location of the four points of interest, Terminal Hangar Facility, Bar Cross and Lewis Cain Ranch Headquarters, and the Yost Escarpment, are also located on Exhibit 4.3-10. DNL values are average noise levels for the 24-hour day. DNL values are presented in Exhibit 4.3-9 and in the text box in Exhibit 4.3-10 for the four points of interest on and near the proposed Spaceport America site. The DNL values indicate that horizontal launch noise would raise the ambient noise level slightly. Exhibit 4.3-11, which presents the estimated noise levels from horizontal launches during the X Prize Cup event, shows that the noise from launches would extend beyond the boundaries and the increased launch activity during this event would raise noise levels on and near the proposed Spaceport America site. As shown in Exhibit 4.3-9, the DNL value for a day during the X Prize Cup event at the Yost Escarpment, which is outside the boundary, is estimated at 47.2 dBA, a level that EPA associates with a small town (EPA, 1974).

Exhibit 4.3-7. DNL 65, 70, and 75 dBA Contours Resulting from Normal Flight Operations



Source: Spalding and Gutman, 2008.

Exhibit 4.3-8. DNL 65, 70, and 75 dBA Contours Resulting from X Prize Cup



Source: Spalding and Gutman, 2008.

Exhibit 4.3-9. DNL (dBA) Values for Airspace Operations at the Four Points of Interest.

Location	Normal Operations			X Prize Cup Operations		
	INM	+ 31 dBA	+ 41 dBA	INM	+ 31 dBA	+ 41 dBA
Terminal Hangar Facility (THF)	44.8	45.0	46.3	69.3	69.3	69.3
Bar Cross HQ	30.3	33.7	41.4	59.3	59.3	59.4
Yost Escarpment	27.1	32.5	41.2	46.0	46.1	47.2
Lewis Cain HQ	28.5	32.9	41.2	40.0	40.5	43.5

Source: Spalding and Gutman, 2008.

Noise Impacts on Wildlife Refuges and Wilderness Areas

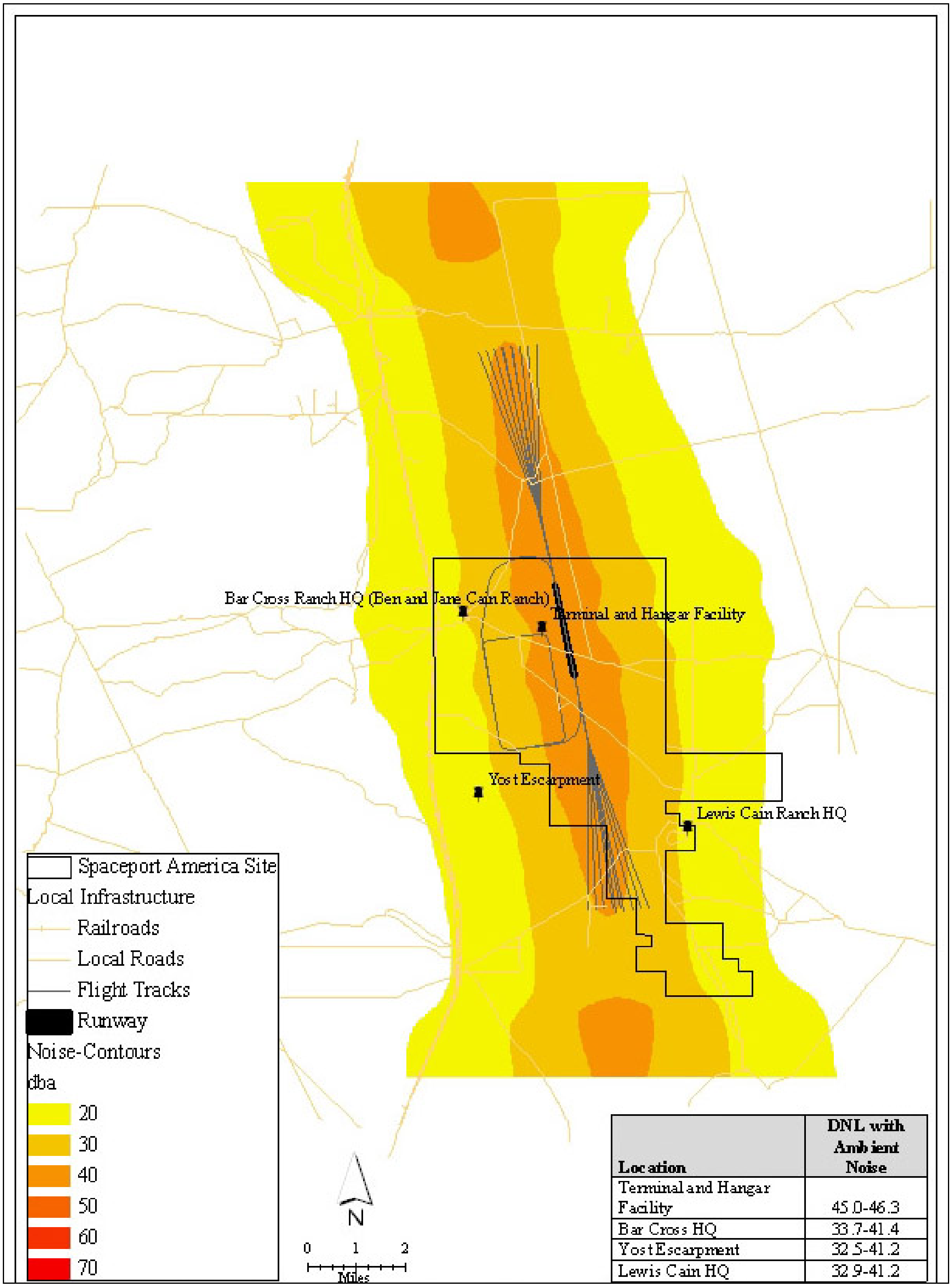
Potential impacts on noise-sensitive areas such as wildlife habitats, refuges, parks, wilderness areas, etc. must be considered as part of a site-specific NEPA analysis. The closest of these noise-sensitive areas is the San Andres National Wildlife Refuge about 25 miles west-southwest of the proposed Spaceport America site. The Sierra de Las Uvas Wilderness Study Area is about 30 miles southwest of the proposed site. In addition, the Bosque del Apache National Wildlife Refuge, Aldo Leopold Wilderness, Apache Kid Wilderness, and White Mountain Wilderness are 55, 56, 70, and 70 miles away from the Spaceport America site, respectively.

The northern part of the San Andres National Wildlife Refuge is 25 miles west-southwest from the Spaceport America vertical launch site. According to the USFWS, it was established in 1941, encompasses 57,215 acres, extends over 21 miles along the southern portion of the San Andres Mountain range, and is not open to the public due to security restrictions. Federal lands belonging to WSMR surround the Refuge. Desert bighorn sheep (*Ovis canadensis mexicana*) generally occupy a habitat found on the east side of the mountain range. The current population of desert bighorn sheep on the Refuge is estimated at 80-100.

Exhibits 4.3-3 and 4.3-4 illustrate that noise levels at the Refuge would be less than 70 dBA for rocket launch and an estimated 48 dBA for static firing. The attenuation due to the distance of the Refuge from potential sonic boom sources at Spaceport America would reduce overpressures even further below the expected 2 psf or lower overpressure. Furthermore, the PEIS LL (FAA, 2001) concluded that there are no significant impacts on wildlife from sonic booms. Therefore, San Andres National Wildlife Refuge and the more distant refuges and wilderness areas would not be significantly impacted.

In addition, the San Andres National Wildlife Refuge is regularly exposed to sounds from rocket launches and sonic booms from military aircraft. Suborbital rockets have been launched from WSMR for more than 50 years and the center of the most-used launch complexes is only 13 miles from the southern edge of the Refuge. These rocket trajectories sometimes over fly the Refuge and impact within 25 miles or less from the northern edge of the Refuge. Thus the Refuge is not in a pristine sound environment and has experienced sounds and sonic booms from WSMR activities that are more intense than those expected from spaceport activities. Furthermore, the north-northeast LV trajectories from Spaceport America would not fly over nor land near the Refuge.

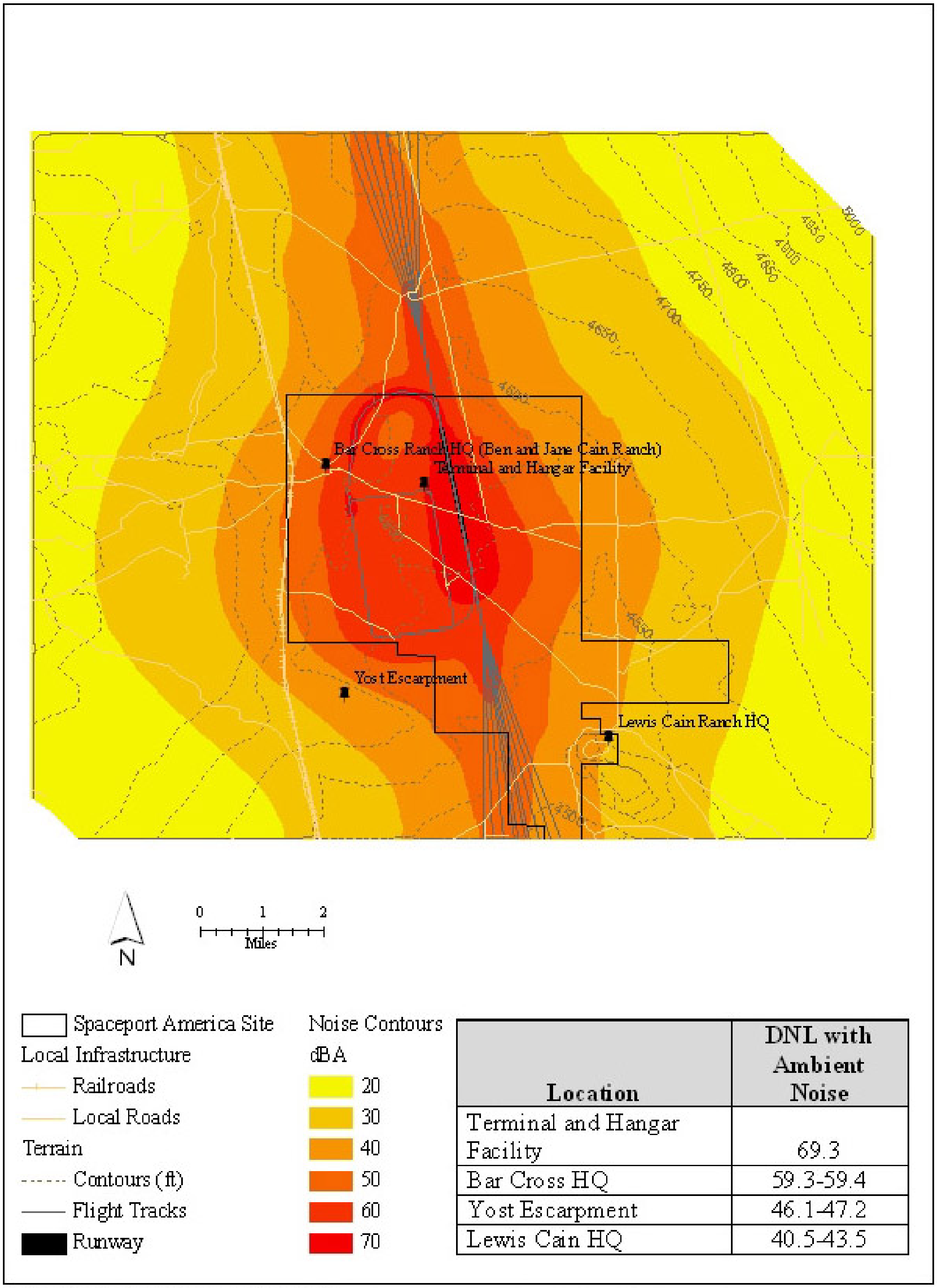
Exhibit 4.3-10. DNL 20 to 70 dBA Contours Resulting from Normal Airspace Operations



Location	DNL with Ambient Noise
Terminal and Hangar Facility	45.0-46.3
Bar Cross HQ	33.7-41.4
Yost Escarpment	32.5-41.2
Lewis Cain HQ	32.9-41.2

Source: Spalding and Gutman, 2008.

Exhibit 4.3-11. DNL 20 to 70 dBA Contours Resulting from X Prize Cup Airspace Operations



Location	DNL with Ambient Noise
Terminal and Hangar Facility	69.3
Bar Cross HQ	59.3-59.4
Yost Escarpment	46.1-47.2
Lewis Cain HQ	40.5-43.5

Source: Spalding and Gutman, 2008.

Traffic Noise

Vehicles traveling to and from the proposed Spaceport America would also be a source of noise during operation and the X Prize Cup event. Appendix H details the roadway network at the proposed site and the estimated traffic from commuting workers and construction materials including water delivery. Section 4.10 describes the assumptions with regard to where in-migrating and local workers are expected to reside and therefore, what direction commuters would be coming from. It was further assumed that the average speed of all vehicles traveling to and from the proposed site during operations would be 55 miles per hour.

As described above for construction traffic noise, sound levels produced by vehicular traffic were estimated using FHWA's TNM application, focusing on the Northern and Southern Routes for accessing the proposed Spaceport America site. However, since the vehicles are assumed to originate in equal portions from the Northern and Southern Routes, only one set of data is included in Exhibit 4.3-12. Again, the sound levels produced by this analysis are characterized in two ways. The total hourly equivalent sound level in dBA per hour is that output by the TNM Lookup application; this does not include ambient noise. The DNL values were calculated by averaging the hourly equivalent sound levels at peak (7 to 8 a.m. and 5 to 6 p.m.) and off-peak hours (8 a.m. to 5 p.m.) adding an ambient sound level and using the ambient level for the remaining hours of the 24-hour day. This was done for both the upper and lower range of the ambient sound level (31 and 41 dBA).

The results, shown in Exhibit 4.3-12, show traffic noise at 50 feet from the road during operations would peak at 55 dBA. The DNL levels accounting for traffic sounds at greater than 200 feet from the road are near the upper range of the ambient level. Residences are 300 feet or more away from the road (except at the stop sign intersection in Engle). The shaded cells in Exhibit 4.3-12 present the estimated traffic noise level if water is hauled to the site rather than installing wells on-site, a conservation approach due to the much greater truck traffic under this scenario. The water trucks were assumed to use the Southern Route, so the slightly higher noise levels estimated apply only to the Southern Route. The largest difference is in operations off-peak traffic, where the sound levels are about 2-4 dBA higher.

Given the absence of dwellings closer than 300 feet along the road that would bear Spaceport America traffic (except at the stop sign intersection in Engle), and the low traffic sound levels that could be expected at distances greater than approximately 300 feet from the road, traffic noise during construction and normal operations would not significantly impact persons living along this road system. However, during the annual X Prize Cup event, traffic levels are expected to be higher, about 50 dBA at 300 feet from the road, a level that EPA associates with a small town (EPA, 1974).

Exhibit 4.3-12. Hourly Equivalent Sound Levels and DNL Values Resulting from Operations and X Prize Cup Traffic

<table>
<tr><th rowspan="4">Sound Type</th><th rowspan="4">Distance from Road (feet)</th><th colspan="7">Hourly Equivalent Sound Level[1] or 24-hour DNL[2] (dBA)</th></tr>
<tr><th colspan="3">Normal Operations</th><th colspan="4">X Prize Cup</th></tr>
<tr><th>Peak
(2 hours)</th><th colspan="2">Off-peak
(9 hours)</th><th colspan="2">Peak
(2 hours)</th><th colspan="2">Off-peak
(8 hours)</th></tr>
<tr></tr>
<tr><td rowspan="5">Hourly Equivalent Sound Level</td><td>50</td><td>55.0</td><td>53.2</td><td>55.4</td><td>65.9</td><td>66.0</td><td>60.9</td><td>61.6</td></tr>
<tr><td>100</td><td>48.9</td><td>47.2</td><td>49.7</td><td>59.7</td><td>59.8</td><td>54.7</td><td>55.5</td></tr>
<tr><td>200</td><td>42.9</td><td>41.4</td><td>44.3</td><td>53.3</td><td>53.4</td><td>48.6</td><td>49.6</td></tr>
<tr><td>500</td><td>35.0</td><td>33.7</td><td>37.0</td><td>45.1</td><td>45.2</td><td>40.5</td><td>41.9</td></tr>
<tr><td>984</td><td>29.4</td><td>27.9</td><td>30.9</td><td>40.0</td><td>40.1</td><td>35.2</td><td>36.2</td></tr>
<tr><th></th><th></th><th colspan="3">Normal Operations</th><th colspan="4">X Prize Cup</th></tr>
<tr><td rowspan="5">DNL</td><td>50</td><td>50.3 – 50.7</td><td colspan="2">52.0 – 52.3</td><td colspan="2">58.7</td><td colspan="2">59.1 – 59.2</td></tr>
<tr><td>100</td><td>44.4 – 45.9</td><td colspan="2">46.3 – 47.3</td><td colspan="2">52.5 – 52.8</td><td colspan="2">53.0 – 53.2</td></tr>
<tr><td>200</td><td>39.1 – 42.9</td><td colspan="2">41.1 – 43.9</td><td colspan="2">46.4 – 47.4</td><td colspan="2">47.0 – 47.9</td></tr>
<tr><td>500</td><td>33.8 – 41.1</td><td colspan="2">35.3 – 41.7</td><td colspan="2">38.9 – 42.8</td><td colspan="2">39.6 – 43.1</td></tr>
<tr><td>984</td><td>31.9 – 41.1</td><td colspan="2">32.5 – 41.2</td><td colspan="2">35.0 – 41.6</td><td colspan="2">35.4 – 41.7</td></tr>
</table>

Source: Spalding and Gutman, 2008.
Data columns with light shading are for water hauling
[1] Total A-weighted hourly equivalent sound level (dBA) of traffic noise with no addition of ambient noise.
[2] DNL (dBA) for 24-hour period. Lower end of range based on ambient sound level of 31 dBA and upper end is based on ambient sound level of 41 dBA. Ambient sound level was estimated for four locations at and near the proposed Spaceport America site with the range being from 31 to 41 dBA (see Exhibit 3.3-2).

4.3.1.3 Summary of Impacts for the Proposed Action

The significance threshold applicable to noise is, "A significant noise impact would occur if analysis shows that the Proposed Action will cause noise sensitive areas to experience an increase in noise of DNL 1.5 dB or more at or above DNL 65 dB noise exposure when compared to the No Action Alternative for the same timeframe" (FAA Order 1050.1E, Appendix A, Section 14). The estimated noise levels that could result from the construction or operation of the Proposed Action are below this threshold.

Noise sources during construction would include construction equipment and traffic. Estimates of noise levels based on the type of equipment to be used and the distance from the major construction activity to nearby residences indicate the noise level would be expected to be at background or ambient levels at the nearest residence. Also, the DNL noise levels from construction traffic at residences along the roadways would be at peak associated with a small town.

Noise sources during operation would be vertical launches, horizontal launches and airplane take-offs and landings, rocket test firings, and traffic. Vertical launches would have the highest noise levels, but occur 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. Also, the communities of Hatch and Truth or Consequences would be shielded from the launch and test firing sites by the Caballo

Mountains and thus would experience lower noise levels. Test firing of rocket engines would be even less frequent and less intense.

Horizontal launches along with airport operations would generate noise that is more frequent than vertical launches, but noise peaks would be less. Exhibit 4.3-10 presents 65 DNL noise contours resulting from these operational activities, which are confined within proposed Spaceport America boundaries. 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.

Finally, the traffic noise of operations would be less than that of the peak of construction, except during the X Prize Cup event, when noise levels are estimated at about 50 dBA at 300 feet from the road, a level that EPA associates with a small town.

4.3.2 Alternative 1 – Horizontal Launch Vehicles Only

Noise would be reduced as compared to the Proposed Action for the following reasons:

- The vertical launch facilities would not be constructed.
- There would be no licensed vertical launches and reentries.
- There would be fewer rocket ground tests and static firings.
- There would be less construction and operations vehicular traffic.
- There would be less X Prize Cup event vehicular traffic.

The main reduction in loud noise would result from the absence of the rocket noise of vertical launches. This reduction would not be large for the following reasons:

- Only 125 vertical launches a year are projected.
- 100 of these launches are Concept V1 vehicles, which are expected to be small sounding rockets.
- The duration of high sound levels is less than a minute.

Reductions in lower sound levels of noise are also not expected to be significant for the following reasons:

- The vertical launch area would be 4 miles from the County Road, and much farther from dwellings. Noise from construction of that facility (which is part of the Proposed Action) would have no impact outside the spaceport property.
- Construction and operations vehicular traffic has no significant impact under the Proposed Action.
- Although there would be less vehicular traffic, there is not expected to be significant impacts from peak traffic.

Alternative 1 would result in only a slight reduction in impacts due to noise.

4.3.3 Alternative 2 – Vertical Launch Vehicles Only

Noise would be reduced as compared to the Proposed Action for the following reasons:

- The airfield facilities would be smaller (reducing construction activities).

- There would be no horizontal launches and reentries.
- There would be fewer rocket ground tests and static firings.
- There would be far fewer airspace operations.
- There would be no horizontal launch X Prize Cup event activities.
- There would be less construction and operations vehicular traffic.
- There would be less X Prize Cup event vehicular traffic.

The main reduction in loud noise would result from the absence of horizontal launches and reentries, and a lower level of spaceport airfield flights. X Prize Cup event airfield-based activities, such as some flight demonstrations and rocket racing, could still take place under this alternative.

Alternative 2 would result in a significant reduction in DNL near the spaceport due to the absence of horizontal launches, which are planned under the Proposed Action at 757 launches in 2013, and lower levels of flight operations at the airfield.

4.3.4 No Action Alternative

Under the No Action Alternative, the FAA would not issue a license for operation of the proposed Spaceport America and it would not be constructed and operated. The existing noise conditions would continue, which could include noise generated during any amateur launches occurring at the site.

4.4 Visual Resources and Light Emissions

Analysis of visual or aesthetic impacts includes an assessment of the proposed modifications to the aesthetic qualities of the existing landscapes. Visual impacts address the extent to which the development associated with the Proposed Action contrasts with the existing environment and aesthetic values. The analysis includes determining whether the action would noticeably increase visual contrast and reduce scenic quality, block or disrupt existing views, inhibit public opportunities to view scenic resources, or would conflict with established policies or scenic quality objectives. Significance of the impact is based on an evaluation of the extent that the proposed Project would contrast with the existing environment.

Analysis of the impacts from light emissions considers the extent to which lighting associated with the Proposed Action or Alternatives would create an annoyance among people in the vicinity or interfere with their normal activities.

Because of the presence of important intact segments of the El Camino Real de Tierra Adentro NHT and the Aleman Draw Historic District, the assessment of visual impacts is also related to assessment of impacts on the setting of cultural resources and potential Section 4(f) properties. The NHT includes a 5-mile visual impact zone around the Trail with the assigned VRM Class II objective to retain the existing character of the landscape and maintain a low level of change in reference to the existing landscape. Contemplated interpretive sites for the NHT would also create new viewpoints. The integrity of the visual settings of the NHT and the Aleman Draw Historic District are considered for determining effects on these historic properties in the Section 106 process described in Section 3.5. See Section 4.5 and Section 4.2 for additional discussion of visual impacts on historic properties and Section 4(f) properties, respectively.

The screening of potential locations and infrastructure planning associated with the development of a commercial spaceport in New Mexico is described in Chapter 2. During the past 10 years, the NMSA has worked and continues to work with public and private entities to minimize visual impacts associated with the proposed Spaceport America. Examples of Project changes and commitments pertaining to visual resources, and in particular to the visual resources of the NHT and the Aleman Draw Historic District, include the following:

- Moving proposed facilities further east, away from the NHT;
- Improving and using a single existing road that already crosses the NHT rather than developing new crossings;
- Placing infrastructure along existing roads and/or rights of way rather than developing previously undisturbed lands for utilities;
- Placing utilities underground where appropriate and feasible;
- Minimizing the use of security and safety lighting, and ensuring that all essential lighting would meet lighting standards consistent with the Outdoor Lighting Code Handbook published by the International Dark-Sky Association (IDA, 2002) and Night Sky Protection Act [74-12-1 to 74-12-10 New Mexico Statutes Annotated 1978];
- Controlling fugitive dust during construction;
- Providing buses and controlling vehicle use associated with Spaceport America activities and events within the limited developed land areas; and
- Using color, texture, height, and distance measures at facility locations to minimize impacts within areas visible from the NHT (see Section 2.1.2.2 and Appendix L).

4.4.1 Proposed Action

4.4.1.1 Construction

The proposed Spaceport America would be developed on State-owned and leased private land. However, since it is adjacent to BLM lands and within the viewshed of the NHT and the Aleman Draw Historic District, the NMSA is seeking to maintain the Class II VRM objectives defined for the NHT. These objectives were not established using a systematic VRM field analysis by the BLM or NPS. Accordingly, field work has been necessary to assess the existing characteristics of the area included within the VRM.

In order to assess visual impacts, field visits have been conducted to determine the visual contrast of the proposed spaceport facilities with the existing setting from viewpoints associated with the El Camino Real NHT. From most locations on the NHT north of Upham, the Spaceport America infrastructure would be blocked from view by terrain. Photo simulations of views of the spaceport facility areas were created from three observation points.

The most sensitive viewpoint area is the Yost Escarpment KOP. The El Camino Real CMP (NPS and BLM, 2004b) contemplates the development of an interpretive site at this location. The site would include a pullout parking area at County Road A013 and short Trail with interpretive signs leading to an overlook where trail ruts and a panoramic view of the Jornada del Muerto could be observed. The simulation in Exhibit 4.4-1 corresponds to a wide-angle view of the proposed Spaceport America airfield area as seen from Yost Escarpment. Facilities would be visible from the KOP, but the proposed infrastructure would blend with the fairly uniform scenery of the Jornada del Muerto. All facilities are very inconspicuous in the simulation and the degree of contrast with the existing visual setting is weak.

Simulations were also made from other likely observation points in the vicinity of County Road A013, which parallels the route of the NHT. Exhibit 4.4-2 shows the major airfield facilities including the THF, the ARFF, the main runway, and the water storage tank from a point just north of Yost Escarpment, between County Road A013 and the NHT. Exhibit 4.4-3 shows the major airfield facilities from high ground near County Road A013 and the NHT just north of Yost Draw. In each of these instances, the facilities are very inconspicuous in the distant landscape and while visible, the degree of contrast with the existing visual setting is weak. There would be minimal visual impacts from the placement of these facilities and VRM Class II objectives would be met.

Views from the Yost Escarpment KOP of the infrastructure proposed for the vertical launch area were also analyzed. Facilities proposed for the vertical launch area would include propellant storage tanks, assembly buildings, control and general purpose buildings, launch pads, and roads.

Photographs of the existing temporary facilities at the vertical launch site facilities are useful in illustrating the potential visual impact of the proposed facilities. Exhibit 4.4-4 is a photograph of the existing temporary vertical launch facilities as seen from Yost Escarpment KOP at a magnification identical to Exhibit 4.4-1. The facilities are highlighted with a circle and the road is barely discernable in the photo. Exhibit 4.4-5 is a 5X telephoto view that is approximately centered on the temporary vertical launch facilities. The road is discernable at this magnification but the buildings are not. Exhibit 4.4-6 is an additional 4X magnification (for a total of 20X magnification) of the region of the previous photograph that includes the temporary launch facilities. At this magnification, the temporary road is clearly visible, but the other facilities remain very difficult to discern.

The consistency between the predicted visibility of the temporary vertical launch facilities and actual field observations gives confidence that the photographic analysis presented here is a correct representation of visual impacts. Visibility of both the vertical and horizontal launch facilities would be low to the point that facilities would be inconspicuous and the degree of contrast with the existing visual setting is weak. There would be minimal visual impacts from the placement of these facilities and VRM Class II objectives would be met. Other stationary facilities include road improvements and utilities crossing a mix of State Trust, BLM, and private lands.

County Road A039, which provides access to the Spaceport America site from County Road A013, would be widened and paved and a portion would be re-routed slightly as it passed through the Aleman Draw Historic District and crosses the NHT. The change in visual setting would be noticeable, especially at this location, but the degree of contrast would not be significant and VRM Class II objectives would continue to be met. Improvements proposed for County A013, an independent action, are being assessed in a separate EA (as discussed in Section 2.1.2.5). Any visual impacts are considered as part of the cumulative effects in this EIS.

Exhibit 4.4-1. Synthetic Photograph of Spaceport America Airfield Area as seen from the Yost Escarpment KOP

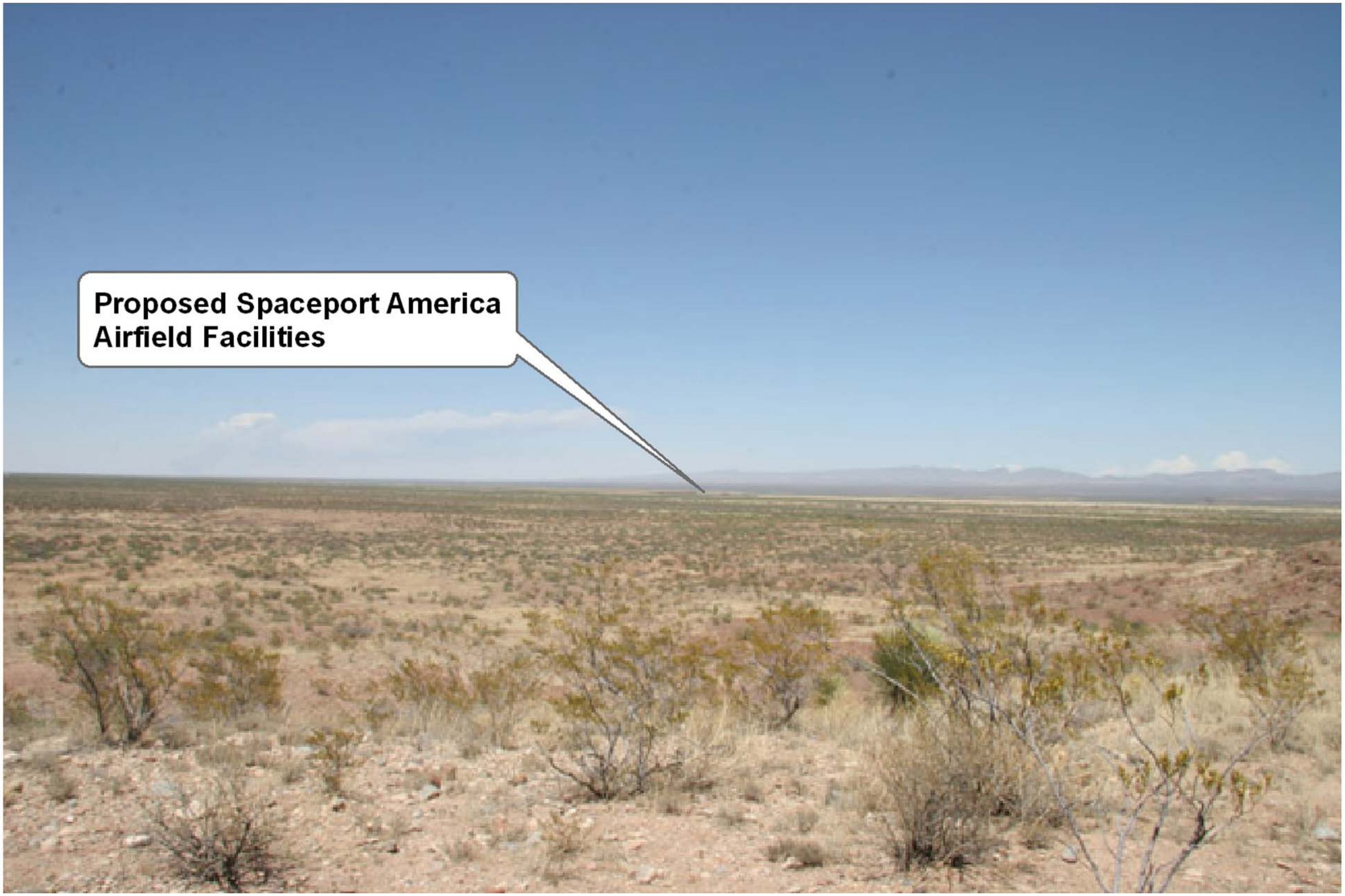


Exhibit 4.4-2. Synthetic Photograph of Spaceport America Airfield Area As Seen From Just North of Yost Escarpment, between County Road A013 and the NHT

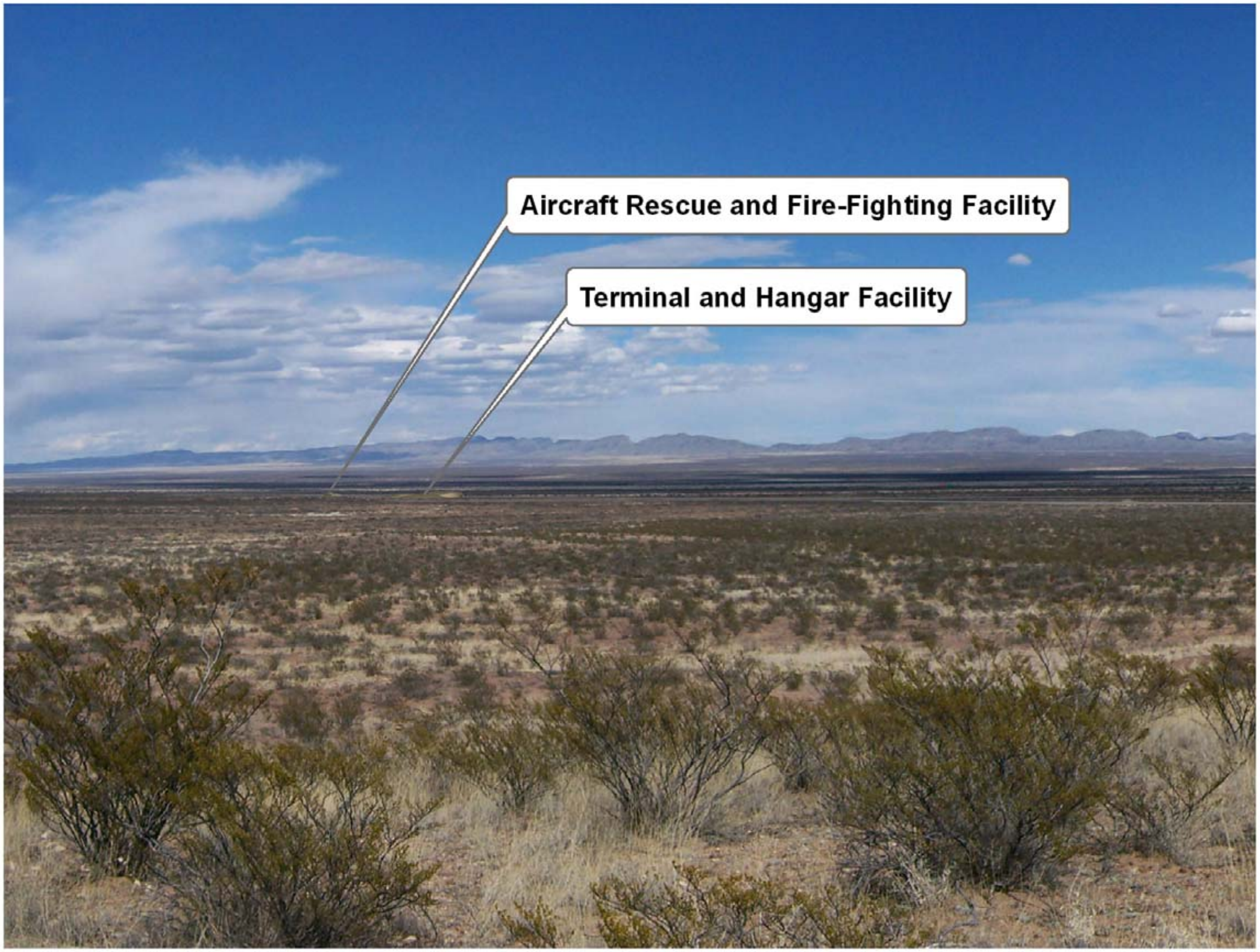


Exhibit 4.4-3. Synthetic Photograph of Spaceport America Airfield Area as seen from Just North of Yost Draw from High Ground near County Road A013 and the NHT

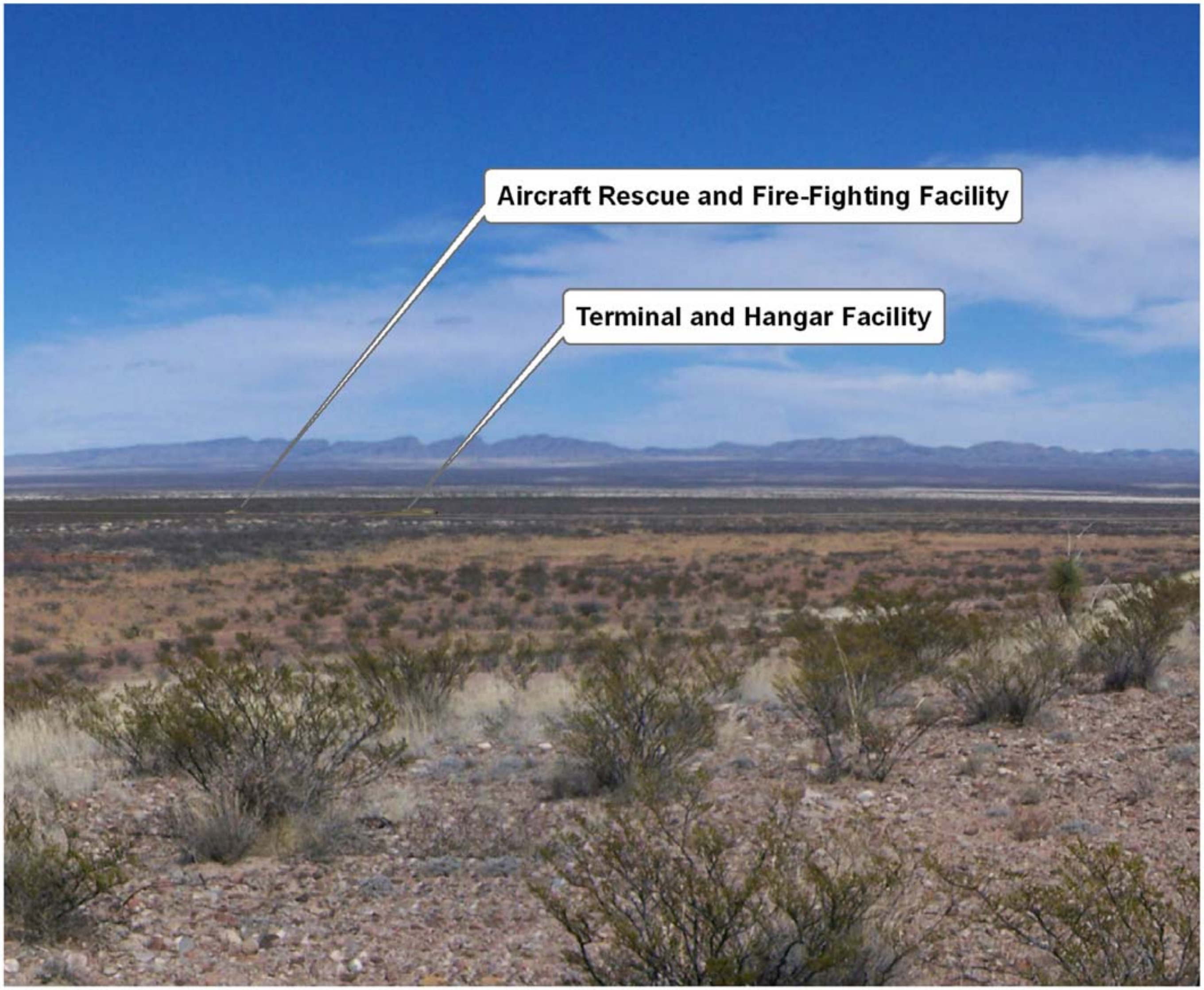


Exhibit 4.4-4. Photograph of Existing Amateur Vertical Launch Facilities as seen from Yost Escarpment KOP

Exhibit 4.4-5. Photograph of Existing Amateur Vertical Launch Facilities as seen from Yost Escarpment KOP (5X Magnification)

Exhibit 4.4-6. Photograph of Existing Temporary Vertical Launch Facilities as seen from Yost Escarpment KOP (20X Magnification)

Approximately miles of transmission line would be built off-site extending from the entrance road west to a new substation at an existing 115 kV transmission line. The western 5 miles would be aboveground and the remainder would be underground. GIS analysis shows that almost all of the aboveground portion of the transmission line (40 foot tall single-pole wood structures) would be hidden by terrain from view from four different locations along the NHT between Yost Escarpment and the Aleman Ranch. Portions that could be seen would be far enough away that the observer would have a difficult time finding the transmission structures. Thus there would be minimal visual impact from this transmission line.

New transmission lines would be placed underground along the entrance road into the Project site. These underground lines would distribute power to the horizontal launch area and run south past the southern end of the runway, and then east along-side the primary access road, past the waste water treatment plant south and east into the vertical launch area. Fiber optic cables, water lines, and sewer lines would also be buried. Burying the utilities would eliminate visual effects. Visual contrast from this line would be weak and Class II objectives would be maintained. Some construction would occur in VRM Class IV, outside of the NHT buffer area. New construction would increase visual contrast, but would be consistent with the objectives for these areas. The 7.2 kV transmission line that supplies the two ranches would be rerouted around the southern end of the runway. This rerouted line would remain aboveground on single-pole wood structures. There would be little visual change from current conditions and minimal visual impact from the rerouted line.

During construction, the major potential visual effect would be equipment use and dust plumes generated by construction activities, and dust generated by increased vehicle traffic on dirt roads. Equipment vehicle use and movement on construction areas would be a major change from the current visual setting at those locations. As discussed in Section 4.6, aggressive dust suppression measures would be taken at construction locations, so the impacts of visible dust plumes would be reduced. Given the difficulty of seeing large structures from Yost Escarpment, it is highly unlikely that construction equipment itself would be discernable. Major visual impacts due to construction would be temporary and be most apparent to workers on site. If construction activity continued into the nighttime hours, lights on the equipment and stationary work lights would be conspicuous from most points with line-of-sight to the construction area. It is not anticipated that nighttime construction would take place; however, there may be some extra security lighting used in the evenings. Overall, potential visual impacts from construction work would be minor and temporary.

Construction would greatly increase the number and size of vehicles accessing the site. Vehicles would be traveling from the north and the south on County Road A013, and then east on A039 to Spaceport America. An estimated total of 309 vehicles per day would travel to and from Spaceport America during peak Phase 1 construction. It is anticipated that the use of van pools and busses would reduce some of the anticipated vehicle trips. In addition to the visual intrusion of the vehicles themselves on the Aleman Draw Historic District setting and NHT corridor, there would be a large increase in dust generated due to travel on unpaved portions of the road. See Section 4.6 and Appendix H for estimates of the changes from current conditions. The visual effects would be moderate, but temporary, and most apparent during the first phase of construction.

4.4.1.2 Operations

Horizontal LV's departing the proposed airfield could fly over visually sensitive areas, and rocket exhaust plumes and/or contrails could be visible. Of the launches estimated to occur each year of the license, only two per year would use rocket-powered takeoff; the remaining would use conventional jet engines. There are no restrictions on aircraft operations associated with visual resource management areas, although such restrictions might exist for other reasons. Currently, airspace restrictions that result from WSMR operations close part of the VRM Class II area around El Camino Real to direct overflight an average of a few hours each weekday. Otherwise, the airspace is open and frequently traversed by a wide variety of aircraft. Even when closed to civil aircraft, military aircraft frequently traverse the area, sometimes at low altitude. Operation of horizontal LV's at the projected rate of twice per day would not represent a large percentage change to existing flight activities, and no significant visual impacts would result.

Contrails that result from high-altitude military and commercial aircraft operations are routinely and commonly visible throughout the proposed Spaceport America area, and rocket plumes from WSMR activities are visible whenever a launch takes place. Vertical and horizontal launch operations would not represent a large percentage change to these occurrences, and no significant visual impacts would result from launch operations. The estimated maximum numbers of launches per year would result in an average of about two launches per day. The visual sight of aircraft, aircraft contrails, or aircraft lights at night, particularly at a distance that is not normally intrusive, is not considered an adverse impact.

Non-launch, non-construction activities within the proposed Spaceport America that could potentially produce visual impacts would include:

- Travel on the regional roads, particularly by buses during the X Prize Cup events;
- Operation of conventional aircraft from the airfield; and
- Use of security and safety lighting.

Daily operations would increase the impacts of vehicles and dust generated from current levels, but would impact visual resources much less than the temporary impacts during construction and during special events. Approximately 51 vehicle trips are anticipated for daily operations. For approximately 7 days each year, Spaceport America would host the X Prize Cup activities, which could bring up to 20,000 spectators and 350 additional workers per day to the area. This could result in a temporary visual impact as a result of a very large number of buses and other vehicles, increased potential for fugitive dust conditions, and increased numbers of launch demonstrations and other activities. Up to 446 vehicle trips would be expected daily during this event. The visual effects would be moderate on those days, but temporary.

Operation of conventional aircraft would have effects similar to those of horizontal LV's except that more daily operations would be expected. Except for higher rates during the annual X Prize Cup event, approximately six aircraft operations per day would be expected. Aircraft operations, including low altitude operations, already are common within the area. Airfield operations at the projected rate would not represent a large percentage change to existing flight activities, and no significant impacts would result. During the X Prize Cup event, the number of aircraft operations per day would increase; however, any impacts on visual resources would be temporary and minor.

The effects of security and safety lighting could degrade the quality of the night sky both for area residents and for the astronomy community that sometimes uses nearby areas for viewing. Lights could be visible from any point with a direct line-of-sight to the facilities, and increased light emissions could cause detrimental effects on the "seeing" quality for professional and amateur astronomers over a wide area. To minimize these undesirable effects, use of security and safety lighting would be kept to a minimum, as described in Section 2.1.2.2, and all essential lighting would meet the Outdoor Lighting Standards published by the International Dark-Sky Association in its Outdoor Lighting Code Handbook, Version 1.14, (IDA, 2002). Use of these practices would ensure that effects of lighting would be insignificant and in compliance with the New Mexico Night Sky Protection Act [74-12-1 to 74-12-10 (New Mexico Statutes Annotated 1978)]. Although an increase in light emissions from current levels is anticipated, light emissions would not have an adverse impact on residents, the astronomy community, or the use or characteristics of the protected properties.

4.4.1.3 Summary of Impacts and from the Proposed Action

The visual impacts and light emissions resulting from construction and operation of Spaceport America would be less-than-significant for the Project area. VRM Class II objectives for the NHT would be maintained in the 5-mile visual buffer zone because of terrain, use of color schemes, distance, and camouflage. There would be weak contrast between the current setting and the proposed Project facilities from the NHT. All new utility-infrastructure would be buried on-site. Road modifications and paving would be noticeable, but would not be a significant visual intrusion. 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 of roadway vehicles and fugitive dust would increase and have some minor impact on the NHT and the overall visual setting. In VRM Class IV areas the new construction would increase visual contrast, but would be consistent with the objectives for these areas.

4.4.2 Alternative 1 – Horizontal Launch Vehicles Only

Although the vertical launch facilities would be inconspicuous, not building these facilities would further reduce the visibility of infrastructure compared with developing the complete facility. Fewer launches and less vehicle traffic would further reduce visual impacts compared with developing the complete facility. Temporary construction impacts due to fugitive dust would be reduced.

4.4.3 Alternative 2 – Vertical Launch Vehicles Only

Airfield facilities would be fewer, traffic would be reduced, and fewer launches would take place when compared to the Proposed Action. Although the airfield facilities in the Proposed Action would be inconspicuous, reducing the number of facilities would further reduce the visibility of infrastructure compared with developing the complete facility. A reduction in launches, operations and special event vehicle traffic would further reduce some visual impacts. Temporary construction impacts due to fugitive dust would be reduced.

4.4.4 No Action Alternative

Under the No Action Alternative, the current visual environment would continue unchanged for the foreseeable future.

4.5 Historical, Architectural, Archaeological, and Cultural Resources

Section 106 of the NHPA requires Federal agencies to take into account the effects of their actions on any district, site, object, building, or structure included in, or eligible for inclusion in, the NRHP. Implementing regulations for Section 106 established by the Advisory Council on Historic Preservation (ACHP) are contained in 36 CFR Part 800, Protection of Historic Properties, as amended in 2004. These regulations provide specific criteria for identifying effects on historic properties. Effects to cultural resources listed, or eligible for listing, on the NRHP are evaluated with regard to the Criteria of Adverse Effects.

> "An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling or association. Consideration shall be given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register. Adverse effects may include reasonably foreseeable effects caused by the undertaking that may occur later in time, be farther removed in distance, or be cumulative." (36 CFR 800.5[a][1]).

Types of adverse effects include:

- Physical destruction of or damage to all or part of a property;
- Physical alteration of a property;
- Removal of a property from its historic location;
- Change in the character of a property's use or of physical features within a property's setting that contribute to its historic significance;
- Introduction of visual, atmospheric, or auditory elements that diminish the integrity of a property's significant historic features;
- Neglect of a property which causes its deterioration, except where such neglect and deterioration are recognized qualities of a property of religious and cultural significance; and
- Transfer, lease, or sale of property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of a property's historic significance. (36 CFR 800.5(a)(2).

The cultural resource inventories of the proposed Spaceport America Project area identified 64 archaeological, architectural, and other cultural resources and 622 isolated occurrences of artifacts within the Physical APE (Exhibits 3.5-2 and 3.5-3). Forty-seven of the resources are considered eligible for listing on the NRHP. Thirteen of the resources have undetermined eligibility and are considered potentially eligible for listing. The remaining four resources are not considered eligible for NRHP-listing. The 622 isolated occurrences of artifacts are not considered eligible for listing on the NRHP. The Setting APE includes 13 resources with undetermined eligibility that are considered potentially eligible, and two resources considered eligible. Some of these resources also occur in the Physical APE.

The remainder of this analysis focuses on the potential direct and indirect effects or impacts to the eligible and potentially eligible resources in the APEs. As described in Section 3.5.1, eligible and potentially eligible resources are called *historic properties*, which is the term that is used throughout the rest of this analysis.

In response to concerns raised by agencies and preservation organizations, NMSA has incorporated certain design standards into the proposed Spaceport America Project to minimize the visual intrusion of the Project on the setting of El Camino Real NHT and the Aleman Draw Historic District and minimize potential impacts to other historic properties. These standards include:

- Using only one existing roadway for access into the Spaceport America site to reduce crossing of the NHT;
- Emphasizing “zero” architecture (meaning minimal intrusion with the landscape, including low profile, non-reflective, compatible color, and on-site material building construction);
- Placing hangar glass and building elevation exposure to the east;
- Using bermed facilities to the extent possible to maintain the natural view;
- Building the runway parallel with existing contours in order to reduce visual effects from grading;
- Providing buses and controlling vehicle use associated with Spaceport America activities and events within the limited developed land areas;
- Placing infrastructure along existing roads and/or rights of way rather than developing previously undisturbed lands for utilities;
- Placing utilities underground where feasible and appropriate; and
- Minimizing the use of security and safety lighting, and ensuring that all essential lighting would meet lighting standards consistent with the Outdoor Lighting Code Handbook published by the International Dark-Sky Association (IDA, 2002) and Night Sky Protection Act [74-12-1 to 74-12-10 New Mexico Statutes Annotated 1978].

As explained in Section 3.5.4.2, 26 historic properties that were identified, recorded, and evaluated during the cultural resource inventories of the Physical APE fall outside areas planned for construction. Twenty of the 26 historic properties are neither within nor near the areas planned for construction activities, and would not be impacted, directly or indirectly, under the Proposed Action or any of the Alternatives. The other six properties are outside of areas planned for construction, but are close to construction area boundaries, and thus would still be subject to some risk for impacts, as described in the following sections.

4.5.1 Proposed Action

4.5.1.1 Construction

Ground disturbance from construction activities would result in direct physical impacts to 31 historic properties located within the Physical APE. These impacted historic properties would include archaeological deposits in the Aleman Draw Historic District, archaeological deposits and visible route remnants in Road Segment #10 of El Camino Real NHT, and other archaeological sites throughout the proposed Project area. There is also the potential for physical damage to an additional nine historic properties, all archaeological sites. Three of these properties are within the construction areas, but have the potential to be avoided by moving utilities to the edge of the survey corridor or spanning the sites by the aboveground transmission line. Six of these properties are located outside of the construction areas, but are close to the construction boundaries and could potentially be impacted (Exhibit 4.5-1). In addition, there is the potential for physical damage to buried archaeological resources within the Physical APE that have not yet been identified or recorded, but could be discovered during earth-moving activities. The impacts to these historic properties would be permanent and, without mitigation, could be significant.

Construction could result in indirect impacts to historic properties and could affect historic properties both within and outside the APEs. Construction of facilities and pavement, compaction of soils, and removal of vegetation would likely alter erosion patterns, which in turn could physically damage properties. The level of construction activities being undertaken at the Project site and the increased number of workers present would increase the chances that inadvertent physical impact would occur to historic properties from use of areas not included in the cultural resource inventories. The improved access to the Project site would also increase the chances for inadvertent physical damage by increasing the volume of visitors and vehicles to the Project site and the area surrounding it. The increase in the number of workers and members of the public in the area could also result in an increase in vandalism and illegal artifact collecting at historic properties. The impacts from erosion, inadvertent damage, vandalism, and illegal artifact collecting would be permanent, and, without mitigation, could accumulate over time to be significant.

Construction of Spaceport America would introduce modern facilities into a largely undeveloped landscape that retains a substantial amount of its historical natural and cultural integrity. The solitude and remoteness of the landscape in and surrounding the proposed Project area contribute to the context and historical significance of the Yost Draw Study Area and other sites along El Camino Real NHT, and the Aleman Draw Historic District (including LA 8871, LA 51205, LA 80070, and LA155962) (see Exhibits 3.5-2 and 3.5-3). The scenery and viewshed currently retain the historic sense of place for these two groups of historic properties with little disturbance from visual and auditory intrusions. The setting is a significant historic feature of these properties. Disruption of this setting through construction of Spaceport America facilities and infrastructure would adversely affect this significant historic feature, the context and integrity of the properties, visitors' appreciation of the properties, and a person's understanding of the historical context and significance of the properties. These direct impacts to the settings of the NHT and District would be permanent, adverse, and, without mitigation, could be significant.

Exhibit 4.5-1. Historic Properties in the Physical APE that Would Be Directly Impacted by Construction

Site Number	Land Status	Impact Source (Proposed Facility or Infrastructure)
LA 8871	NMSLO, private	Entrance road, cattle fence, utility corridor
LA 51204	NMSLO, BLM	Fiber optic corridor
LA 51205	NMSLO, BLM, private	Entrance road, cattle fence, utility corridor, fiber optic corridor, underground transmission line
LA 80070	NMSLO, private	Entrance road, cattle fence, utility corridor
LA 111420	NMSLO, BLM	Utility corridor
LA 111421	NMSLO	Utility corridor
LA 111422	NMSLO	Utility corridor
LA 111432	NMSLO, BLM	Utility corridor
LA 111435	NMSLO	Utility corridor
LA 112367 [a]	NMSLO	Utility corridor
LA 112370	NMSLO	Utility corridor, road maintenance
LA 112371	NMSLO	Utility corridor, road maintenance
LA 112372[b]	NMSLO	Utility corridor, road maintenance
LA 112374	NMSLO	Utility corridor, road maintenance
LA 155962	NMSLO, private	Entrance road, cattle fence, utility corridor
LA 155963	NMSLO	Entrance road, primary access road, cattle fence, perimeter fence, utility corridor, secondary access road
LA 155964	NMSLO	Perimeter fence, utility corridor
LA 155968	NMSLO	Primary access road , cattle fence, utility corridor
LA 155969	NMSLO	Runway
LA 155970	NMSLO	Runway
LA 155971 [b]	NMSLO	Horizontal launch development area
LA 155972 [b]	NMSLO	Horizontal launch development area
LA 155973 [b]	NMSLO	Horizontal launch development area
LA 156861	private	Fiber optic corridor
LA 156862	NMSLO	Fiber optic corridor
LA 156863	private	Fiber optic corridor
LA 156864	NMSLO, private	Fiber optic corridor
LA 156865	NMSLO, BLM	Fiber optic corridor
LA 156866	NMSLO	Fiber optic corridor
LA 156867	BLM	Fiber optic corridor
LA 156869	BLM	Underground transmission line
LA 156870 [a]	BLM	Aboveground transmission line
LA 156872 [b]	BLM	Aboveground transmission line
LA 156873	BLM	Aboveground transmission line
LA 156874	BLM	Aboveground transmission line
LA 156875 [a]	BLM	Aboveground transmission line
LA 156876	BLM	Aboveground transmission line
LA 156877	NMSLO	Primary access road, cattle fence
LA 156878 [b]	NMSLO	Utility corridor
LA 156879	NMSLO	Secondary access road, utility corridor

[a] = potential for avoidance of impacts; [b] = close to construction boundaries, potential for impacts

BLM = Bureau of Land Management, LA = Laboratory of Anthropology, NMSLO = New Mexico State Land Office

During construction and earth-moving activities, visual effects to the settings of the NHT properties and District would occur from dust, vegetation removal, and on-site vehicle traffic. Noise effects would be minimal for construction activities in much of the proposed construction area (see Section 4.3.1), but would occur for construction work conducted along the entrance road, near the NHT and District. The direct visual and noise impacts from construction activities would range from minimal to moderate, but these impacts would be temporary, lasting only the duration of the construction activities.

Construction would also result in indirect impacts to the settings of the NHT properties and District. Traffic would be increased along County Road A013 during both phases of construction (see Exhibit H-2). This would result in increased traffic noise and dust, which would impact the historic properties' settings through visible and audible intrusions. The indirect visual and noise impacts from traffic would be minimal to moderate, but these impacts would be temporary, lasting only the duration of the construction activities.

4.5.1.2 Operations

Launch Operations

No direct physical impacts would occur to historic properties due to launch activities because all activities would occur within areas already disturbed during construction. Potential physical damage to historic properties from impacts of LV's returning to ground would be limited to launch accidents, which would be rare in occurrence. Controlled landings would occur either by landing on the Spaceport America runway, on a launch pad, or by landing with a parachute in a designated landing area on WSMR.

Indirect physical disturbance of historic properties could occur from changed erosion patterns, inadvertent impacts caused by Spaceport America workers or tenant organizations, and vandalism or illegal artifact collecting by workers or visitors. Additional visitors could lead to impacts to historic properties located both within and outside of the APEs from off-road vehicles, illegal artifact collecting, and vandalism. The impacts would be permanent, adverse, and, without mitigation, could accumulate over time to be significant.

Launching of vehicles at Spaceport America would result in moderate visual and noise effects to the settings of the NHT properties and District, but these direct impacts would be short-term 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 of the year. The additional traffic, both on-site and on County Road A013, dust, and activity would result in visual and noise effects to the NHT properties and District settings, but these indirect impacts would be minimal.

Non-Launch Activities

Non-launch operations at the proposed Spaceport America are described in Section 2.1.3. Facility and infrastructure maintenance activities would usually occur within areas already disturbed during construction, thus no direct physical impacts to historic properties are anticipated.

The presence of Spaceport America employees, contractors, and tenant organizations would increase the chances that inadvertent physical damage would occur to historic properties. The improved access to the Project site would also increase the chances for inadvertent physical damage to properties from increased visitors and off-road vehicles. The increase in the number of workers and members of the public in the area could also result in an increase in vandalism and illegal artifact collecting at historic properties. Visitors could cause impacts to historic properties located outside of the APEs from off-road vehicles, illegal artifact collecting, and vandalism. The resulting indirect impacts would be permanent, adverse, and, without mitigation, could accumulate over time to be significant.

Direct visual and noise impacts to the NHT properties and District settings would occur. These would arise from conventional aircraft landings and take-offs, engine tests, and static test firings. While some of these activities may be, at most, moderate in significance, they would be periodic and short-term in duration.

There would be general activity at Spaceport America, with workers and visitors traveling to the site. Approximately 51 vehicle trips are anticipated for daily operations. The additional traffic, both on-site and on County Road A013, dust, and activity would result in visual and noise effects to the NHT properties and District settings, but these indirect impacts would be minimal. Lighting of the proposed Spaceport America would be kept to a minimum while still providing for safety and security. The lighting design would address lighting standards consistent with the Outdoor Lighting Code Handbook published by the International Dark-Sky Association (IDA, 2002) and Night Sky Protection Act [74-12-1 to 74-12-10 New Mexico Statutes Annotated 1978]. Indirect impacts from Spaceport America lighting would be minimal.

X Prize Cup

There would be no direct physical impacts to historic properties during X Prize Cup because activities would be conducted within areas already disturbed during construction and visitors would be restricted to safe areas. Indirect impacts could include inadvertent physical damage to properties from the increase in activities taking place, and vandalism and illegal artifact collecting by the increased numbers of workers and the public. Additional visitors could lead to impacts to historic properties located outside of the APEs from off-road vehicles, illegal artifact collecting, and vandalism. The impacts would be permanent, and, without mitigation, could accumulate over time to be significant.

Potential direct impacts to the settings of the NHT properties and District from the X Prize Cup event would include visual and noise effects from the launches and demonstrations, increased worker traffic on-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 on County Road A013 and the large number of buses bringing spectators to the event (see Section H.2.1.2 for estimated traffic numbers). Up to 446 vehicle trips could be expected daily during this event. The resulting indirect impacts to the NHT properties and District settings 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.

4.5.1.3 Summary of Impacts from the Proposed Action

Impacts to historic properties, including physical damage, changes to setting, and visual and auditory effects, would occur as a result of the Proposed Action. These impacts, without mitigation measures, would include minimal impacts to setting, moderate impacts to setting, and significant impacts to setting and physical resource integrity.

If the alternative selected by the FAA is one that includes construction (Proposed Action, Alternative 1, or Alternative 2), the FAA would complete consult with the New Mexico SHPO prior to commencement of construction by NMSA. The purpose of the consultation would be to develop measures to avoid, minimize, or mitigate the adverse effects to historic properties. An MOA would be developed for signature by the FAA, NMSA, SHPO, ACHP, land management agencies, and other consulting parties, which would document the measures to be completed. The MOA would describe the processes to be followed when previously unknown cultural resources or human remains are discovered during construction or operation of the selected alternative. The MOA would also address processes to be followed when inadvertent physical damage to an historic property is discovered. While the adverse effects to the resources would remain, the MOA and the measures contained within it would resolve these effects and reduce the impacts to a level below the applicable threshold of significance.

The following measures to avoid, minimize, or mitigate adverse effects could be considered and included in the MOA:

- Conducting data recovery excavations of archaeological sites;
- Conducting in-depth background research and field investigations of historical resources;
- Implementing standard Best Management Practices during construction and maintenance activities to control erosion and changes to erosion patterns;
- Training Spaceport America construction, maintenance, and operations personnel, as well as contractors and tenant organizations, to recognize when archaeological resources or human remains have been discovered or when inadvertent damage has occurred to a resource, to halt ground disturbing activities in the vicinity of the discovery, and to notify appropriate personnel;
- Educating Spaceport America construction, maintenance, and operations personnel, as well as contractors and tenant organizations, on the importance of cultural resources, the need to stay within defined work zones, and the legal implications of vandalism and artifact collecting;
- Educating visitors and the general public on the importance of cultural resources, the need to stay within defined access areas, and the legal implications of vandalism and artifact collecting;
- Developing a State management plan for those portions of the NHT located on State Trust Land;
- Developing a site Cultural Resource Management Plan to ensure long-term protection of cultural resources within the Spaceport America boundaries;
- Establishing a Design Committee, with membership to include agency and public stakeholders, to develop ways to reduce the visibility of proposed facilities through use of color, texture, topography, orientation, materials;
- Developing joint marketing and education programs that benefit both Spaceport America and the NHT, such as:

- Providing educational outreach to the public about the region's cultural heritage through programs and publications;
- Developing public activities in coordination with El Camino Real International Heritage Center and the New Mexico Museum of Space History; and
- Developing and maintaining road-side interpretive signs and foot trails to enhance the visitor experience.

4.5.2 Alternative 1 – Horizontal Launch Vehicles Only

Fewer facilities would be constructed in the vertical launch area under Alternative 1. Because the facilities that would not be built under this alternative would not directly impact any historic properties under the Proposed Action, direct physical impacts to historic properties from construction under Alternative 1 would be the same as under the Proposed Action. Indirect impacts during construction or operation resulting from erosion, inadvertent physical damage, vandalism, and artifact collecting would be reduced, as the only activities occurring in the vertical launch area would be associated with the existing amateur launch pad. Visual and noise impacts from traffic would be reduced, as fewer vertical launches would take place and fewer workers would be needed on-site. Impacts to the setting of the NHT properties and District would remain substantially the same as under the Proposed Action with the horizontal launch area and airfield fully implemented due to the airfield's location closer to these historic properties.

4.5.3 Alternative 2 – Vertical Launch Vehicles Only

Limiting the facilities in the horizontal launch area would result in fewer adverse effects to historic properties than under the Proposed Action. Scaling back the facilities and infrastructure in the horizontal launch area could result in fewer direct physical impacts to historic properties. Indirect impacts during construction resulting from erosion, inadvertent physical damage, vandalism, and illegal artifact collecting would be only slightly reduced with the smaller construction area. Because both the airfield and the vertical launch area would still require operation personnel and maintenance activities, indirect impacts during operations would be only slightly reduced. Adverse effects to the settings of the NHT properties and District from the introduction of modern facilities into the landscape would be only slightly reduced because, although there would be fewer facilities at the horizontal launch area, the runway and some facilities would still be constructed. Visual and noise effects from launches would be reduced more under Alternative 2 than Alternative 1 with no horizontal launches taking place. This would also mean that launch-induced traffic from workers and visitors would be reduced more under this alternative.

4.5.4 No Action Alternative

Under this alternative, Spaceport America facilities and infrastructure would not be developed and no licensed launch activity would occur at the site. Sporadic amateur launches from the existing facility in the vertical launch area would continue. Effects to cultural resources would remain as they are now, with sporadic and temporary impacts occurring to historic property settings from the occasional amateur launch.

4.6 Air Quality

4.6.1 Proposed Action

Impacts to ambient air resources would occur from the construction and operation of the proposed launch site. As discussed in more detail below, the impact levels would not be significant. Because the proposed launch site is located in an air quality control region designated as attainment with Federal and State ambient air quality standards, a CAA Section 176(c) General Conformity evaluation is not required.

Appendix I provides a detailed discussion of the assumptions and calculations applied to estimate construction and other non-launch emissions associated with the Proposed Action. Appendix J provides details of the vertical launch-related emissions assumptions and calculations. Appendix M describes the assumptions and calculations applied to estimate emissions associated with airfield operations associated with the Proposed Action.

4.6.1.1 Construction

Construction of the proposed Project would produce HAP and criteria pollutant emissions from: construction equipment, delivery trucks, and commuter vehicles; fugitive dust generated by vehicle and equipment travel on unpaved surfaces; and temporary operation of a hot asphalt mix plant.

Pollutant emission levels from highway vehicles (i.e., worker commute vehicles and delivery vehicles) were quantified based on emission factors from the EPA Mobile Source Emission Factor Model, MOBILE6.2 (EPA, 2004). Pollutant emission levels from non-road vehicles (including construction engines and equipment) were quantified based on emission factors from the EPA NONROAD2005 model (EPA, 2006c). Pollutant levels from other sources associated with construction were quantified based on emission factors provided in the U.S. EPA document AP-42, "Compilation of Air Pollutant Emission Factors" (EPA, 1995).

The quantity of fugitive dust generated by soil transfers, land grading, and other construction-related activities are estimated based on the methods outlined in AP-42 (EPA, 1995). Where possible, fugitive dust suppression methods would be applied.

Two phases of construction activities are planned as outlined in Section 2.1.2 of this EIS. Exhibits 4.6-1 and 4.6-2 illustrate key inputs for determining pollutant emissions during each phase of construction. Other inputs and assumptions are described in Appendix I.

Exhibit 4.6-1. Construction Impacts by Phase – Disturbed Acreage and Material Use

	Disturbed Land (acres)	Asphalt (tons)	Concrete (yards^3)	Pile Drop (tons)	Crushed Stone (tons)	Sand and Gravel (tons)
Phase I	700	110,880	14,179	1,066,593	131,554	53,826
Phase 2	41	0	6,875	130,710	0	46,109

Exhibit 4.6-2. Type and Operation of Construction Equipment On-site by Phase

	Days Operated	
Equipment	**Phase 1 (17 Months)**	**Phase 2 (12 Months)**
auger	19	0
compactor	4	316
crane	1,281	359
dozer	1866	0
dump truck	2240	756
excavator	93	4
grader	1309	273
roller	1654	184
scraper	970	0
tractor/backhoe/loader	158	251
trencher	344	0
truck	3456	936
tampers/rammers	510	0

Criteria Pollutants

The estimated maximum annual criteria pollutant emissions due to proposed construction activities are presented in Exhibit 4.6-3. These estimates are conservative overestimates and actual construction emissions are expected to be less.

Exhibit 4.6-4 provides a comparison of the estimated annual emissions for each phase of construction to the total annual emissions from all sources in Sierra County (EPA, 1999). As this table shows, the Project construction emissions would represent a very small fractional increase over the emissions already present in Sierra County.

Impacts on air quality due to construction are expected to be localized and short-term. Measures, as described in Section 6.3, would be applied to minimize impacts caused by construction emissions. Therefore, the minimal emissions of criteria pollutants from construction activities would have a negligible impact on air quality and would not impair visibility along El Camino Real de Tierra Adentro NHT.

Exhibit 4.6-3. Maximum Annual Criteria Pollutant Emissions Due To Construction Activities (tons)

Emission Category	NO_2	CO	SO_2	VOC[a]	PM_{10}	$PM_{2.5}$	CO_2
Phase 1 - Water Scenario 1							
Fugitive Dust	0.0	0.0	0.0	0.0	326.8	37.3	0.0
Industrial Engines	1.1	43.4	0.1	2.2	0.1	0.1	106.7
Nonindustrial Surface Coating	0.0	0.0	0.0	19.4	0.0	0.0	0.0
Hot Mix Asphalt Plant	3.1	7.4	0.6	2.7	0.3	0.2	1,829.5
Propane Combustion	<0.1	0.0	0.0	0.0	0.0	0.0	18.8
Roadway Vehicles	15.7	53.2	0.1	4.7	0.7	0.5	4,530.1
Non-road Vehicles	50.5	18.8	0.2	3.0	2.6	2.5	6,025.5
Water Scenario 1 Total	70.4	122.7	0.9	32.0	330.5	40.6	12,510.5
Phase 1 - Water Scenario 2							
Fugitive Dust	0.0	0.0	0.0	0.0	326.9	37.3	0.0
Industrial Engines	1.1	43.4	0.1	2.2	0.1	0.1	106.7
Nonindustrial Surface Coating	0.0	0.0	0.0	19.4	0.0	0.0	0.0
Hot Mix Asphalt Plant	3.1	7.4	0.6	2.7	0.3	0.2	1,829.5
Propane Combustion	<0.1	0.0	0.0	0.0	0.0	0.0	18.8
Roadway Vehicles	15.7	53.2	0.1	4.7	0.7	0.5	4,530.1
Non-road Vehicles	50.8	18.9	0.2	3.1	2.6	2.5	6,054.8
Water Scenario 2 Total	70.6	122.8	0.9	32.0	330.5	40.6	12539.8
Phase 1 - Water Scenario 3							
Fugitive Dust	0.0	0.0	0.0	0.0	326.8	37.3	0.0
Industrial Engines	1.1	43.4	0.1	2.2	0.1	0.1	106.7
Nonindustrial Surface Coating	0.0	0.0	0.0	19.4	0.0	0.0	0.0
Hot Mix Asphalt Plant	3.1	7.4	0.6	2.7	0.3	0.2	1,829.5
Propane Combustion	<0.1	0.0	0.0	0.0	0.0	0.0	18.8
Roadway Vehicles	15.7	53.2	0.1	4.7	0.7	0.5	4,530.1
Non-road Vehicles	50.5	18.8	0.2	3.0	2.6	2.5	6,022.5
Water Scenario 3 Total	70.4	122.7	0.9	32.0	330.5	40.6	12,507.5
Phase 2							
Fugitive Dust	0.0	0.0	0.0	0.0	76.2	8.3	0.0
Industrial Engines	0.9	34.4	0.1	1.7	0.1	0.1	84.7
Nonindustrial Surface Coating	0.0	0.0	0.0	0.6	0.0	0.0	0.0
Hot Mix Asphalt Plant	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Propane Combustion	<0.05	0.0	0.0	0.0	0.0	0.0	28.9
Roadway Vehicles	4.5	8.9	<0.05	0.9	0.2	0.1	1,295.4
Non-road Vehicles	11.3	4.4	<0.05	0.7	0.6	0.6	1,415.8
Phase 2 Total	16.6	47.7	0.1	3.9	77.0	9.1	2,824.8

[a] VOCs contribute to the formation of ground level O_3.

Exhibit 4.6-4. Maximum Annual Criteria Pollutant Emissions and Percentage Increase Over Sierra County Baseline Emissions Due To Construction Activities (tons)

Entity	NO_2	CO	SO_2	VOC[a]	PM_{10}	$PM_{2.5}$
1999 Baseline[b]	2,004	13,217	114	1,493	7,648	1,695
Phase 1 – Water Scenario 1						
Maximum	70	123	1	32	330	41
Percent Increase	3.5%	0.9%	0.9%	2.1%	4.3%	2.4%
Phase 1 – Water Scenario 2						
Maximum	71	123	1	32	331	41
Percent Increase	3.5%	0.9%	0.9%	2.1%	4.3%	2.4%
Phase 1 – Water Scenario 3						
Maximum	70	123	1	32	330	41
Percent Increase	3.5%	0.9%	0.9%	2.1%	4.3%	2.4%
Phase 2						
Maximum	17	48	<0.5	4	77	9
Percent Increase	0.8%	0.4%	0.4%	0.3%	1.0%	0.5%

[a] VOCs contribute to the formation of ground level O_3.

[b] The 1999 Baseline is from the U.S. EPA National Emissions Trends Database (EPA, 1999)

HAPs

The estimated maximum annual HAP emissions from construction equipment and highway vehicles, surface coatings, and temporary operation of a hot asphalt mix plant are presented in Exhibit 4.6-5, 4.6-6, and 4.6-7. HAP emissions due to construction activities are expected to be short-term. The minimal HAP emissions from construction activities would have a negligible impact on air quality.

Exhibit 4.6-5. Nonindustrial Surface Coating HAP Emissions for Spaceport Construction (pounds per year)

Species	Phase 1	Phase 2	Total
Benzene	24.1	3.3	27.4
Dichloromethane	442	60.5	502.5
Ethyl chloride	48.2	6.6	54.8
Ethylene glycol	40.2	5.5	45.7
Dimethyl formamide	154.2	0	154.2
Ethylbenzene	1326.1	0	1326.1
Ethylene glycol	185	0	185
Isomers of xylene	801.8	0	801.8
Methyl ethyl ketone	1727	0	1727
Methyl isobutyl ketone	185	0	185
Toluene	1603.6	0	1603.6
Total	6537.2	75.9	6613.1

Exhibit 4.6-6. Annual Engine HAP Emissions for Spaceport Construction (pounds per year)

Species	Highway vehicles	Non-road vehicles	Industrial engines	Totals
Phase 1 - Water Scenarios 1 and 2				
Benzene	276.1	124.1	309.0	709.1
MTBE	28.3	0.0	0.0	28.3
1,3 Butadiene	34.9	11.4	41.6	87.8
Formaldehyde	252.4	720.8	55.7	1029.0
Acetaldehyde	94.8	323.8	22.4	441.0
Acrolein	11.4	18.5	3.0	33.0
Total	698.0	1198.6	431.7	2328.2
Phase 1 - Water Scenario 3				
Benzene	276.1	123.4	309.0	708.4
MTBE	28.3	0.0	0.0	28.3
1,3 Butadiene	34.9	11.3	41.6	87.7
Formaldehyde	252.4	716.8	55.7	1025.0
Acetaldehyde	94.8	322.0	22.4	439.2
Acrolein	11.4	18.4	3.0	32.9
Total	698.0	1191.9	431.7	2321.6
Phase 2				
Benzene	44.9	27.6	245.4	317.8
MTBE	4.1	0.0	0.0	4.1
1,3 Butadiene	8.1	2.5	33.0	43.6
Formaldehyde	75.6	160.1	44.3	280.0
Acetaldehyde	28.1	71.9	17.8	117.8
Acrolein	3.4	4.1	2.4	9.9
Total	164.2	266.3	342.9	773.3

Exhibit 4.6-7. Hot Mix Asphalt Plant HAP Emissions for Construction Phase 1 (pounds per year)

Species	Asphalt Plant	Other PM-based	Other Volatile-based	Total
Non-PAH[a] HAPs				
Benzene	43.131	0.242	0.442	43.815
Bromomethane	0	0.045	0.068	0.113
2-Butanone	0	0.228	0.539	0.767
Carbon Disulfide	0	0.061	0.221	0.282
Chloroethane	0	0.001	0.055	0.056
Chloromethane	0	0.07	0.318	0.388
Cumene	0	0.512	0	0.512
Ethylbenzene	26.542	1.304	0.525	28.371
Formaldehyde	342.839	0.41	9.53	352.779
n-Hexane	101.746	0.699	1.381	103.826
Isooctane	4.424	0.008	0.004	4.436
Methylene Chloride	0	0	0.004	0.004
Methyl chloroform	5.308	0	0	5.308

Exhibit 4.6-7. Hot Mix Asphalt Plant HAP Emissions for Construction Phase 1 (pounds per year) (cont'd)

Species	Asphalt Plant	Other PM-based	Other Volatile-based	Total
Styrene	0	0.034	0.075	0.109
Tetrachloroethene	0	0.036	0	0.036
Toluene	320.72	0.978	0.856	322.554
Trichlorofluoromethane	0	0.006	0	0.006
m-/p-Xylene	0	1.91	2.762	4.672
o-Xylene	0	0.373	0.787	1.16
Xylene	22.119	0	0	22.119
Total non-PAH HAPs	**866.829**	**6.917**	**17.567**	**891.313**
PAH HAPs				
2-Methylnaphthalene	18.801	0.899	1.482	21.182
Acenaphthene	0.155	0.098	0.132	0.385
Acenaphthylene	2.433	0.011	0.004	2.448
Anthracene	0.343	0.026	0.037	0.406
Benzo(a)anthracene	0.023	0.007	0.016	0.046
Benzo(a)pyrene	0.001	0.001	0	0.002
Benzo(b)fluoranthene	0.011	0.003	0	0.014
Benzo(e)pyrene	0.012	0.003	0.003	0.018
Benzo(g,h,i)perylene	0.004	0.001	0	0.005
Benzo(k)fluoranthene	0.005	0.001	0	0.006
Chrysene	0.02	0.039	0.059	0.118
Dibenz(a,h)anthracene	0	0	0	0
Fluoranthene	0.067	0.019	0.042	0.128
Fluorene	1.217	0.291	0.284	1.792
Indeno(1,2,3-cd)pyrene	0.001	0	0	0.001
Naphthalene	71.886	0.472	0.512	72.87
Perylene	0.001	0.008	0.008	0.017
Phenanthrene	2.544	0.306	0.506	3.356
Pyrene	0.332	0.057	0.124	0.513
Total PAH HAPs	**97.856**	**2.242**	**3.209**	**103.307**
Other semi-volatile HAPs				
Phenol	0	0.446	0	0.446
Metal HAPS				
Arsenic	0.062	0	0	0.062
Cadmium	0.045	0	0	0.045
Chromium	0.608	0	0	0.608
Cobalt	0.003	0	0	0.003
Hexavalent chromium	0.05	0	0	0.05
Lead	1.659	0	0	1.659
Manganese	0.852	0	0	0.852
Mercury	0.288	0	0	0.288
Nickel	6.967	0	0	6.967
Selenium	0.039	0	0	0.039
Total metal HAPs	**10.573**	**0**	**0**	**10.573**
Total organic HAPs	**964.685**	**9.159**	**20.776**	**994.62**
Total HAPs	**975.258**	**9.159**	**20.776**	**1005.193**

[a] PAH = Polynuclear aromatic hydrocarbon

4.6.1.2 Operations

Impacts in the Troposphere

Criteria Pollutants and CO_2

Emissions would be generated by both launch and non-launch operational activities. Non-launch emission sources include personal vehicles, buses, delivery and maintenance trucks; natural airborne fugitive dust; auxiliary diesel generator operation; propellant storage and handling; static test firing of rocket engines; and airfield operations. All non-launch emissions would have some impact on air quality. Emissions from launch activities are primarily due to rocket propellant combustion. Launch-related emissions below 3,000 feet AGL would also have an impact on air quality. Emissions from non-launch sources and launch related emissions released below 3,000 feet AGL are discussed in the Lower Troposphere heading in this subsection. Emissions released above 3,000 feet AGL generally do not contribute to ground-level air quality and are discussed in the Upper Troposphere heading in this subsection.

Section 2.1.2 of this EIS describes three possible scenarios for supplying water to Spaceport America. The air quality impacts associated with operational activities under each water scenario are analyzed in this subsection.

Lower Troposphere

A detailed discussion of the assumptions and calculations applied to estimate emissions associated with the Proposed Action is provided in Appendix I. Pollutant emission levels from highway vehicles (i.e., worker commuter vehicles and delivery vehicles) were quantified based on emission factors from the EPA Mobile Source Emission Factor Model, MOBILE6.2 (EPA, 2004). Pollutant emission levels from an auxiliary diesel generator were quantified based on emission factors from the EPA NONROAD2005 model (EPA, 2006c).

The quantity of fugitive dust generated by traffic on paved and unpaved roads is estimated based on the methods outlined in AP-42 (EPA, 1995). The analyses assume that fugitive dust suppression methods would be applied on unpaved roads.

Emissions from filling LV fuel tanks with alcohol were estimated based on the methods outlined in AP-42 (EPA, 1995), Section 5.2.2.3 "Motor Vehicle Refueling" using the following assumptions.

- Alcohol and tank temperatures of 80 degrees Fahrenheit;
- Reid Vapor Pressure of 1.2 at 80 degrees Fahrenheit;
- 10 launches per year using 5 tons each of alcohol.

Methane emissions resulting from storage and transfer of liquid methane would not be significant because of the small quantities used and emission control measures on storage facilities and fuel transfer equipment. Other LV fuels that would be stored and used at Spaceport America would have insignificant or no air emissions because either they do not contain air pollutants or they have a low vapor pressure, or are solid fuels.

Pollutant emission levels from airfield operations were estimated using the FAA's Emissions and Dispersion Modeling System (EDMS) (FAA, 2007). Inputs and assumptions to the EDMS model are described in Appendix M. The estimated annual pollutant emissions from non-launch activities are presented in Exhibit 4.6-8.

Exhibit 4.6-8. Annual Non-Launch Emissions of Criteria Pollutants and CO_2 (tons per year)

Emission Category	NO_2	CO	SO_2	VOC[a]	PM_{10}	$PM_{2.5}$	CO_2
Water Scenarios 1 and 2							
Vertical area operations	4.7	8.14	0.02	0.55	6.35	0.69	1229.79
Horizontal area operations	10.76	16.4	0.07	1.11	9.58	1.34	2883.49
X Prize event operations	2.93	1.7	0	0.14	1.87	0.27	617.94
Airfield operations	22.93	51.60	2.56	7.34	0.61	0.60	0
Static test firings	0 [b]	0	0	0	0	0	372
Fuel/propellant storage and handling	0	0	0	0.03	0	0	0
Total Water Scenarios 1 and 2	41.32	77.84	2.65	9.17	18.41	2.90	0
Water Scenario 3							
Vertical area operations	5.03	8.79	0.02	0.6	7.17	0.82	1328.89
Horizontal area operations	12.11	16.91	0.07	1.21	19.11	2.76	3247.85
X Prize event operations	2.99	1.72	0	0.14	2.03	0.3	634.71
Airfield operations	22.93	51.60	2.56	7.34	0.61	0.60	0
Static test firings	0 [b]	0	0	0	0	0	372
Fuel/propellant storage and handling	0	0	0	0.03	0	0	0
Total Water Scenario 3	43.06	79.02	2.65	9.32	28.92	4.48	0

[a] VOCs contribute to the formation of ground level O_3.
[b] Due to the high exhaust temperatures, the exhaust upon contact with the atmosphere will lead to formation of NO_X from atmospheric nitrogen, but the amount of NO_X would be minor and has not been quantified.

The assessments of atmospheric impacts from launches at the proposed Spaceport tier from the PEIS HL (FAA, 2005) and the PEIS LL (FAA, 2001). The PEIS HL analyzed the same horizontal LV concepts proposed for Spaceport America and concluded that the estimated number of licensed launches for the entire U.S. would not have significant impacts on air quality or other atmospheric conditions of concern. The maximum annual emission estimates from the PEIS HL for the entire U.S. are used as a conservative estimate of the annual emissions from horizontal launches at Spaceport America.

The PEIS LL (FAA, 2001) estimated emissions for vertical LV's delivering payloads to orbit. The proposed vertical LV concepts at the proposed Spaceport are all smaller suborbital rockets and include powered landings. Therefore, the launch emission estimates cannot be used directly and applied to launches at the proposed Spaceport America. Instead, PEIS LL data on the emissions of different types of propellants were used to calculate emissions for the types of LV's and propellants proposed for Spaceport America. A detailed discussion of the assumptions and calculations applied to estimate emissions from vertical launches is provided in Appendix J.

Estimates of criteria pollutant emissions below 3,000 feet AGL from all launches for the year of the maximum number of launches (2013) are shown in Exhibit 4.6-9.

Exhibit 4.6-9. Summary of Maximum Annual Launch Related Emissions of Criteria Pollutants and CO_2 below 3,000 feet AGL (tons per year)

Type of Launch	CO	SO_2	NO_2	VOC[a]	PM_{10}	$PM_{2.5}$	CO_2
Horizontal	4.10	0.03	0.13	0.53	1.20	1.20	71.80
Vertical	0	0	5.10	0	0	0	144.99
Total	4.10	0.03	5.23	0.53	1.20	1.20	216.79

[a] VOCs contribute to the formation of ground level O_3

Estimated annual emissions below 3,000 feet AGL attributable to operation of the Proposed Action are shown in Exhibit 4.6-10 along with the 1999 Baseline emissions for Sierra County. As stated in Section 3.6.4.3, the area of the proposed Spaceport America is in attainment of Federal and New Mexico Ambient Air Quality Standards. The estimated annual emissions shown below are small (zero to four percent) compared to emissions already present in the area. Increases in ambient background concentrations resulting from these emissions would be negligible.

Exhibit 4.6-10. Estimated Annual Emissions below 3,000 feet AGL of Criteria Pollutants and CO_2 from all Sources due to Operation of the Launch Site Compared with Baseline Emissions in Sierra County (tons per year)

Year	NO_2	CO	SO_2	VOC[a]	PM_{10}	$PM_{2.5}$	CO_2
1999 Baseline[b]	2,004	13,217	114	1,493	7,648	1,695	46,039,300[c]
Water Scenario 1							
2009	75.33	139.80	3.26	30.04	235.11	29.40	9,117
2010	60.73	121.80	2.96	19.44	147.51	18.50	6,689
2011	42.83	85.80	2.66	10.04	42.51	6.00	3,947
2012	41.53	74.30	2.66	9.14	15.41	3.20	4,164
2013	46.53	81.90	2.66	9.74	19.61	4.10	5,320
Water Scenario 2							
2009	75.53	139.90	3.26	30.04	235.21	29.40	9,138
2010	60.83	121.80	2.96	19.44	147.51	18.50	6,698
2011	42.83	85.80	2.66	10.04	42.51	6.00	3,947
2012	41.53	74.30	2.66	9.14	15.41	3.20	4,164
2013	46.53	81.90	2.66	9.74	19.61	4.10	5,320
Water Scenario 3							
2009	75.43	140.00	3.26	30.04	235.31	29.40	9,135
2010	61.03	122.10	2.96	19.54	148.61	18.60	6,770
2011	43.63	86.50	2.66	10.14	46.41	6.60	4,158
2012	42.83	75.30	2.66	9.24	22.61	4.30	4,515
2013	48.33	83.10	2.66	9.84	30.11	5.70	5,801

[a] VOCs contribute to the formation of ground level O_3.
[b] The 1999 baseline is from the U.S. EPA National Emissions Trends Database (EPA, 1999).
[c] Sierra County CO_2 emissions are not available. Baseline CO_2 emissions are 1996 CO_2 emissions for the State of New Mexico (WERC, 2002).

Upper Troposphere

Although LV emissions from operations at or above 3,000 feet AGL do occur, these emissions would not result in appreciable ground-level concentrations. Pollutants released into the atmosphere above the mixing height will, in large part, remain above the mixing height. Releases of pollutants above this altitude will not result in appreciable ground-level concentrations of the pollutant. Accordingly, when LV's reach an altitude at or above the mixing height, their emissions would have negligible effect on ground-level concentrations.

HAPs

Lower Troposphere

Engine emissions from highway vehicles (i.e., worker commute vehicles and delivery vehicles) are the only non-launch source of HAP emissions during Spaceport America operations. Estimates of HAP emissions from operation of engines are shown in Exhibit 4.6-11.

Exhibit 4.6-11. Annual HAP Emissions from Highway Vehicles for Spaceport America Operations (pounds per year)

Species	Water Scenarios 1 and 2	Water Scenario 3
Benzene	100.5	41.4
MTBE	9.9	14.9
1,3 Butadiene	14.3	105.2
Formaldehyde	114.9	74.4
Acetaldehyde	43.1	18.3
Acrolein	5.2	233.4
Total	287.9	487.6

The solid propellant in SRMs is the only propellant type proposed for use in LV's that would emit HAPs. Solid propellant exhaust emissions include two EPA regulated air toxics, HCl and Cl_2. Aluminum oxide (Al_2O_3), which is regulated as a toxic air pollutant by New Mexico per 20.2.72.400-502 NMAC, is also a component of SRM exhaust.

Concept V1 vehicles of the small sounding rocket class are the only LV's that would emit HAPs in the troposphere. A maximum of 70 such launches are estimated in 2013 with typical propellant masses of one ton. The only horizontal LV's that would use solid propellant are Concept H3 vehicles, which use a liquid/solid hybrid propellant rocket motor. Concept H3 vehicles are carried aloft by assist aircraft, and are expected to ignite at an altitude of 50,000 feet (the lower troposphere extends to an elevation of 3,000 feet). Therefore, no HAPs would be emitted in the lower troposphere by any of the horizontal LV's planned for Spaceport America. No concept vehicles of any type would use SRMs for landing, and no SRMs would be tested in static test stands.

Estimates of air toxic emissions in the lower troposphere (below 3,000 feet AGL) per launch and from all launches for the year of the maximum number of launches (2013) are shown in Exhibit 4.6-12. The minimal HAP emissions from launch and non-launch activities during operation of the proposed Spaceport America would have a negligible impact on air quality in the lower troposphere.

Upper Troposphere

As stated above, the only horizontal LV's that would use solid propellant are Concept H3 vehicles, which are expected to ignite at an altitude of 50,000 feet (the upper troposphere extends to an elevation of 32,800 feet). Therefore, no HAPs would be emitted in the upper troposphere by any of the horizontal LV's planned for Spaceport America.

Estimates of air toxic emissions in the upper troposphere per launch and from all launches for the year of the maximum number of launches (2013) are shown in Exhibit 4.6-12. The minimal HAP emissions from launch and non-launch activities during operation of the proposed Spaceport America would have a negligible impact on air quality in the upper troposphere.

Exhibit 4.6-12. Emissions of Air Toxics from Vertical Concept V1 Launches

Emission Type	Atmospheric Layer	HCl	Cl	Al_2O_3
Emissions per launch (tons)	Below 3,000 feet	0.057	0.0008	0.103
	Upper troposphere	0.191	0.0025	0.346
Maximum annual emissions (tons per year)	Below 3,000 feet	3.97	0.053	7.18
	Upper troposphere	13.38	0.178	24.21

Impacts in the Stratosphere

Potential impacts of launch emissions to the stratosphere include climate change from contributions of greenhouse gases and depletion of the stratospheric ozone layer.

Emissions were estimated by the methods described above for the troposphere. Horizontal launch emissions are those from the year of maximum emissions (2015) for all U.S. launches in the PEIS HL (FAA, 2005). Vertical launch emissions are those from the year of maximum emissions (2013) for launches at Spaceport America. These emission estimates are shown in Exhibit 4.6-13.

Exhibit 4.6-13. Estimated Maximum Annual Emissions to the Stratosphere (tons per year)

Type of Launch	HCl	Cl_2	PM_{10}	CO	CO_2	NO_2	H_2O
Horizontal	7.3	.005	13.1	122	294	0.11	188
Vertical	1.32	0.02	2.39[a]	0	427	1.70	157
Total	8.62	0.025	15.5	122	721	1.81	345

[a] The value for vertical PM emissions is that for Al_2O_3.

Ozone Depletion

With regard to ozone depletion, chlorine emissions from rocket propellant combustion are the primary pollutant of concern. This is produced by solid rocket propellant directly as Cl_2 and indirectly as HCl, which must be photolyzed (i.e., light must interact with the HCl molecule and release Cl_2) before it can deplete ozone (FAA, 2001). Both the PEIS LL and PEIS HL review several studies on the impact of rocket exhaust chlorine on stratospheric ozone. These include LV's with large SRMs or solid rocket boosters (SRBs) that emit far more chlorine than the smaller suborbital rockets proposed for Spaceport America. Those studies concluded that the amount of chlorine emitted would represent a negligible portion of the total U.S. industrial emissions such that the contribution to ozone depletion would be insignificant.

Both the PEIS LL (FAA, 2001) and PEIS HL (FAA, 2005) discuss two other pollutants generated by rocket fuel combustion that could potentially deplete ozone levels in the stratosphere. PM (as Al_2O_3) may deplete ozone, but the exact impact is unclear. Both the PEIS LL and PEIS HL conclude that the impact of PM emission would not be significant. The PEIS HL states that NO_2 emissions could also deplete ozone levels in the stratosphere. The PEIS HL concludes, however, that NO_2 emissions would be extremely small relative to total U.S. emissions, 21 million tons in 2002 alone. In 2006, 16 million tons of NO_2 were released in 2006 (EPA, 2008). Maximum NO_2 annual emissions for proposed launch activities are estimated at 1.81 tons, which is negligible compared to the 16 million tons of NO_2 released annually in the U.S.

Climate Change

The propellants that would be used for launches at the proposed launch site are described in Chapter 2 of this EIS. CO_2 is by far the most abundant pollutant generated by combustion of these propellants (FAA, 2001). For an assumed 125 vertical launches and 797 horizontal launches in year 2013, a total of 721 tons of CO_2 would be released into the stratosphere by the launch activities. By comparison, the total annual CO_2 emissions from all U.S. sources for 2005 were nearly 6.6 billion tons (EPA, 2008). Although CO_2 emissions could affect climate change, the CO_2 emissions from the Proposed Action would be negligible compared to the rest of the CO_2 emissions sources in the U.S.

Impacts in the Mesosphere and Ionosphere

During both horizontal and vertical launches, rocket firing would be terminated before reaching the mesosphere and the LV's would have sufficient velocity to coast unpowered to their maximum altitudes. Since no propellants would be consumed above the stratosphere, there would be no emissions in either the mesosphere or the ionosphere. Therefore, the Proposed Action would have no impact on the mesosphere and ionosphere.

4.6.1.3 Impacts to the Atmosphere from Accidents

Both the PEIS LL and PEIS HL discuss accident scenarios and impacts from catastrophic accidents in which the LV explodes, either on the launch pad, runway, or in mid flight. The impacts from accidents are obviously a function of their frequency. The PEIS HL states:

> The FAA License and Safety Division is responsible to regulate and license the safety aspects of launch activities. The FAA is responsible to review license applications for safety adequacy and to develop public safety protocols and

standards. A Safety Review is a critical part of the license process and ensures that license applicants will comply with the FAA-established procedures. (FAA, 2005)

All non-amateur commercial launches at the proposed Spaceport America would be licensed or permitted by the FAA. The launch operator would have to meet the appropriate safety measures to obtain a launch license or permit. The launch site operator license application must specify the safety measures that would be applied to launches to minimize the occurrence of accidents and their impacts on the environment. Also, pursuant to the FAA regulation 14 CFR §417.225, flight hazard areas must be protected by emergency response plans and emergency response personnel. The safety of all launch missions would be the primary goal of operations at Spaceport America.

An accident on the launch pad would have the greatest impact on the troposphere. All or much of the propellants on board would burn rapidly near the ground and produce a cloud of combustion products much larger than the ground cloud from a normal launch. An accident in which the LV explodes during ascent would release smaller amounts of combustion products because some of the propellant would have already been consumed. Accidents that involve horizontal LV's could occur on the runway or during LV ascent or descent, and could involve combustion of jet fuel and rocket propellants.

The PEIS LL (FAA, 2001) discusses the impacts of accidents in the troposphere and stratosphere by propellant type. This information is summarized briefly as follows.

- SRMs. If an accident occurs when SRMs are already ignited, their integrity would be destroyed. Most solid propellants do not continue burning when the propellant grain is broken and no longer under pressure, so the rate at which the solid propellant would burn depends on the size of the solid fuel fragments and the air pressure. Because solid propellant is fragmented into relatively small pieces and only a small percentage of it burns completely, the amounts released from a failed vehicle launch may be less than the amounts from 100 percent combustion.
- Hydrocarbon. LV's that use LOX-RP1 propellants, hybrid propellants, or hydrogen peroxide (as an oxidizer), would mainly emit CO_2.
- Cryogenics. LV's that use cryogenic propellants, LOX and LH_2, would mainly emit water vapor.
- Hydrogen peroxide monopropellant. This propellant system emits only H_2O and O_2.

Accidents of non-solid hydrocarbon propellant systems would produce mostly H_2O and CO_2, and these vapors would disperse rapidly. The most significant accident impact would be an explosion of a solid propellant LV on the launch pad. This would produce large quantities of HCl and Al_2O_3. If it is assumed that an LV with a propellant mass of 2.0 tons explodes, and that 100 percent of the solid fuel burns near the launch pad, this would produce 840 pounds of HCl and 1,520 pounds of Al_2O_3. The PEIS HL (FAA, 2005) states that the HCl may combine with moisture in the air to form hydrochloric acid (HCl). This vapor may exist in hazardous quantities in the immediate vicinity of the launch pad and downwind. Wind conditions in excess of four miles per hour and strong sunshine could dissipate HCl concentrations. HCl may also be extracted from the ambient air by moisture and cause wet deposition onto the ground, most likely within close proximity to the launch pad.

Results of an HCl dispersion calculation, presented in the PEIS HL (FAA, 2005), show the potential health impacts of a launch pad accident. This analysis is based on an HCl emission of 4,450 pounds – more than five times the amount expected (840 pounds) at Spaceport America.

The FAA used the Level 2 Emergency Response Planning Guideline (ERPG-2) concentration for HCl to evaluate air quality impacts associated with HCl emissions. ERPG-2 concentrations are believed to be the maximum airborne concentrations that nearly all people could be exposed for one hour without experiencing irreversible or other serious health effects or symptoms that would impair their ability to take protective action. For HCl, the ERPG-2 concentration is 20 parts per million (ppm), which assumes at least one hour of exposure at this concentration level and a total dose of 1,200 ppm per minute. For a wind speed of five miles per hour, the maximum threat zone (distance from the catastrophic accident where the concentration would be at least 20 ppm) would extend 2.4 miles downwind from the area. Individuals at that location would only be exposed to the 20 ppm concentration for less than 10 minutes and would not receive a total dose of 1,200 ppm per minute. The dispersion model also demonstrated that the maximum distance from the test pad where an individual would be exposed to a total dose of 1,200 ppm per minute is 0.6 mile downwind at 5 miles per hour.

For a wind speed of three miles per hour, the maximum threat zone would extend 2.1 miles downwind from the catastrophic accident. Individuals at that location would only be exposed to the 20 ppm concentration for less than 15 minutes and would not receive a total dose of 1,200 ppm per minute. The concentration of HCl in the emission cloud would be reduced to safe levels (less than 20 ppm) within about 30 minutes in five miles per hour wind and 45 minutes in three miles per hour wind.

These analyses indicate that a health threat from HCl (and perhaps Al_2O_3, although this was not analyzed) would exist around and downwind from the accident site. The launch operator's license would specify measures to protect the public against toxic release hazards. The prevailing wind direction in the proposed Spaceport America area is from the west, which is one reason why the vertical launch facility would be located on the east side of Spaceport America site. If wind conditions were such that the ground cloud from an accident might reach Spaceport America airfield or El Camino Real NHT, the launch may have to be rescheduled.

Cryogenic, solid-rocket propulsion systems contain oxidizing agents such as ammonium perchlorate. These agents are designed to burn the propellant completely and it is expected that the liquids released from an accident would explode. Perchlorate, which is naturally occurring in the southwest (surface and atmosphere), has been detected in a variety of foods and in drinking water across the United States. It is known that perchlorate can act as a competitive inhibitor of biochemical reactions, such as iodine transport in the human thyroid, but there is currently no relevant information on exposure to evaluate the potential risk of perchlorate to human health. In the event of an accident, there is a potential for perchlorate to be deposited to vegetation and surface water, which could in turn be used for human or bovine consumption. Additionally, it is possible that unburned segments of the ammonium perchlorate (in a binder matrix) could fall into water bodies (standing water in arroyos or stock tanks) and slowly dissolve, with only very local impacts proportional to the size of the body of water. Although monitoring methods are available, high perchlorate levels would not be distinguishable above natural background due to lack of monitoring baseline and regulatory standards (FAA, 2001; USFDA, 2008).

Atmospheric impacts from catastrophic accidents would depend on the frequency of such accidents. All reasonable and feasible measures would be taken by Spaceport America operators, launch operators, and the FAA to minimize accidents. To minimize the risk of accidents, Spaceport America will fully comply with the safety requirements set forth in 14 CFR Part 420, License to Operate a Launch Site, for both ground safety and flight safety, and any other applicable regulations or guidance from the FAA. In addition, all tenants and customers of Spaceport America must fully meet the requirements set forth in 14 CFR Chapter III related to launch operator safety. These will include, at a minimum, those requirements set forth in 14 CFR Parts 415, 417, 431, and 435, and any other applicable regulations or guidance from the FAA.

4.6.1.4 Summary of Impacts from the Proposed Action

The criteria pollutant and HAP emissions from construction and operation of Spaceport America would have a negligible impact on air quality and would not impair visibility along El Camino Real NHT. The emissions of CO_2 and ozone depleting substances in the stratosphere would have a negligible impact on climate change and ozone depletion. In addition, construction and operation of Spaceport America would have no impact on the mesosphere or ionosphere.

4.6.2 Alternative 1 – Horizontal Launch Vehicles Only

The vertical launch area would not be constructed or operated under this alternative and there would be no licensed vertical launches. Impacts to the atmosphere, although not significant in the Proposed Action, would be reduced as compared to the Proposed Action.

4.6.3 Alternative 2 – Vertical Launch Vehicles Only

The airfield facilities would be fewer under this alternative and there would be no horizontal launches. Impacts to the atmosphere, although not significant in the Proposed Action, would be reduced as compared to the Proposed Action.

4.6.4 No Action Alternative

Under the No Action Alternative, Spaceport America would not be developed and no licensed launch activity would occur at the site. Minimal impacts to the atmosphere would only result from continued use of the site for amateur launches.

4.7 Water Quality, Wetlands, Wild and Scenic Rivers, Coastal Resources, and Floodplains

As described in Section 3.7, there are no wetlands, wild and scenic rivers, nor coastal resources in the vicinity of the Spaceport America site. Effects on surface and ground water quality and quantity and floodplains are described.

4.7.1 Proposed Action

Analysis of the Proposed Action was conducted to identify the potential for significant potential impacts to water resources. The types of impacts that were analyzed for include:

- Degradation of surface water quality;
- Alteration of drainage patterns to cause significant flooding or erosion;
- Construction of structures within a 100-year floodplain; or

- Adverse effects on ground water quality or quantity.

4.7.1.1 Construction

Surface Water and Floodplains

Construction of Spaceport America would not have significant negative impacts on the floodplain (as identified in Section 3.7). Construction activities may slightly alter storm water runoff patterns in the 100-year floodplain as designated by the U.S. Army Corps of Engineers, but there would be no negative impacts on the floodplain. To the maximum extent practicable, placement of proposed Spaceport America facilities outside the floodplain was an important design criterion of the conceptual facilities. The only points where proposed Spaceport America facilities would intersect the 100-year floodplain are in the vertical launch area (Exhibit 3.7-2).

The proposed Spaceport America entrance road into the site from County Road A013 would cross Aleman Draw. The crossing of Aleman Draw, a 15-foot deep arroyo, would include channelization of the arroyo and installation of a bridge with culverts. A below-grade utility corridor, consisting of a powerline, water pipeline, and fiber optic line, would cross Jornada Draw just before entering the vertical launch area. All construction activities that may alter a drainage feature would be conducted in accordance with applicable Clean Water Act permitting.

For the reasons above, construction of the proposed Spaceport America would not result in a notable adverse impact on natural and beneficial floodplain values. Consequently, the proposed Spaceport America does not constitute a significant floodplain encroachment.

Ground Water

Construction of Spaceport America facilities and roads would be constructed in two phases. The first phase would require the withdrawal of approximately 88.4 acre-feet (76,800 gallons per working day) of water over a 1.5 year period. The second phase would require the withdrawal of approximately 10.9 acre-feet of water (14,250 gallons per working day) over a one year period. Three wells would likely be developed in high transmissive portions (i.e., yielding relatively large water quantities) of the alluvial aquifer for water scenarios 1 and 2. Aquifer drawdown from construction activities was conservatively calculated assuming a transmissivity of 500 square feet/day, a storativity of 0.0001, and a single equivalent source well. If any of the new wells tap into a less transmissive local fracture zone (an area where there are water-containing fractures in the underlying consolidated rocks which may be interconnected near the well, but are not connected to the broader area away from the well) beneath the alluvial aquifer, they would not affect off-site drawdown because of the local nature of these zones. Exhibit 4.7-1 presents the drawdown at 0.5, 1, 2, and 3 miles from the well after 1.5, 2, and 2.5 years of aquifer withdrawal for construction. The drawdown at 2 miles from the single equivalent source well would range up to 4.5 feet after 1.5 years of construction withdrawal. At the conclusion of construction Phase 1, the drawdown would begin to recover in response to the decrease in withdrawal rate. Exhibit 4.7-1 assumes that Phase 2 immediately follows Phase 1. If there is a pause between the construction phases, then the drawdown as shown in the exhibit would be less than indicated because of the intervening recovery during the construction (and associated pumping) pause.

Exhibit 4.7-1. Aquifer Drawdown from Construction Activities

Years of Pumping	Distance From Withdrawal Well			
	0.5 miles	1.0 miles	2.0 miles	3.0 miles
	Aquifer Drawdown (feet)			
1.5	7.6	6.0	4.5	3.6
2	2.7	2.4	2.1	1.9
2.5	2.3	2.1	1.8	1.6

Calculated using Theis Equation (University of Wyoming [UWY], 2007).
Calculations described in Appendix K.
One mile = 1.61 kilometers
One foot = 0.305 meters

As described in Section 3.7, the southernmost well at the nearby ranch north of the site is 2 miles from the proposed Spaceport America boundary. The bottom of that well is 50 feet below its pumping water level (Shomaker, 2006). The maximum impact of the additional drawdown (4.5 feet) from Spaceport America withdrawal on that well would be small (less than 10 percent) and transitory, with the drawdown recovering to near operating levels (see Exhibit 4.7-2) approximately one-half year after the conclusion of the construction Phase 1.

All new production wells would be permitted by the New Mexico Office of the State Engineer, which would conduct an independent assessment of effects of ground water withdrawal on the Rio Grande watershed as a whole and concomitant impact on downstream water rights. Any new depletion of water from the fully appropriated Rio Grande would be offset by transfer of existing water rights (DMJM/AECOM, 2007). NMSA has conducted a preliminary study regarding availability and purchase of water rights. This acquisition would entail negotiations with prospective sellers and additional legal steps as required by New Mexico law, which are intended to ensure that existing water users are not adversely impacted. Ground water resources in the area would not be significantly affected by construction of the proposed Spaceport America.

Water Supply Scenarios

Three water supply scenarios are being considered for Spaceport America, as described in Chapter 2. Scenarios 1, 2 and 3 are variations in placement of the three on-site water supply wells. The impacts discussion above considers a single withdrawal well (with withdrawal rate equal to the total of the three wells in either Scenario 1, 2 or 3) at the Spaceport America site boundary. Those impacts thus bound those from either of these scenarios.

Scenario 3 has all water coming to the site from an off-site supplier. That scenario would result in no impacts on nearby ground water.

4.7.1.2 Operations

Surface Water and Floodplains

An area of concern for impacts to surface water is the potential impact of launch-related liquid hazardous and toxic materials on the Rio Grande. The liquid-fueled suborbital LV's would use oxygen, hydrogen, and hydrocarbons for propellants. 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 storm water runoff.

No additional impacts to ephemeral surface waters or the floodplain are expected to occur once construction activities have been completed. At that point, all proposed Spaceport America roads and facilities in the floodplain would have been constructed so as not to negatively impact surface water runoff.

Ground Water

Three on-site wells would be used to supply 16.7 acre-feet/year (21,800 gallons per working day) of water for facility operations. Aquifer drawdown, making the same conservative assumptions as for construction (including assumptions that this rate is pumped from a single well) would be 2.1 feet at 2 miles from the well after 20 years of pumping. As described in Section 3.7, measured flow rates of some wells in the site area exceed this water use rate. Impacts of this water withdrawal on other possible on-site and off-site water uses would be small. Exhibit 4.7-2 presents the drawdown at distances from 0.5 to 3 miles from the well after 10 and 20 years of aquifer withdrawal for operations.

Exhibit 4.7-2. Aquifer Drawdown from Spaceport America Operations

Years of Pumping	Distance From Withdrawal Well			
	0.5 miles	1.0 miles	2.0 miles	3.0 miles
	Aquifer Drawdown (feet)			
10	2.8	2.3	1.9	1.6
20	3.0	2.5	2.1	1.8

Calculated using Theis Equation (UWY, 2007)
Calculations provided in Appendix K.
One mile = 1.61 kilometers
One foot = 0.305 meters

During special events, such as the X Prize Cup, withdrawal rates could be approximately double those of normal operations. These special events withdrawal rates will still be less than during Phase 1 construction and their effect on drawdown will be transitory.

No ponds would be used for waste-water storage or discharge. Based on the anticipated flows at the vertical launch area for the first 5 to 10 years of operation, standard commercial septic tanks would be used and their placement would be in accordance with NMED regulations. If demand increases, alternatives include addition of a re-circulating filter system, use of discharge for irrigation provided the nitrogen balance is maintained, or pumping to an expanded wastewater treatment facility.

The launch site design would incorporate water management methods, such as sediment barriers and retention ponds, for all building sites, parking lots and areas where a change in grading or ground cover has occurred as a result of construction. Launch site areas where potentially contaminated waste-water or solutions may be inadvertently discharged would have fixed containment barriers.

Launch releases are expected to be composed mainly of gases and water vapor. Any minor amounts of chemicals that may deposit on the ground would be dispersed. Such deposits would not be expected to impact the ground water because of the lack of ground water recharge at the site.

Impervious surfaces, such as concrete, asphalt, or pavement, would be constructed at the launch facilities. Because of the minimal precipitation recharge at the site except in the arroyos, no impact on ground water resources is expected from this change in ground cover.

No additional impacts to ground water are expected to occur once construction activities have been completed and launch operations begin.

The normal substances that would be used in the proposed Spaceport America facilities (including the airfield) and vehicle maintenance (e.g., petroleum products, cleaning solvents, etc.) are currently in use at numerous locations such as ranches and businesses in the I-25 corridor. These materials would be stored in lesser quantities at the proposed Spaceport America and used under carefully controlled conditions and in accordance with EPA and NMED/Water Quality Control Commission regulations and would not impact ground water from these sources.

4.7.1.3 Summary of Impacts from the Proposed Action

The construction and operation of Spaceport America would not result in significant impacts on water quality in the Spaceport America region. There could be small off-site water quantity (drawdown) effects in the immediate vicinity of the site, but no changes in off-site water use are anticipated as a result of the Proposed Action. The proposed Spaceport America would not result in a notable adverse impact on natural and beneficial floodplain values.

4.7.2 Alternative 1 – Horizontal Launches Only

Under this alternative the vertical launch facility would not be constructed and both construction and operational activities would be reduced. The impacts of this alternative on ground water resources (i.e., available water in the aquifer) would be somewhat less than that of the Proposed Action due to less construction and no vertical launch activities. Impacts on the floodplain would not be significantly different than those of the Proposed Action because all non-beneficial impacts in the Proposed Action for the vertical launch complex would have been mitigated through siting and construction practices.

4.7.3 Alternative 2 – Vertical Launches Only

Under this alternative the vertical launch facilities would be constructed as in the Proposed Action. The proposed airfield would be constructed but with fewer facilities and a smaller runway. Operational activities would be reduced due to no horizontal launches. The impacts on water resources of this alternative would be similar but slightly less than that of the Proposed Action. Impacts on the floodplain would not be significantly different than those of the Proposed Action because the airfield would be constructed outside of the floodplain, as in the Proposed Action.

4.7.4 No Action Alternative

Without construction of the proposed Spaceport America, ground water usage would remain very low and existing storm water runoff and erosion patterns would continue without modification. There would be no impacts to water resources and the floodplain under this alternative.

4.8 Fish, Wildlife, and Plants

4.8.1 Proposed Action

The following sections provide an assessment of potential impacts to biological resources from the Proposed Action and Alternatives. Because there are no aquatic habitats in the vicinity of the launch site, the discussion will focus on terrestrial biota and habitats, including special status species.

4.8.1.1 Construction

<u>Plants</u>

Construction activities described in Chapter 2 would result in the clearing, grading, or disturbance (temporary ground disturbance) of approximately 970 acres, which is six percent of the almost 26 square miles within the proposed Spaceport America Project boundaries. Of this total, only 145 acres, which is less than one percent of the Project area, would be permanently lost due to facility construction. An additional 330 acres associated with transmission and fiber optic corridors would be disturbed. This includes a Project-associated electrical substation (1.3 acres) that would be permanently impacted due to construction, 6 miles of transmission lines (5 miles above ground, 1 mile underground) and 12 miles of below ground fiber optic line in corridors that would be temporarily disturbed.

Generally, the proposed Spaceport America site consists of flat to gently-sloping grasslands and desert shrub lands, with arroyos (intermittent drainages) providing the only relief. Soils in the area, mostly of the Stellar-Continental association, are deep and well-drained. Sierra County typically receives about 10 inches of rain annually (WRCC, 2007), so the potential for erosion is low (Zia EEC, 2007a). Heavy rains during the late summer "wet season" could result in erosion of soils from construction-disturbed lands into the ephemeral streams and arroyos in the Project area, possibly impacting down-gradient vegetation in these sites. These potential impacts would be minimized by best management practices during construction (e.g., use of silt fencing, mulching, hay bales) to reduce run-off from the disturbed areas, and possibly to limit major ground-disturbing activities during the wet season.

Arroyo habitats associated with the dry washes found within the Spaceport America Project area are not considered riparian areas by definition (BLM, 1992). Although not riparian, they typically have a vegetation community that is distinct from the surrounding desert scrub and grassland habitats, and add diversity to the area. Arroyos would have to be crossed by roadways/corridors supporting Spaceport America facilities. These roadways/corridors would be designed and built to reduce or minimize, to the extent possible, impacts to arroyos and arroyo-associated plant communities.

Chihuahuan desert scrub, semi-desert grassland, and plains-mesa sand scrub plant communities found within the proposed Project area are similar to those plant communities on similar topography throughout the Jornada del Muerto (Sullivan et al., 1996). The Project area also has a history of grazing, so portions of the area may be somewhat degraded. However, semi-desert grasslands are considered a "key terrestrial habitat" to be protected and enhanced due to its importance to grassland wildlife species (NMDGF, 2006a) and portions of the proposed Project area have been managed/enhanced as part of a grassland restoration program (BLM, 2007a). Multi-agency efforts led by BLM to restore and/or enhance grassland habitats are ongoing throughout the region, with over 250,000 acres restored on public lands in 2007 (BLM, 2007c). The temporary ground disturbance of 970 acres during construction and the permanent loss of 145 acres, for facilities, would impact only a small fraction of this community in this region of New Mexico and should not adversely affect local or regional plant diversity. Recovery of temporarily disturbed grounds, without assistance, could be a long-term, multi-decadal process and thus these temporarily disturbed areas would be re-vegetated after construction activities are complete.

Night-blooming cereus (*Peniocereus greggii* var *greggii*) has not been observed on the Project area, but may occur in shrublands. If discovered, these plants would be relocated.

Wildlife

Noise, clearing/grading, and human presence are potential construction-related activities that could impact wildlife at the proposed Spaceport America site. Although noise levels in construction areas can be high (up to 100 dBA at 100 feet from sources of noise), these high local noise levels would not be expected to propagate far beyond the boundaries of the construction site. Exhibit 4.8-1 shows the rapid attenuation of construction noise over relatively short distances. For example, at 400 feet from the source of 100 dBA construction noise, noise levels have generally dropped to 60-80 dBA, below levels known to startle small mammals and waterfowl (Golden et al., 1980). Even with this attenuation, some displacement of small mammals and birds would be expected. This displacement would likely be permanent for some species and temporary for others. These noise impacts would be considered small, generally short-term, localized, and not ecologically significant.

Clearing and grading would result in the loss of wildlife habitat (less than 1,000 acres) during the construction phase of the Project with approximately 825 acres re-vegetated post-construction. Large game species, such as oryx (*Oryx gazella*), pronghorn (*Antilocapra americanus*) and mule deer (*Odocoileus hemionus*), would experience temporary disturbance of habitat during the construction period and permanent removal of some habitats when fences are established. Approximately 1,400 acres (less than 9 percent) of the Project area (horizontal runway and facilities) would be enclosed by fencing for security and to keep big game and livestock off the runways. This fencing would result in the permanent removal of these acres to big game species and may disrupt established travel routes that they use to move through the Project area. As noted in Section 3.8, other than the enhanced desert grasslands on-site, the Project area contains no unique or critical habitats, wetlands, or special areas needed by wildlife. Displaced wildlife would have to shift to adjacent lands of varying quality. However, the exclusion of grazing

Exhibit 4.8-1. Peak and Attenuated Noise (in dBA) Levels Expected from Operation of Construction Equipment

Source	Noise Level (peak)	Distance from Source			
		50 feet	100 feet	200 feet	400 feet
Heavy trucks	95	84-89	78-83	72-77	66-71
Dump trucks	108	88	82	76	70
Concrete mixer	105	85	79	73	67
Jackhammer	108	88	82	76	70
Scraper	93	80-89	74-82	68-77	60-71
Dozer	107	87-102	81-96	75-90	69-84
Generator	96	76	70	64	58
Crane	104	75-88	69-82	63-76	55-70
Loader	104	73-86	67-80	61-74	55-68
Grader	108	88-91	82-85	76-79	70-73
Dragline	105	85	79	73	67
Pile driver	105	95	89	83	77
Fork lift	100	95	89	83	77

Source: Golden et al. (1980)
1 foot = 0.3 meters

animals from the fenced area may benefit small mammals, reptiles, and birds by allowing the enclosed plant communities to return to a more pristine, non-grazed condition. Construction of the facility may result in the loss of water sources (drinkers and catchments built for livestock and/or wildlife) or impact their use by wildlife. Any trenching activities would follow State guidelines (NMDGF, 2003b) to the extent possible, to prevent trapping animals in open trenches. Above ground transmission lines would be designed to the extent possible to minimize risk of electrocution of raptors and other avian species (APLIC, 2006; NMDGF, 2003c).

Habitat fragmentation due to construction/fence establishment can impact wildlife. However, only 1,400 acres (less than 9 percent) of the Project area is fenced and, for utilities, infrastructure would be placed along existing roads and rights-of-way rather than developing previously undisturbed lands, thus further minimizing habitat fragmentation.

Migratory birds may use the Project area. To the extent possible, active bird nests would be relocated during construction or avoided until the young fledge from the nest.

Human presence and activity (additional vehicular traffic, etc.) during construction would likely result in disturbance, and a slightly increased probability of mortality, of wildlife species, but this impact would be temporary, of short duration, and unlikely to affect wildlife diversity within the area.

Special Status Species

Of the federally-protected "special status" species for Sierra and Doña Ana Counties, four have the best potential to be marginally affected: Aplomado falcon (*Falco femoralis septentrionalis*), bald (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*), and yellow-billed cuckoo (*Coccyzus americanus*). The habitat present for the endangered Aplomado falcon in the Project area is considered marginal (Zia EEC, 2007c) and no Aplomado falcons have been observed in the Spaceport America area during surveys conducted in support of the Project (Sullivan et al., 1996; North Wind, 2006; Zia EEC, 2007c). The disturbance of the acreage due to construction would not impact their ability to return to this region. The USFWS stated that construction and operation of the Spaceport is "unlikely to jeopardize" the Aplomado falcon (USFWS, 2008). Federally protected eagles have been observed on site property, presumably scavenging for prey (North Wind, 2006; Zia EEC, 2007c). Disturbance of existing habitat during construction would be temporary and any impact associated with the permanent facilities would be minimal on the scavenging area needs of these species. The yellow-billed cuckoo, a candidate for Federal listing, occasionally uses the type of Chihuahuan Desert scrub habitat found on and near the site. However, this species has not been observed on the Spaceport America site during the biological surveys, and the disturbance of potential habitat due to construction would not impact the regional population (Sullivan et al., 1996; North Wind, 2006; Zia EEC, 2007a). None of the property within the Proposed Action's Project area is designated critical habitat.

Multiple species are listed for the area as USFWS "species of concern," BLM sensitive species, and/or State of New Mexico endangered or threatened species (Section 3.8, Exhibit 3.8-4). Most of these species are associated with either rocky, cliff-like habitat not found on the Spaceport site or aquatic habitats, also not found on the site. Only two of the avian species have been observed on Project lands: loggerhead shrike (*Lanius ludovicianus*) and Bell's vireo (*Vireo bellii*). If loggerhead shrikes nest in the construction area, they could be temporarily impacted if construction occurs during the nesting season. Bell's vireo occurs only as a migrant in this area and they would likely shift to similar nearby habitats during the construction period. Texas horned lizards (*Phrynosoma cornutum*) also have been observed in the Project area. The Proposed Action may impact this species, but the effects would be reduced or eliminated by monitoring and relocation of individuals found during construction to the extent possible. Burrowing owls (*Athene cunicularia hypugaea*) have not been observed on Project lands, but their presence is likely. If they were found in the construction area, impacts would occur during the construction period and would be reduced or minimized to the extent possible by methods developed by the State (NMDGF, 2007b). The remaining species have not been observed and only have potential habitat in the Project area. Impacts to these species, if any, would be of short duration during the construction period.

For the State-listed species, desert bighorn sheep (*Ovis canadensis mexicana*) occur in three nearby mountain ranges (San Andres, Caballos, Fra Cristobal), but do not have habitat on Project lands and have never been observed there. They may possibly use portions of the Project area as travel corridors between these populations. It is possible that human presence and/or construction activities would temporarily block such potential corridors. Only 1,400 acres (less than 9 percent) of the total Project area is fenced, physically precluding such travel. Two other species, common ground doves (*Columbina passerine pallescens*) and varied buntings

(*Passerina versicolor*), have potential habitat on the Project lands, but have never been observed there and would be unlikely to be impacted by construction activities.

Human presence and activity (additional vehicular traffic, etc.) during construction would likely result in disturbance, and a slightly increased probability of mortality, of sensitive wildlife species, but this impact would be temporary, of short duration, and unlikely to affect wildlife diversity within the area.

4.8.1.2 Operations

Plants

Approximately 145 acres of land would be used for construction of permanent facilities at the Spaceport America site. Operational activities such as grounds maintenance would only occur in areas already impacted during the construction phase. Since operational activities would be long-term, they would occur in areas that do not provide locally or regionally important vegetation, and as a result their impacts would be minimal.

Launch and recovery operations would not affect vegetation since these activities would be conducted over established concrete pads. High temperature exhaust would not impact vegetation during either take-offs or landings, because it would generally occur over concrete pads where vegetation is lacking.

Although chemicals from vehicle launch emissions could impact vegetation, ecologically significant effects would not be expected from proposed launch activities. Proposed rocket propellants vary depending on the proposed LV, and chemical emissions vary by propellant type. Propellant types include conventional jet fuel, hydrocarbon fuel, cryogenic propellants, solid propellants (polybutadiene matrix), hybrid propellants (solid with liquid oxidizers), and hydrogen peroxide monopropellant. The solid and hybrid propellant types result in Al_2O_3 and HCl emissions, which are considered possible significant impacts to the environment (FAA, 2001). While most of the projected flights employ LV's that use solid or hybrid propellants, estimated deposition of these two chemicals are likely at rates too low to impact local vegetation. CO_2 is another emission from launch activities (FAA, 2001). 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.

Wildlife

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 on-site and on roads. Noise levels greater than 80 dBA could result in startle reactions in birds and mammals (Golden et al., 1979). Predicted noise levels from rocket launches suggest levels greater than 80 dBA at locations up to 8 miles from the launch site. Ascent-related launch noise typically lasts only 1 minute, with peak noise levels lasting only 5 to 15 seconds after launch (FAA, 2001). Noise from launches would temporarily disturb wildlife, but they should return and resume normal activities after the disturbance (launch noise) ceases. Birds startled from their nests during shuttle launches at Cape Canaveral returned within 2 to 4 minutes (FAA, 1996). Other birds living within 1,000 feet of a rocket launching site at the same facility have not exhibited mortality or reductions in habitat use during rocket launches (FAA, 1996). No permanent negative impacts related to launches would be expected.

Of the vehicles projected to use this facility, only the Concept V3 would produce rocket noise during landing. This noise level would be substantially less than the noise associated with launch and would be of shorter duration (less than 20 seconds). Large mammals, including mountain sheep (*Ovis canadensis nelsoni*), desert bighorn sheep, mule deer, and pronghorns, have been found to exhibit only temporary changes in behavior (back to normal in less than 5 minutes) and heart rate in response to noise from low level aircraft over-flights (Krausman et al. 1998; Krausman et al. 2002; Weisenberger et al. 1996). Animal responses to noise decreased with increased exposure, suggesting they habituate to noise over time (Weisenberger et al. 1996). No negative impacts related to landings would be expected.

Sonic booms are another potential source of disturbance to wildlife. Sonic booms associated with vertical take-offs would project away from the Earth's surface and likely not be heard by wildlife. The FAA (2001, 2005) concluded that sonic booms associated with vertical and horizontal launches would not impact humans or structures. Any impacts on wildlife from sonic booms would be of short duration and would not result in a significant impact.

Vehicle launch emissions would have little impact on birds since the launch noise would likely startle the birds into leaving the area, which would reduce the likelihood of contact with the emission plume. Development of the launching pads, associated buildings, and other facilities would reduce the incidence of wildlife near the launch area. Emissions from spaceport operations would not affect wildlife.

Increased human presence (people, vehicular traffic, etc.) from site personnel may disturb portions of wildlife populations near roads, buildings, and facilities. It is likely that some wildlife would acclimate to the new conditions, while others would be displaced and would move from the area. Water sources located near active portions of the Project area, typically established for livestock but beneficial to both livestock and wildlife, may be avoided due to increased human presence. The likelihood of mortality due to additional vehicular traffic associated with facility staff and launch observers (visitors) may increase slightly for resident wildlife. Impacts from noise, human activity, and traffic would increase during the X Prize Cup; however, because this event only occurs once a year for up to 7 days, this increase would be temporary.

Special Status Species

As discussed in Sections 3.8 and 4.8.1, 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., species do not breed on-site). Marginal habitat exists in the Project area for Aplomado falcons, but they have not been observed on-site. Sensitive species and/or species of concern present on the Project area include loggerhead shrikes, Texas horned lizards, and possibly burrowing owls (see Section 3.8.4.3). 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. Several species of bat could be located in the Project vicinity. Lighting on facilities would likely have impacts on the local bat population, possibly resulting in their moving to new areas or altering foraging and/or roosting behavior. This would have a minimal impact on the species. These impacts would be reduced by minimizing exterior light use to the extent practicable. Facilities and buildings constructed on the Project area may provide roosting habitat for crevasse-roosting bats.

4.8.1.3 Summary of Impacts from the Proposed Action

Impacts from construction and operation of Spaceport America would occur, but would not jeopardize the continued existence of special status species of plants or wildlife, or result in the destruction or adverse modification of designated critical habitat, and would not be significant. Impacts from construction, primarily habitat loss, and site operation, primarily noise increased human activities, may result in displacement of some local wildlife, impacts on regional wildlife populations would not be significant.

4.8.2 Alternative 1 - Horizontal Launch Vehicles Only

Under Alternative 1, the FAA would issue a Launch Site Operator License for the operation of a launch site to support only horizontal launches. This would entail the development of a smaller facilities area and result in fewer launches. Construction activities and resultant disturbance at the Spaceport America Project site would be reduced as compared to the Proposed Action, where potential impacts to vegetation, general wildlife, and threatened and endangered species are not considered significant. Several structures would not be constructed under this alternative, resulting in less soil disturbance due to clearing and less construction noise. Site operational noise due to vehicle launches would be reduced (no vertical take-offs and subsequent landings) and rocket emissions would be lower due to fewer take-offs and landings. Alternative 1 would result in slightly smaller impacts on local and regional biological resources due to construction and operation of Spaceport America than those of the Proposed Action.

4.8.3 Alternative 2 - Vertical Launch Vehicles Only

Under Alternative 2, the FAA would issue a Launch Site Operator License for the operation of a launch site to support only vertical launches. This would entail the development of a smaller facilities area and result in fewer launches. Construction activities and resultant disturbance at the Spaceport America Project site would be reduced compared to the Proposed Action, where potential impacts to vegetation, general wildlife, and threatened and endangered species are not considered significant. Several structures would not be constructed under this alternative, resulting in less soil disturbance due to clearing and less construction noise. The area to be fenced would be smaller. Site operational noise due to vehicle launches would be reduced (no horizontal launches and subsequent landings) and rocket emissions would be lower due to fewer take-offs and landings. Alternative 2 would result in slightly smaller impacts on local and regional biological resources due to construction and operation of Spaceport America than those of the Proposed Action.

4.8.4 No Action Alternative

Under the No Action Alternative, no Launch Site Operator License would be issued and conditions at the proposed site would remain in their current condition. There would be no impact to vegetation, wildlife, or special status species other than the temporary disturbance caused by use of the existing amateur launch pad.

4.9 Hazardous Materials, Pollution Prevention, and Solid Waste

4.9.1 Proposed Action

4.9.1.1 Construction Activities

Construction activities would result in the generation of small volumes of hazardous wastes. The hazardous materials expected to be used are common to construction and include diesel fuel, gasoline, and propane to fuel the construction equipment; hydraulic fluids, oils and lubricants; and welding gases, paints, solvents, adhesives, and batteries. Appropriate materials management techniques would be followed to minimize their use and manage waste disposal. The use, management, and disposal of hazardous materials for both the construction and operation phases are described in Exhibit 4.9-1.

Non-hazardous and hazardous waste generated during construction of Spaceport America could include construction debris, empty containers, spent solvents, waste oil, spill cleanup materials (if used), and lead-acid batteries from construction equipment. Construction contractors would be responsible for safely removing these wastes from the site for recycling or disposal in accordance with applicable regulations. Debris, such as brush or stumps, resulting from site preparation could be burned in accordance with New Mexico Administrative Code 20.2.60, Open Burning, or disposed of in a permitted landfill. Soil excavated during construction activities would be stockpiled for construction and landscaping uses. Building materials such as asphalt and concrete are not expected to generate waste since they are produced in the needed quantities and can be recycled in the event that the material or its placement does not meet specifications.

Excess building materials would be collected for re-use and scrap building materials would be disposed of at area landfills. Scrap building materials that would be generated from construction of buildings with interior spaces (e.g., offices) include such materials as wood, drywall, plastic, and masonry. NMSA estimates approximately 220 tons of scrap building materials would be generated for Phase 2 of construction when more of the buildings would be constructed, based on a rate of 3.89 pounds per square foot (EPA, 1998). The proposed spaceport site is in New Mexico Solid Waste Bureau District 3. District 3 includes Grant, Sierra, Luna, Doña Ana, Otero, and Hidalgo Counties. In 2004, District 3 disposed of 48,100 tons of construction and demolition debris in landfills (NMED, 2006). Spaceport America's peak annual construction and demolition debris would be 0.45 percent of the 2004 disposal rate in the District.

Other non-hazardous waste would be generated at the construction site from workers (e.g., lunch waste, office waste), packaging materials. This waste is estimated at 1,200 tons annually during Phase 2, the peak time for municipal waste generation from construction activities, based on a generation rate of 21.6 pounds per square foot (CIWMB, 2007).

The New Mexico Solid Waste Bureau District 3 disposed of 904,000 tons of municipal solid waste in landfills in 2004 (NMED, 2006). Spaceport America's estimated waste quantity would be 0.13 percent of the total 2004 disposal rate.

Small quantities of hazardous waste would be generated during construction activities. Construction contractors would be responsible for safely removing these wastes from the site for recycling or disposal in accordance with applicable regulations. Hazardous waste generation from paint (assumed to be 10 percent of paint supplies) was estimated at 96 pounds per month during construction. Hazardous waste would also be expected from other hazardous materials such as cleaning supplies, sealants, and adhesives, but in smaller quantities. Solvents used during construction would be collected for recycling. Other hazardous materials such as welding gases are expected to be consumed in their entirety. The total monthly generation of hazardous waste during construction would be less than 220 pounds, qualifying Spaceport America as a

Exhibit 4.9-1. Hazardous Materials Usage and Waste Management During Construction and During Operational Maintenance and Flight Support

Material	Use	Management
Hazardous Materials Usage		
Hydraulic fluid and lubrication oils	Construction equipment	Stored on impervious surface with spill cleanup materials available. Used oils would be collected for recycling.
Welding gases	Construction of launch site structures and fabrication and maintenance of equipment in on-site welding and machine shops	Consumed in welding operations. Cylinders would be removed from launch site by vendors.
Diesel fuel, gasoline, propane	Fuel for construction equipment	Stored in aboveground tanks with secondary containment and periodic inspections.
Paints, primers, thinners, cleaning fluids, degreasers, adhesives, sealants, isopropyl alcohol	Construction and maintenance of launch site facilities and equipment, cleaning	Limited quantities stored on-site at any one time. Stored in a small, locked steel building in the office/shop area at least 2,500 feet from any fuel storage. Small amounts of spent solvents would be transported off-site for recycling or disposal. Waste generated from these materials would be managed by the construction contractor and disposed of at the local landfills or hazardous waste quantities may be disposed as allowed under New Mexico regulations.
Jet fuel, hydrocarbon fuels (kerosene, alcohol, liquid methane), cryogenic propellants (liquid oxygen, liquid hydrogen), nitrous oxide	Fuels, propellants, oxidizers	Stored on impervious ground surfaces with berms capable of containing full volume of material stored. Areas would be fenced and checked for security. Delivered to the launch site in DOT-approved trucks and containers. Consumed during launch or recovered after landing.

Exhibit 4.9-1. Hazardous Materials Usage and Waste Management During Construction and During Operational Maintenance and Flight Support (cont'd)

Material	Use	Management
Hydrogen peroxide	Oxidizer and monopropellant	Stored on impervious ground surfaces with berms capable of containing full volume of material stored. Areas would be fenced and checked for security. Delivered to the launch site in DOT approved trucks and containers. Consumed during launch or recovered after landing.
Solid propellant and solid rocket motors	Propellant and motors	Stored in containers meeting Alcohol, Tobacco and Firearms (ATF) specifications. Consumed during launch or recovered after landing.
Small explosive initiators and rocket motor igniters	Ignite fuels and propellants	Stored in a locked bunker at least 2,500 feet from fuel storage. Consumed during launch.
Compressed helium and nitrogen gases	Used in LV assembly and testing	Cylinders would be removed from launch site by vendors.
Waste Management		
Construction debris	Scrap lumber, metal, cardboard, paper	Removed for off-site recycling or disposal during construction phase.
Spent solvents, paper, waste oil, batteries, spill cleanup materials, antifreeze, and empty containers	From construction, grounds maintenance, housekeeping, maintenance, and spill response (as needed) activities	Removed for appropriate off-site recycling or disposal.
Sewage	From portable toilets during Phase 1 construction; a combination of on-site sewage treatment and portable toilets during Phase 2 of construction and operations; and portable toilets during the X Prize Cup Event	Vendor would remove contents of portable toilets. The on-site wastewater treatment system would dispose of treated wastewater on-site.

conditionally-exempt small quantity generator (CESQG) of hazardous waste. Hazardous waste from CESQGs can be disposed in the types of treatment, storage, and disposal facilities described in 40 CFR 261.5(g)(3), including municipal solid waste landfills and commercial hazardous waste management facilities. The waste types and amounts generated during construction could easily be accommodated by existing treatment, storage, and disposal facilities within the region. The impact to disposal capacity at available facilities from Spaceport America hazardous waste would be negligible.

On-site impacts stemming from the management of hazardous materials and hazardous and non-hazardous wastes are not anticipated because they would be handled, stored, and used in compliance with all applicable regulations. Hazardous material storage areas 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. Off-site impacts from disposal of the waste from the proposed spaceport would be negligible to minimal due to the small quantities of waste in comparison to the quantity of waste actually disposed of and the remaining disposal capacity of the region.

Sewage generated during construction activities from portable toilets would be removed for off site treatment and disposal by the vendor supplying the toilets. On-site wastewater treatment systems would be installed during Phase 1 after obtaining the proper permits from the NMED. A wastewater treatment plant would be installed to serve the horizontal launch area and airfield, and individual septic tanks and drain fields would serve the vertical launch area. Portable toilets would continue to be used for remote construction areas as needed. The average daily water consumption for construction Phase 2 is estimated at 4,010 gallons (Thomas and Gutman, 2007).

4.9.1.2 Operations

Launches would use hazardous materials and maintenance and flight support activities would also use hazardous materials (Exhibit 4.9-1). Use of these materials would in some cases result in the generation of hazardous waste. Flight support operations at both the horizontal and vertical launch areas would use products containing hazardous materials, including paints, solvents, oils, lubricants, acids, batteries, fuels, surface coating, and cleaning compounds. Some rocket propellants and materials used in maintaining LV's are considered hazardous. The types of rocket propellants and systems for LV concepts to be potentially launched from Spaceport America include:

- Jet fuel used in conventional and modified jet engines;
- Hydrocarbon fuel (e.g., Rocket Propellant-1 [RP-1], kerosene, alcohol, or liquid methane) with an oxidizer such as liquid oxygen (LOX);
- Cryogenic propellants (i.e., LOX/liquefied hydrogen [LH_2], where the fuel and oxidizer are maintained at very low temperatures);
- Solid propellant (e.g., polybutadiene matrix with acrylonitrile oxidizer and powdered aluminum);
- Hybrid propulsion systems, consisting of solid propellants with a liquid oxidizer such as LOX or nitrous oxide; or
- Concentrated hydrogen peroxide used as a monopropellant or an oxidizer.

These products would be used and stored at appropriate locations throughout Spaceport America. Fuel storage facilities would be constructed in Phases 1 and 2. Prior to that time, Spaceport America would use tanker trucks that would only be on-site to support a launch. Specific materials management plans would be developed to include strategies and procedures for storing, handling, and transporting hazardous materials in addition to responding to on-site or off-site spills. This would include compliance with protocols for maintaining up-to-date material safety data sheets, as well as spill prevention, control, and countermeasures (SPCC) plans.

Small quantities of hazardous waste would be generated during operations. Most of the hazardous materials would be consumed, so no waste would be left requiring disposal. Aircraft and vehicle maintenance, propellant and fuel storage and dispensing, and facility and grounds maintenance are among those activities that may generate very small quantities of hazardous wastes. The sources of hazardous waste include waste fuel, waste oils, spent solvents, paint waste, and used batteries. The State of New Mexico's operations and management entity would develop a hazardous waste management plan for Spaceport America. The plan would lay out the steps for appropriate management of hazardous waste, such as satellite accumulation points and properly labeled U.S. DOT-approved containers. Wastes would be disposed of using designated hazardous waste accumulation facilities or private hazardous waste contractors, as needed. NMSA estimates that the hazardous waste quantities would be small enough to qualify Spaceport America as a CESQG of hazardous waste, which would be less than 220 pounds per month. As indicated in Section 4.9.1.1, this rate of generation would have a negligible impact on disposal capacity in the region.

Operations would also generate non-hazardous waste such as office waste, break room waste, packaging from supplies, solid waste from maintenance activities that use non-hazardous materials. Section 4.10 indicates that peak employment at Spaceport America would be 100 workers in 2013. Based on an estimated generation rate of 9.2 pounds per worker per day (CIWMB, 2007), the annual generation during 2013 would be approximately 120 tons. As indicated in Section 4.9.1.1, the New Mexico Solid Waste Bureau District encompassing the proposed spaceport site disposed of 904,000 tons of municipal solid waste in 2004. Spaceport America waste would increase the disposal rate by 0.013 percent. As indicated in Section 3.9, the multi-county region that borders Mexico is projected to have adequate waste disposal capacity for about 80 years.

Based on 60 gallons of water usage per worker per day and 20 gallons per day for guests of passengers, the average daily sewage flow in 2013 is estimated to be 12,225 gallons. The on-site wastewater treatment systems would be designed to accommodate the expected flow (DMJM/AECOM, 2007). In addition, portable toilets would be used in remote construction areas as needed.

The X Prize Cup would generate an amount of waste consistent with similar spectator events. Based on the 2005 national daily average waste generation rate of 4.54 pounds per person (EPA, 2006), the expected crowd of 20,000 persons would generate 45.4 tons of waste per day for up to 7 days for a total of approximately 320 tons. However, implementation of EPA's Recycle on the Go program at the X Prize Cup could greatly reduce the amount of waste requiring disposal through recycling programs. Through Recycle on the Go, EPA is partnering with government agencies and businesses to introduce recycling programs in places where large numbers of people gather including special events (EPA, 2007).

During the X Prize Cup, NMSA plans to use portable toilets for attendees. The vendors supplying the toilets would service them and the waste would be disposed off-site.

In case of a crash or other vehicle accident, clean up and recovery of components would be performed to minimize impacts on lands. Fire suppression and clean up teams would be sent to the area to put out possible fires and clean up possibly hazardous materials and waste. The specific recovery activities following accidents would be specified in the Launch Site Operator License, Spaceport America standard operating procedures, and Environment, Safety, and Health documents. Hazardous materials and waste would be managed in accordance with Federal, State, and local requirements and any necessary permits would be obtained prior to on-site treatment. Additional considerations for specific LV's would be specified in the launch licenses. In all cases, the owner or agency of the affected land would be notified of the accident and response activities would begin as soon as possible.

4.9.1.3 Summary of Impacts from the Proposed Action

On-site impacts stemming from the management of hazardous materials and hazardous and non-hazardous wastes are not anticipated 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 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.

4.9.2 Alternative 1 – Horizontal Launch Vehicles Only

Under this alternative, the impacts would be slightly less than the Proposed Action due to fewer launches, reduced amount of propellants, and from the construction and operation of fewer facilities.

4.9.3 Alternative 2 – Vertical Launch Vehicles Only

Although there are no significant impacts from hazardous materials and waste in the Proposed Action, under this alternative the impacts would be slightly less due to the reduced amount of propellants, fewer launches, and from the construction and operation of fewer facilities.

4.9.4 No Action Alternative

Under this alternative Spaceport America would not be constructed or operated, and hazardous materials and waste would only result from continued use of the area for amateur launches.

4.10 Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks

The ROI for this analysis includes the host site, Sierra County, and two adjacent counties, Doña Ana and Otero County in New Mexico. The ROI occupies approximately 7,987 square miles. The significance thresholds applicable to socioeconomics, environmental justice, and children's environmental health and safety risk are found in FAA Order 1050.1E, Appendix A, Section 16. The significance thresholds are:

- Extensive relocation of residents where sufficient housing is not available;
- Disruptions of local traffic patterns that substantially reduce the levels of service of the roads serving the [spaceport] and its surrounding communities;
- Relocation of community businesses that would create severe economic hardship for the affected communities;

- A substantial loss in the community tax base;
- Disproportionately high and adverse human health or environmental effects on minority and low-income populations; and
- Disproportionate health and safety risks to children.

The subsections of Section 4.10 discuss impacts to the socioeconomic environment (Section 4.10.1), the environmental justice analysis (Section 4.10.2), and a determination if the Project would pose a disproportionate risk to children's health and safety (Section 4.10.3). Potential traffic impacts (see second bullet above) are addressed in Appendix H, Traffic and Transportation, with the potential impacts summarized in this section.

4.10.1 Socioeconomic Impacts

The socioeconomic impact analysis was based on two variables: 1) the estimated number of construction and operations workers and 2) the estimated dollars to be spent constructing and operating the proposed Spaceport America. The estimated number of workers was used to estimate impacts to local community services and the dollars estimate was used to measure impacts to the ROI's economy. The estimated construction and operations expenditure was used in a method of analysis known as input-output (I/O) analysis. This analysis incorporates the IMPlan 2.0 database. This method of analysis follows the accounting conventions of the U.S. Bureau of Economic Analysis.

The equation for I/O analysis is:

$$\Delta\gamma = (1 + \alpha)\,\Delta\rho$$

Where:

$\Delta\gamma$ = Change in total industry output, value added, or employment

α = Regional multiplier (This analysis used multipliers that are specific to the construction industry and to operations of the aerospace industry as well as household multipliers.)

$\Delta\rho$ = Change in spending on facility construction or operation (The estimated annual dollars to be expended for construction and then operation of the proposed spaceport.)

This analysis incorporates the following assumptions:

- Of the new direct construction and operations jobs created by the Project, approximately 60 percent of the jobs would be filled by workers hired from the existing regional labor force. The remaining 40 percent of the needed work force would come from outside the three-county ROI, and in-migrate (move to and reside in) to the ROI. This assumption is based on industrial and employment structures found in the IMPlan 2.0 database and adjusted to be consistent with regional conditions.
- The in-migrating, non-regional, construction workforce is estimated to consist of 75 percent workers in-migrating without accompanying household members and 25 percent workers in-migrating with accompanying household members. The in-migrating operations workforce is estimated to consist of 20 percent workers without accompanying household members and 80 percent workers arriving with accompanying household members. This assumption is

based on industrial and employment structures found in the IMPlan 2.0 database and adjusted to be consistent with regional conditions.

- Estimates of increased population are calculated based on one person per single-person household and an average of 3.5 persons per worker with accompanying household members. This assumption is based on average 2006 family size reported by the Census Bureau in the 2006 American Community Survey of 3.36 for Doña Ana County and 3.67 for El Paso County, Texas (USCB, 2006b), two nearby population centers.

4.10.1.1 Proposed Action

Construction

Population

Based on industrial and employment structures found in the IMPlan 2.0 database and adjusted to be consistent with existing regional conditions, it is expected that 60 percent of the construction workers are currently living in the ROI. The remaining 40 percent of construction workers would in-migrate and are expected to elect to reside in Sierra County during construction. These workers, and their households, are not expected to become permanent residents of the county. Of the in-migrating construction workers, 25 percent are assumed to bring other household members. This assumption is based on the industry and employment data in IMPlan and adjusted for regional conditions. A household size of 3.5 persons was used in the analysis based on average family size in for nearby population centers of Doña Ana County and El Paso County, Texas (USCB, 2006b). In-migration to Sierra County, based on the peak number of construction workers, could increase the county's population by an estimated 2.7 percent. Because Sierra County has been experiencing a decline in population, from 2000 to 2005 (USCB, 2006), any impacts related to new workers and their households' presence or spending would likely be beneficial to the ROI. Exhibit 4.10-1 presents estimated number of needed construction workers, worker in-migration estimates, and estimated increases in the Sierra County population. The potential impact of the Proposed Action on the existing population was determined by estimating increases in the number of direct jobs created during each of three years of construction of the proposed Spaceport America. The population impact would be small and positive since the in-migration would serve to partially offset population losses in the county.

Exhibit 4.10-1. Estimated Construction Worker In-migration and Population Increases

Phase	Peak Number of Project Construction Workers[1]	In-migrating Workers Temporarily Residing in Sierra County	Workers without accom-panying families	Workers with Families (Family size for 3.5 persons per household)	Total Population Increase in Sierra County	Percentage Increase in Sierra County Population
Year 1	550	220	165	55 (193)	358	2.7%
Year 2	100	40	30	10 (35)	65	0.4%
Year 3	75	30	23	8 (26)	49	0.4%

[1] Gutman, 2007b

Economic Impacts

During the 30 months of construction, Project related expenditures are expected to be about $134 million. These expenditures would generate economic activity and lead to indirect job creation in the ROI that would likely be filled by current residents of the region. Anticipated aggregate economic impacts from construction of the proposed Spaceport America are presented in Exhibit 4.10-2. The figures represent increases in total economic activity, including salaries and wages, and the creation of indirect jobs as the result of construction spending. The economic impact would be positive in the ROI with the magnitude being small in Doña Ana County and Otero County and moderate to large in Sierra County.

Exhibit 4.10-2. Potential Economic Impacts During Construction

Phase	Regional Economic Activity Resulting from Proposed Action[1]	Indirect Jobs[2, 3] Created in ROI	Wages and Salaries of Indirect Employees[2]
Year 1	$90,100,000	169	$4,820,000
Year 2	$36,700,000	68	$1,910,000
Year 3	$12,200,000	22	$609,000

Source: [1]Ward, 2008a; [3]Ward, 2008b
[2] Indirect jobs are defined as jobs created by direct employees spending and those jobs that support population growth that would result from Spaceport America (such as extra teachers, service-related workers, etc.).

Housing

Exhibit 3.10-5 presents the available housing in Sierra County. It is assumed that in-migrating workers would attempt to locate within commuting distance of the construction site in Sierra County and would, therefore, chose to reside in Sierra County. Sierra County has approximately 2,600 housing units available for occupancy (USCB, 2008). If construction were to begin, as planned, the potential for reducing vacancy rates in Sierra County would represent a significant economic benefit that might not otherwise occur. However, the impact would be small and temporary.

Because of the temporary nature of the work, construction workers might also seek to occupy motels and recreational vehicle parks in Sierra County. Truth or Consequences has 300 motel rooms (NMTD, 2008). In addition, two nearby State parks have recreational vehicle spaces. Elephant Butte State Park has 100 spaces and Caballo Lake State Park has 63 vehicle spaces (City of TorC, 2004 and NMSP, 2008). Given the existing permanent and temporary housing inventory (available housing units, motel rooms, and recreational vehicle spaces) in Sierra County, the in-migrating population would be accommodated. The anticipated decreased need for temporary housing in Years 2 and 3 would coincide with an increased demand for housing by operations workers. The impact to temporary housing from construction would be positive, but temporary, and large in Year 1 and decrease thereafter.

Taxes

As discussed in Section 3.10.1.4, New Mexico residents are subject to a variety of taxes. The spending associated with the construction of the proposed spaceport would increase tax revenue collections, including lodger's tax revenues and gross receipt tax revenues. Income of the resident direct and indirect workers would be taxed as would the income received by area businesses benefiting from the additional sale of goods and services to Project related workers. Personal income tax rates, corporate income tax rates, and gross receipts rates vary widely within the ROI.

Community Services

As shown in Exhibit 4.10-1, the temporary increase in Project-related population is expected to peak at 358 people in Sierra County. This peak is expected to last for 2 months. Using an average Project employment for Year 1 of 319 workers, the average population increase in Sierra County would be 207 people. Exhibit 3.10-8 presents the number of law enforcement officers and firefighters currently serving in Sierra County. Using the Sierra County 2000 population of 13,270 (Exhibit 3.10-1), the temporary increase in population in Sierra County would increase the ratio of residents to law enforcement officers by 2.7 percent for the peak period of population increase and by 1.6 percent for the Year 1 average. The ratio of residents to firefighters would increase by 2.7 percent for the peak period of population increase and by 1.6 percent for the Year 1 average.

The residents of the ROI are served by a number of medical care facilities. The total staffed beds for medical care in Sierra County, Doña Ana County, excluding behavioral health and rehabilitation facilities, is 469. Sierra County and Doña Ana County facilities, but not facilities in Otero County, are included in this because they would be the most convenient for Sierra County residents. The 2000 population of Sierra County and Doña Ana County is 187,952 people (see Exhibit 3.10-1), and results in 1 staff bed for every 401 persons. The peak population increase during construction would change the staffed bed to resident ratio to 1:402.

The increase in population would also be expected to include some student-aged residents and thus increase the local school enrollment. Students in Sierra County attend schools in the county's only school district, Truth or Consequences, which had a 2006-2007 enrollment of 1,474 students and a teacher to student ratio of 1:14.6. Using the average number of workers for Year 1, the peak construction year, and assuming that those in-migrating with an accompanying household brought an average of 2.5 school children with them, the upper bound number of school-age children in-migrating to Sierra County would be 80. The school district's teacher to student ratio would increase from 1:14.6 to 1:15. The school district has six schools. If the 80 students were equally distributed to the schools, the average increase at any one school would be 14 students.

The potential impact on Sierra County law enforcement, medical facilities, and public schools infrastructure would be small and temporary.

Operations

Potential impacts during the spaceport operations would stem from launches which would include suborbital tourism flights of multiple operators, orbital cargo, crew and commercial passenger operations, and launch support activities. In addition, potential impacts would stem from space tourism attributable to the operation of the proposed spaceport and its spectator events such as the X Prize Cup.

Population

The operations workforce is expected to be three workers initially, in 2009, and then increase to 100 workers in 2013 (see Exhibit 4.10-3). This analysis is based on the 2013 estimated workforce, which is a conservative assumption. Current workers in the ROI are expected to fill 60 percent of the operations jobs, in part because of the ease of commuting to the proposed spaceport. The remainder of the workforce is expected to in-migrate to Sierra County. Of the 40 percent of workers in-migrating, 80 percent or 32 workers are assumed to bring other household members. The estimated household size is assumed to be 3.5 persons, the same size household as was assumed for construction workers. Based on the number of in-migrating workers and their accompanying household members, the increase to population in Sierra County would be approximately120 people. As shown in Exhibit 3.10-2, Sierra County has recently experienced a decline in population. The 2005 population estimate was 455 persons less than the 2000 Census-count (see Exhibit 3.10-1). Therefore, the Spaceport America Project-related population increase would have a positive impact by helping to stem the county's population decline. Sierra County would experience a small population impact, with an increase of 0.9 percent, based on the 2000 Census or the 2005 estimate, as a result of the Spaceport America Project.

The X Prize Cup event, and perhaps similar events involving flights of space vehicles and aircraft, would be held at the proposed Spaceport America. These events would result in a temporary increase in transient population due to spectators traveling to the county to watch launches. Up to 20,000 spectators per day could attend the annual X Prize Cup event, which is expected to last up to 7 days. Other temporary population increases related to the X Prize Cup event and other space tourism, like rocket racing, is discussed below in economic impacts.

Economic Impacts

Potential economic impacts arising from launch operations under the Proposed Action are shown in Exhibit 4.10-3. The impacts include direct jobs, indirect jobs (those jobs created as a result of Spaceport America expenditures and directly employed workers spending of wages), and operational expenditures. Potential impacts from spending by passengers, guests, and spectators are calculated separately and discussed as economic impacts from tourism.

Exhibit 4.10-3. Potential Economic Impacts on ROI from Launch Operations, 2009-2013

Year	Regional Economic Activity[1]	Wages and Salaries (direct & indirect jobs)[1]	Direct Jobs[2]	Indirect Jobs[1]
2009	$811,000	$183,000	3	3
2010	$3,510,000	$795,000	13	13
2011	$10,800,000	$2,440,000	40	40
2012	$19,200,000	$4,340,000	71	70
2013	$27,000,000	$6,110,000	100	99

Source: [1]Ward, 2008a; [2]Holston, 2008

Spending by visitors and tourists is expected to generate significant revenue for the State and local businesses. Because the commercial space industry is constantly evolving, economic impacts of the proposed Spaceport America are difficult to forecast. The proposed schedule of horizontal and vertical launch activities serves as a basis for projecting economic impacts from spending by space passengers, guests and spectators. Using the following three assumptions based on historical New Mexico tourism patterns (Futron, 2005), and a maximum 200 visitors on site at any one time, potential economic benefits from tourism were estimated and are presented in Exhibit 4.10-4. Visitor spending and tourism are expected to generate significant revenues for the State and its local businesses:

- 4-day average overnight tourist stays;
- $70 per day average public visitor spending; and
- $350 per day average space tourist spending.

Exhibit 4.10-4. Potential Economic Impacts on ROI from Spaceport America Visitors and Tourism from Launch Operations, 2009-2013

Year	Regional Economic Activity	Wages and Salaries	Tourism Industry Jobs
2009	$595,000	$222,000	13
2010	$3,260,000	$1,220,000	72
2011	$11,400,000	$4,280,000	252
2012	$20,800,000	$7,790,000	460
2013	$30,000,000	$11,220,000	662

Source: Ward, 2008a

The proposed schedule of horizontal and vertical launches serves as a basis for projecting economic impacts from spending by space passengers, guests and spectators. See Exhibits 2-22 and 2-28 for the estimated number of launches by year.

The X Prize Foundation anticipates use of Spaceport America for its annual event. Because this potential economic impact is derived from a single annual activity, the impact is analyzed separately from anticipated recurring launch activities. Potential economic impacts from this 20,000 visitor-per-day, 7-day event are shown in Exhibit 4.10-5.

Exhibit 4.10-5. Potential Economic Impacts on ROI from X Prize Cup Activities

Year	Regional Economic Activity	Wages and Salaries	Jobs[1]
2013	$16,700,000	$6,230,000	367

Source: Ward, 2008a

[1] Includes permanent, temporary, and part time jobs in the tourism industry and X Prize Cup event workers.

Potential impacts on population in the three-county ROI from combined spectator and tourism and X Prize Cup activities are shown in Exhibit 4.10-6. As with construction and launch operations, 60 percent of the workers are expected to currently reside in the ROI and 40 percent of workers are assumed to in-migrate to the ROI. Fifty percent of the in-migrating workers are assumed to have 2.5 additional accompanying household members. The analysis projects a potential 927-person increase in the ROI's population by 2013 from jobs created by space tourism and spectator spending.

Exhibit 4.10-6. Potential Population Impacts on ROI from Operations, 2009-2013

Year	Workers without accompanying household members	Workers with additional household members (3.5 total persons per household)	Total In-Migrating Population
2009	76	76 (266)	342
2010	88	88 (308)	396
2011	124	124 (434)	558
2012	165	165 (578)	743
2013	206	206 (721)	927

Source: Ward, 2008a

As presented in Exhibits 4.10-3 through 4.10-5, the operation of the proposed spaceport would generate regional economic activity of approximately $73.7 million during 2013. This positive impact would be experienced throughout the ROI. The impact would likely be larger in Sierra County where the proposed spaceport would be located and whose population is small. The impact would likely be small to moderate in Doña Ana County and Otero County due to their larger population and distance from the proposed site.

Housing

Permanent housing would be needed by in-migrating Spaceport America operational workers and X Prize Cup activities workers. Based on the estimated number of workers needed in 2013, assuming that all the Spaceport America operational workers settle in Sierra County and one-third of the tourism and X Prize Cup workers also settle in Sierra County, the Sierra County population increase would be approximately 429 persons or 2.7 percent. The number of housing units needed would be approximately 101. Sierra County has approximately 2,600 vacant housing units. The in-migrating workers would be easily accommodated by the existing housing inventory. The workers in-migrating to Doña Ana County and Otero County would require 137 housing units, which would also be easily accommodated by existing housing in these more populous counties. The impact on the permanent housing market would be small and positive in all the counties of the ROI.

Spaceport America launch visitors and spectators would utilize the hospitality accommodations in nearby Truth or Consequences or seek accommodations in the larger market of Las Cruces which has approximately 2,200 hotel/motel rooms (NMTD, 2008). Spectators, visitors, and travelers attending the X Prize Cup event, would also find accommodations in the Albuquerque area which offers approximately 13,000 hotel/motel rooms (NMTD, 2008). Albuquerque is approximately 150 driving miles from the Spaceport America site. The socioeconomic impact of these visitors and spectators would be realized also in the form of local spending and collection of lodger's tax. The impact on the temporary accommodations in the area would be positive and by 2013 would have a moderate to large impact on the hospitality industry in the ROI.

Taxes

As discussed in Section 3.10.1.4, New Mexico residents are subject to a variety of taxes. The spending associated with the operation and launches of the proposed spaceport would increase tax revenue collections, including lodger's tax revenues and gross receipt tax revenues. Income of the resident direct and indirect workers would be taxed as would the income received by area businesses benefiting from the additional sale of goods and services to Project related workers. Personal income tax rates, corporate income tax rates, and gross receipts rates vary widely within the ROI. These additional revenues to governments would have a positive impact. The tax revenues could be used to mitigate impacts to community services as discussed below.

Community Services

The following discussion addresses the impact on community services in Sierra County. The discussion focuses on Sierra County because all in-migrating Spaceport America operations workers and their accompanying household members are expected to settle in the county. In addition, one-third of the tourism and X Prize Cup related in-migrating workers and households are expected to elect to live in Sierra County after in-migrating to the ROI. The remaining tourism and X Prize Cup workers are expected to choose to reside, equally, in Dona County and Otero County. As presented in the housing impact analysis above, Sierra County would be expected to gain 429 residents as a result of the proposed Project and associated activities. The in-migrating tourism and X Prize Cup related population increase in Otero County and Doña Ana County is estimated at 309 persons per county. This increase in population would have a small impact to these more populous counties. Doña Ana County had a population of 174,682 persons in 2000 and Otero County had 62,298 residents (see Exhibit 3.10-1).

Exhibit 3.10-8 presents the number of law enforcement officers and firefighters currently serving in Sierra County. Project related increases in population would raise the ratio of residents to law enforcement officers and residents to firefighters by 3 percent. Should additional law enforcement officers be needed, the anticipated increased tax revenue arising from the proposed Project could mitigate the small impact on these community services by allowing the hiring of additional staff. Unincorporated Sierra County has a volunteer firefighting staff, but municipalities in the county have professional fire departments. Should paid firefighter staff be needed in municipalities or unincorporated Sierra County, the anticipated increase in tax revenue arising from the proposed Project could mitigate the small impact by facilitating the hiring of firefighters.

Existing medical services are characterized as 1 staffed hospital bed per 401 residents of Sierra County and Doña Ana County. The combined increase in population in Sierra and Doña Ana Counties would increase the staffed bed to person ratio to 1:402.

The population increase would include some school-aged children. These new residents would add students to the baseline (enrollment without the proposed Project) local school enrollment. Students in Sierra County attend schools in the Truth or Consequences school district, which had a 2006-2007 enrollment of 1,474 students and a teacher to student ratio of 1:14.6. The 429-person population increase is associated with 101 households (32 Spaceport America worker families and one-third of the 206 tourism and X Prize Cup worker families). To account for a portion of the 3.5 person households headed by a single parent, each household was assumed to have 2 children. Thus, the number of school age children in-migrating to Sierra County is estimated at 201. This represents bounding increase of 14 percent. The teacher to student ratio would increase from 1:14.6 to 1:16.6. The school district has six schools. If the 201 students were equally distributed to the schools, the increase at any one school would be 34 students.

The potential impact on Sierra County community services would, generally, be small. Increase in school enrollment would be large. The Truth or Consequences school district has been experiencing declining enrollment for several years. Although the increase in school enrollment would be large based on school year 2006/07 enrollment, the additional students would mean that district enrollment would be at the 2002/03 level. With the additional students, the teacher to student ratio would be at the current level of the New Mexico average. If necessary, the impacts, including those to the school district, could be mitigated by hiring additional staff facilitated by the increased tax revenues due to Spaceport America impacts on the local economy. The potential impact on the regional medical infrastructure would be small. However, the ROI is currently designated a Medically Underserved Area by the Health Resources and Service Administration of the U.S. Department of Health and Human Services (Ward, 2008a). Any impact, even this small one, would further strain the existing medical services. Increased tax revenues could facilitate retaining existing staff and hiring new staff at publicly-funded medical facilities.

Summary of Impacts from the Proposed Action

The proposed Spaceport America site is in a sparsely populated area and no permanent residents would be displaced. No ranches would cease to operate due to construction or operation of the proposed Spaceport America; therefore, no community businesses would be lost or relocated. The construction and operation of the proposed spaceport would increase the community tax base through the workers adding to gross receipts by purchasing goods and services in the locality and workers and visitors renting hotel/motel rooms in the area that are subject to lodger's tax. As described in Appendix H, Traffic and Transportation, there would be disruptions to traffic patterns during the peak of construction, during the improvement of County Road A013, and during the X Prize Cup event. However, these impacts would be temporary. Therefore, the Proposed Action would not have any significant negative impacts to socioeconomics, as defined by FAA Order 1050.1E because identified significance thresholds are not expected to be reached.

The Proposed Action would lead to small impacts to population, employment, housing, income and community services in Sierra County on a temporary basis during the construction phase. The Proposed Action would lead to small impacts to population, employment, housing, income and most community services in Sierra County on a permanent basis during the operations phase. Even though the impacts would be small, the permanent impacts experienced during operations could be mitigated. The increase in tax revenues generated by the Project could be used to facilitate the hiring of additional school and medical staff. The proposed Spaceport America would have a large positive economic impact on the ROI (Sierra, Doña Ana, and Otero Counties). The regional economic activity is estimated to be approximately $73.7 million during 2013 (see Exhibits 4.10-3, -4, and -5).

4.10.1.2 Alternative 1 – Horizontal Launch Vehicles Only

Implementation of Alternative 1 would have impacts similar to those presented under the Proposed Action, but would result in no construction or operation of vertical launch facilities at the proposed Spaceport America. Licensing only a subset of the LV activity outlined in the Proposed Action would reduce the magnitude of the presented economic impacts associated with both horizontal and vertical launches in proportion with the reduced number of launches and would likely result in less spectator attendance.

4.10.1.3 Alternative 2 – Vertical Launch Vehicles Only

Implementation of Alternative 2 would have impacts similar to those presented under the Proposed Action, but would result in no construction or operation of horizontal launch facilities at the proposed Spaceport America. Licensing only a subset of the LV activity outlined in the Proposed Action would reduce the magnitude of the presented economic impacts associated with both horizontal and vertical launches in proportion with the reduced number of launches and would likely result in less spectator attendance.

4.10.1.4 No Action Alternative

Under the No Action Alternative, the FAA would not issue a license for operation of the proposed Spaceport America, which would not be constructed or operated, though the site could still be used for amateur launches. Implementation of the No Action Alternative would likely result in a withdrawal of recent investment in aerospace research in the region and could result in an adverse socioeconomic impact. Under this alternative, existing socioeconomic conditions would continue.

4.10.2 Environmental Justice

The environmental justice analysis involved three steps. First, minority and low-income populations within the ROI were identified (see Section 3.10.2.4). Second, the impacts of each alternative were assessed. Third, an analysis was conducted to identify any special considerations, such as unique exposure pathways or cultural practices, which could contribute to any disproportionate high and adverse impacts to potential environmental justice populations.

4.10.2.1 Proposed Action

<u>Construction</u>

Impacts on minority or low-income populations that could result from the Proposed Action were analyzed for the geographic area, by Census tract, in which the proposed Spaceport America would be located to determine if the impacts would be disproportionately high and adverse in minority or low-income populations. Impacts related to the proposed Project were analyzed within the Census tracts surrounding the Project area and included the all Census tracts in the socioeconomic three-county ROI (see Exhibit 3.10-11).

In this assessment, potential construction impacts arising under the major discipline and resource areas were reviewed. As described in Chapter 4, impacts to any of these resources were estimated to be small for the activities analyzed for the Proposed Action with the exception of cultural resources. The Proposed Action would result in small to moderate impacts to cultural resources which could require mitigation; however, those impacts would not disproportionately affect minority or low-income populations. Accordingly, no disproportionate high and adverse impacts would be expected from the construction of the proposed Spaceport America.

Operations

The impacts from operation of the proposed spaceport are analyzed and presented in Chapter 4 for the various resource areas. As with construction, operational impacts to any of these resources were estimated to be small with the exception of cultural resources. The Proposed Action would result in small to moderate impacts to cultural resources which could require mitigation; however, those impacts would not disproportionately affect minority or low-income populations and no disproportionate adverse impacts would be expected.

Summary of Impacts from the Proposed Action

There are no anticipated significant adverse impacts arising from the proposed Project that would disproportionately impact minority or low-income populations. There are no disproportionate high and adverse impacts to minority or low-income populations expected from the construction or operation of the proposed Spaceport America. Therefore, there are no significant environmental justice impacts as defined by FAA Order 1050.1E because identified significance thresholds are not expected to be reached.

4.10.2.2 Alternative 1 – Horizontal Launch Vehicles Only

The impacts of Alternative 1 are similar to those of the Proposed Action as discussed above in Section 4.10.2.1. Under this alternative, there would be no disproportionately high or adverse impacts on minority or low-income populations.

4.10.2.3 Alternative 2 – Vertical Launch Vehicles Only

The impacts of Alternative 2 are similar to those of the Proposed Action as discussed above in Section 4.10.2.1. Under this alternative, there would be no disproportionately high or adverse impacts on minority or low-income populations.

4.10.2.4 No Action Alternative

Under the No Action Alternative, no Launch Site Operator License would be issued and thus Spaceport America would not be constructed and operated. The area could continue to be used for amateur launches. Under this alternative, there would be no disproportionately high or adverse impacts on minority or low-income populations.

4.10.3 Children's' Environmental Health and Safety Risks

The children's environmental health and safety risks analysis involved three steps. First, populations within the ROI, classified by age, were identified and the places where children would congregate in proximity to the proposed site were identified (see Section 3.10.3.4). The immediate area is nearly vacant of human population for a radius of 17 miles. The nearest public school is Truth or Consequences Elementary, 18 miles northeast of the proposed Spaceport America site. In the second step, the impacts of each of the alternatives were assessed. The third step was a review conducted to identify any special considerations, such as unique exposure pathways or cultural practices, in the ROI where the proposed Project could contribute to any disproportionate adverse impacts to children in the ROI.

4.10.3.1 Proposed Action

Construction

Environmental health impacts and safety risks to the populations that could result from the Proposed Action were analyzed. Potential construction impacts arising under the major disciplines and resource areas were reviewed. Sections 4.3, 4.6, 4.7, 4.9, and Appendix G describe air quality, hazardous materials and waste, health and safety, noise, and water resources impacts of the construction of the proposed Spaceport America. The impacts of construction traffic are described in Appendix H. These resource impacts related to environmental health and safety risks were reviewed for their potential to disproportionately affect children's health and safety.

Given the short duration of construction and the distance of the Project area from population areas, no substantial effect on air quality is expected. Impacts stemming from the management of hazardous materials and hazardous and non-hazardous wastes are not anticipated because they would be handled, stored, and used in compliance with all applicable regulations. Off-site impacts from disposal of the waste from the proposed spaceport would be negligible to minimal due to the small quantities of waste. Noise from construction activities would be attenuated distance and is expected to be near background levels at the nearest residence which is four miles away. Construction traffic noise experienced by residences along the roadways is expected to be similar to the noise level of a small town during peak traffic hours. Surface water and ground water resources in the area would not be significantly affected by construction of the proposed Spaceport America.

The construction of the proposed Spaceport America would have some degree of unavoidable impact, or hazards, in regard to public safety. These hazards would be minimized following OSHA, the FAA, NASA, DOT, and State applicable regulations and guidelines. Spaceport America traffic would be a large increase over the existing traffic in the vicinity of the site especially on County Road A013; users of the roadways could experience increased traffic and congestion. Peak construction-related traffic is estimated at approximately 300 vehicles daily. NMDOT has existing plans to pave and install shoulders on County Road A013 by 2010 to accommodate the traffic impacts. The increased traffic is estimated to potentially result in three injuries from traffic accidents during the year of peak construction.

These impacts would affect the surrounding population, but the impact is expected to be small. These small impacts would not be expected to disproportionately affect children because the proposed site is a sparsely populated area, the distance to the nearest area schools is 18 miles, and most specifically, the general population of the ROI does not have a significantly higher percentage of children as compared to the State of New Mexico and the nation.

Operations

The resource areas listed in the construction discussion, above, were analyzed for potential impacts during the operational phase. Traffic impacts and traffic noise would be less than those described for construction phase because less traffic would be expected to be generated due to fewer workers commuting to the site. The exception is expected additional traffic during the X Prize Cup event. Operations would result in small quantities of dust and launch exhaust emissions, but these are expected to have a negligible decrease in local ambient air quality. Off-site impacts stemming from hazardous materials and waste are not anticipated. 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 through storm water runoff. Oxygen, nitrous oxide, hydrogen, and methane gases would quickly evaporate into the atmosphere (none is an air pollutant). Liquid hydrocarbons would be stored so that spills could be captured in a secondary containment. Noise from launches and rocket firings would be of short duration and not be at damaging levels in visitor areas. The cities of Hatch and Truth or Consequences 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. The location of the proposed Spaceport America is in a very sparsely populated area. Launches would be directed toward and over WSMR. Persons within WSMR would be notified of Spaceport America launches and would evacuate the recovery area according to proscribed, standard WSMR procedures for launches.

These impacts would affect the surrounding population, but the impact is expected to be small. These small impacts would not be expected to disproportionately affect children because the site is in a sparsely populated area, the distance to the nearest school is 18 miles, and the general population of the ROI does not have a significantly higher percentage of children as compared to the State of New Mexico and the nation.

Summary of Impacts from the Proposed Action

The potential environmental health impacts and safety risks from the construction and operation of the proposed Spaceport America would not be expected to disproportionately affect children because the site is in a sparsely populated area, the distance to area school is 18 miles, and the general population of the ROI does not have a significantly higher percentage of children as compared to the State of New Mexico and the nation. Therefore, there are no significant environmental health and safety impacts as defined by FAA Order 1050.1E because identified significance thresholds are not expected to be reached.

4.10.3.2 Alternative 1 – Horizontal Launch Vehicles Only

The impacts of Alternative 1 are similar to those of the Proposed Action as discussed above in Section 4.10.3.1.

4.10.3.3 Alternative 2 – Vertical Launch Vehicles Only

The impacts of Alternative 2 are similar to those of the Proposed Action as discussed above in Section 4.10.3.1.

4.10.3.4 No Action Alternative

Because the No Action Alternative would not change the current status of children in the region, children's health and safety in the region would not be affected.

4.11 Energy Supply and Natural Resources

Construction and operation of Spaceport America would require the use of energy: electricity to cool, heat, and light buildings; and fuels to operate LV's and ground support vehicles. This section describes the impact of the Project on the supply and demand for energy and natural resources in the area of Spaceport America. The potential impact to the energy supply and natural resources were assessed in accordance with FAA Order 1050.1E.

4.11.1 Proposed Action

4.11.1.1 Construction

Energy Supply

Construction activities would include excavation, digging and pouring of foundations, erection of buildings, and construction of roads and utilities. Energy needed for construction would be derived primarily from gasoline or diesel fuels used to operate construction equipment and portable or mobile generators. Single phase grid electricity is already available at the Spaceport America site and could be upgraded for construction load purposes (DMJM/AECOM, 2007).

Fuel use during construction has not been quantified. Gasoline and diesel would have to be trucked to the site and could be supplied from various sources in the area. It is unlikely that this use would impact the fuel supply to communities in the area. Total grid electricity use during construction has not been quantified, but would be served by a 5 mega volt ampere (MVA) capacity (DMJM/AECOM, 2007); this capacity limit makes it unlikely that other system users would be impacted.

Natural Resources

FAA Order 1050.1E states that the use of natural resources other than fuel need be examined only if the action involves a need for unusual materials or those in short supply. No unusual materials are anticipated for the construction phase. This section examines the supply of aggregate, which is required in substantial amounts for asphalt and concrete construction (e.g., runway, taxiway, apron, roads) associated with Spaceport America, and ground water supply.

The proposed Spaceport America site is in the Jornada del Muerto valley, a region in which there has been no recent or historic need for aggregate for road paving projects. Though this is an isolated location, there are aggregate sources available in the area. Recent construction on I-25 at Rincon revealed that there are gravel pits available in this location. This pit is located only 15 miles from the proposed Spaceport America site, and may be available for Spaceport construction. There are additional pits located near Truth or Consequences, which have been used on I-25 Projects. Further, it is believed that aggregate sources, even closer to the Spaceport may exist on Prisor Hill (DMJM/AECOM, 2007). Given a number of potential local sources of aggregate, it is unlikely that Spaceport America construction would impact the availability of aggregate in the area.

Spaceport America facilities and roads would be constructed in two phases. The first phase would require the use of approximately 76,800 gallons of water per working day over a 1.5 year period. The second phase would require the use of approximately 14,250 gallons per working day over a one-year period. At the conclusion of these two construction phases, aquifer drawdown is estimated at 1.6 feet at 3 miles from the pumping wells (see Section 4.7.1.1). To provide for the proposed Spaceport America water use estimates, water rights from existing ranch wells would be acquired. This acquisition would entail negotiations with prospective sellers and additional legal steps as required by New Mexico law, which are intended to ensure that existing water users are not adversely impacted.

4.11.1.2 Operation

Energy Supply

The energy supply analysis addresses fossil fuel consumption and electricity use at Spaceport America. The Spaceport America Final Programming Report (DMJM/AECOM, 2007) provides detailed information regarding energy use.

Various fuels and propellants 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 fuels would depend on the specific launch operations and types of LV's finally selected. The fuels and estimates described and listed below are for the full implementation of the Proposed Action.

Rocket Propellant

The variety and types of rocket propellant (including solid rocket motors) used on-site would depend on the type of vehicle technologies employed. The estimated types and amounts of rocket propellant anticipated for Spaceport America operations were estimated using information from potential users and are summarized in Exhibit 4.11-1. Exotic fuels could also be used on a limited basis. Rocket propellant would be acquired from regional or national suppliers and transported to the site via truck. It is unlikely that there would be impacts to local supplies.

Exhibit 4.11-1. Estimated Rocket Propellant Demand

Rocket Propellant Type	Peak (Year 5) Annual Demand
Kerosene	2,250,000 gallons
Liquid oxygen (LOX)	2,250,000 gallons
Nitrous oxide (N_2O)	15,000,000 gallons
Solid rocket motors	100 motors

Source: Gutman, 2007

Aviation Fuel

Aviation fuel would be required by tenant and transient aircraft. Transient aircraft include tenants and customers who fly directly to Spaceport America and require fuel before departing. Jet fuel, Jet-A, is the only aviation fuel anticipated to be supplied at Spaceport America.

The Jet-A fuel requirement is dependent on the needs of the tenants and customers. The exact amount of fuel needed for transient aircraft is unknown at this time, but was estimated assuming five private jets arriving daily with a demand of 1,031 gallons of fuel per plane. The aviation fuel demand is estimated in Exhibit 4.11-2. Jet-A would be acquired from regional or national suppliers and transported to the site via truck. It is unlikely that there would be impacts to local supplies.

Exhibit 4.11-2. Estimated Jet-A Fuel Demand

User	Daily Demand (gallons)	Weekly Demand (gallons)	Annual Demand (gallons)
Tenant Usage	5,250	24,000	1,250,000
Customer/Private Jet Usage	5,150	24,000	1,250,000

Source: DMJM/AECOM, 2007

Ground Vehicle Fuels

Ground support equipment such as aviation fuel trucks, fire-fighting equipment, trucks, automobiles, lawn mowers, etc. would require gasoline or diesel fuels. Specific fuel demands would be determined as spaceport operations and plans are developed. Exhibit 4.11-3 provides order-of-magnitude estimates of ground vehicle fuel demands. These relatively small quantities would not impact local diesel or gasoline supplies.

Exhibit 4.11-3. Estimated Ground Equipment Fuel Demand

Fuel Type	Weekly Demand (gallons)	Monthly Demand (gallons)	Annual Demand (gallons)
Diesel	250	1,000	13,500
Gasoline	100	400	5,000

Source: DMJM/AECOM, 2007

Propane

Propane for hot water and building heat would be contracted by the tenant and stored at the individual buildings. The demand would be defined as each building is designed. There are no plans to route a natural gas line to the Project site, because of the high capital cost, so propane is the preferred fossil-fuel energy source for heating water and buildings. Alternative energy sources such as wind and solar could also be considered. It is unlikely that there would be impacts to local propane supplies.

Electrical Power

With full implementation of the Proposed Action, Spaceport America operations are expected to require 10 MVA of electrical power capacity, which includes 10 percent for contingency due to lack of complete user information (DMJM/AECOM, 2007). This capacity limit makes it unlikely that other system users would be impacted by Spaceport America electricity use. Diesel generators would be included in each facility as a back-up energy supply, should the electricity supply be interrupted. Diesel used by these generators is not included in the estimate of ground vehicle fuels, above. As use would be limited to times of power-grid failure and generator testing, overall diesel consumption for generators would be minimal.

Natural Resources

The only natural resource to be used in Spaceport America operations that is in short supply is ground water. Operational water use is estimated at 21,800 gallons per working day. The Proposed Action contains three scenarios for water supply (see Section 2.1.2.3). Scenarios 1 and 2 each involve pumping water from three on-site wells. Under these scenarios, simplified to a conservative one combined-well calculation, aquifer drawdown is estimated at 1.6 feet at a distance of 3 miles from the water supply wells (see Section 4.7.1.2). This drawdown is unlikely to affect the water supply of nearby ground water users.

Scenario 3 calls for all water coming to the site via truck from an off-site supplier. Scenario 3 would result in no impacts to nearby ground water users.

4.11.1.3 Efficiency and Sustainability

Executive Order 13123, Greening the Government through Efficient Energy Management (64 FR 30851, June 8, 1999), encourages each Federal agency to expand the use of renewable energy within its facilities and in its activities. The Executive Order also requires each Federal agency to reduce petroleum use, total energy use and associated air emissions, and water consumption in its facilities. It is also the policy of the FAA, consistent with NEPA and the CEQ regulations, to encourage the development of facilities that exemplify the highest standards of design including principles of sustainability.

The energy consumption for operating Spaceport America in its desert surroundings is going to be one of the greater impacts that the Spaceport will have on the environment. Therefore, efforts would be made to make the facility as energy efficient as possible. This would be done at various stages, by using energy efficient building design and alternative fuels, but also by ensuring that the construction process and operation of the Spaceport is managed and carried out in the most energy-efficient way possible.

Leadership in Energy and Environmental Design (LEED®) is a green building rating system that was developed by the U.S. Green Building Council in 2000 through a consensus based process. Based on well-founded scientific standards, LEED emphasizes state of the art strategies for sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality. Spaceport America facilities would be designed incorporating LEED principles with the goal of achieving LEED certification. Design philosophies to reduce energy use could include:

- **Embracing the Natural Environment**. The inherent characteristics of the proposed site create a number of opportunities to include innovative, sustainable and low energy strategies within the design concept. The warm, low humidity desert air allows for the consideration of evaporative cooling strategies, perhaps in conjunction with desiccant strategies. These passive cooling strategies would substantially reduce the mechanical cooling requirements of the facility. The high average daylight levels, in conjunction with the low average cloud cover allow for the sun to be utilized in a number of ways, for example, solar power and heat generation as well as lighting. The ground water table at the site is at a relatively shallow depth, allowing for the possibility of ground source heat pumps. The traditional design of dwellings in New Mexico often utilizes the thermal mass of the Earth as a method of controlling the internal temperature, a strategy that would be considered as a way of stabilizing a building's internal environment at

Spaceport America. This would be especially applicable to the Terminal and Hangar Facility, which would incorporate large earthen berms into its design.

- **Utilizing Alternative Energy Sources**. An important contribution to achieving an energy efficient development in a remote location is to produce as much energy as possible on-site rather than relying on the national energy network, therefore limiting transmission losses and cost of transportation. Producing energy on-site using fossil fuel would still require the fuel to be delivered to the site as well as emitting greenhouse gas emissions to the atmosphere. Alternatives to be considered as sources of energy at Spaceport America include: solar technologies, such as photovoltaic panels, solar water heating, or thermal solar electricity generation; geothermal technologies for ground-source heat pumps, electricity generation, or inter-seasonal heat transfer; and wind energy. Each of these alternatives would be evaluated during the design phase to determine feasibility of implementation.
- **Reducing Energy Demand**. The energy performance of the facility directly impacts not only the ongoing operational costs of the facility, but also the initial capital costs. While this is generally true for most facilities, the remote location of Spaceport America means that the impact is magnified. Through minimizing the energy requirements of the Spaceport and incorporating renewable energy sources on-site, significant reductions in utility infrastructure costs would be achieved.

The proposed site is located in a desert area with a total annual precipitation of approximately 8 inches. In addition, water rights are a significant issue for all neighboring landowners. Therefore investigating methods to minimize water consumption on-site would be considered a priority. Strategies for water conservation could include:

- **Storm water/Gray water Collection and Reuse**. Despite the relatively low rainfall, the volume of rainwater and storm water runoff that could be collected from the large paved areas and building roofs would be assessed for future use for toilet flushing or vehicle washing. Water used for vehicle washing could be collected and recycled to flush toilets or be used again for vehicle washing or other low-grade uses. A closed loop system would be considered to reduce the amount of water pumped to the site.
- **Water Fixture/Appliance Selection**. Innovative water-efficient water fixtures and appliances would be investigated as these could not only reduce the overall water use at the Spaceport, but could also provide useful educational tools for visitors. A number of innovative technologies would be considered to aid in reducing the potable water requirements of the Spaceport, including dual flush toilets, waterless urinals, aerated faucets, and low flow showers.

4.11.1.1 Summary of Impacts from the Proposed Action

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 LV's 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 implementation of the Proposed Action.

The demand for electrical energy in the region would increase if the Proposed Action were implemented. However, the limited electrical transmission capacity to the site makes it unlikely that other system users would be impacted by Spaceport America electricity use.

Potential supplies of aggregate needed for construction of runways, taxiways, aprons, and roads, are numerous and would not restrict material availability in the area.

Under two of three scenarios defined in the Proposed Action, water would be pumped from on-site wells to supply construction and operation activities. Aquifer drawdowns calculated for these use scenarios indicate that nearby users would not be affected.

4.11.2 Alternative 1 – Horizontal Launch Vehicles Only

Under Alternative 1, the types of fuels used at Spaceport America would be more limited than under the Proposed Action, and the quantities used would decrease. Likewise, there would be a probable reduction in water and electrical energy demand. There would be no impacts to energy supplies or natural resources under this alternative.

4.11.3 Alternative 2 – Vertical Launch Vehicles Only

Under Alternative 2, the types of fuels used at Spaceport America would be more limited than under the Proposed Action, and the quantities used would decrease. Likewise, there would be a probable reduction in water and electrical energy demand. There would be no impacts to energy supplies or natural resources under this alternative.

4.11.4 No Action Alternative

Under the No Action Alternative, the FAA would not issue a license for operation of the proposed Spaceport America and it would not be constructed and operated. There would be no energy use or consumption of natural resources beyond those described in Chapter 3 for the existing environment. No impact to energy supplies or natural resources would occur under this alternative.

4.12 Construction Impacts

FAA Order 1050.IE directs the FAA to include a general description of the type and nature of construction associate with a proposed action. This section summarizes the construction-related impacts that would occur under the Proposed Action.

Implementation of the Proposed Action would result in construction of facilities and infrastructure to support licensed horizontal and vertical launches from Spaceport America. As described in Sections 4.1 through 4.11, construction activities at Spaceport America would have impacts on a variety of environmental resources. Some impacts would be short-term or temporary, and others long-term or permanent. Some impacts would be beneficial, though most identified impacts would be adverse. While some impacts could be significant, with mitigation all potential impacts would be reduced to a less-than-significant level.

The following table (Exhibit 4.12-1) summarizes the potential construction-related impacts that would occur under the Proposed Action, identified by resource area. Many of the potential construction impacts would be temporary or short-term in nature, dissipating or ending with the conclusion of construction activities at the Project site. Many of these temporary impacts would be mitigated or avoided through the implementation of Best Management Practices. The temporary impacts, considered individually, would not be significant. These impacts would be occurring at the same time (during construction activities lasting a total of 29 months), and when considered together, the impact would be significant; however, the impact would be short-term in duration.

Long-term or permanent impacts would include direct and indirect physical impacts to historic properties, impacts to the setting (a significant historic feature) of the NHT and Aleman Draw Historic District, removing land from grazing use, and slightly altered storm water runoff patterns. The direct and indirect physical impacts to historic properties would be mitigated or reduced by the development of appropriate measures in consultation with the SHPO and consulting parties, bringing the impacts to a less-than-significant level. Impacts to the settings of the NHT and District would also be reduced to less-than-significant through implementation of mitigation measures developed in consultation with the SHPO and consulting parties. The amount of land that would be removed from grazing would be small compared to the amount of grazing area still in production within the Spaceport America boundaries, thus the impact would not be significant. Impacts from altered storm water runoff patterns would be avoided or reduced through implementation of Best Management Practices that control erosion and would not be significant. Upon implementation of mitigation and avoidance measures, these long-term impacts would not be significant individually. When considered together, the impact would remain not significant.

Alternatives 1 and 2 would include construction of fewer facilities than the Proposed Action. Implementation of either alternative would result in similar types of construction-related impacts as identified for the Proposed Action. However, because of the reduced amount of construction, these alternatives would result in less significant or fewer construction-related impacts than the Proposed Action.

The No Action Alternative includes no construction activities and would result in no construction impacts.

Exhibit 4.12-1. Potential Construction-Related Impacts from Implementation of the Proposed Action

Resource Area	Duration	Potential Impacts
Compatible land use	Temporary	Disturbance of approximately 1,300 acres of land.
		Increase in erosion rate.
		Development of construction support facilities and services on private land.
	Long-term	Reduction of land available for grazing.
		Restriction of recreational access to State Trust Land within the Project area boundary.

Exhibit 4.12-1. Potential Construction-Related Impacts from Implementation of the Proposed Action (cont'd)

Resource Area	Duration	Potential Impacts
Section 4(f) properties and farmlands	Long-term	Development of construction support facilities on private land, which could lead to the future conversion of farmland in the I-25 corridor.
		Impairing a cultural resource's historical integrity through realignment of the access road.
Noise	Temporary	Increase of site ambient noise level from multiple, individual noise sources ranging from 70 to 100 dBA at 100 feet.
		Peak traffic noise along roads leading to site (from I-25 in the south and Truth or Consequences in the north) of 58.2 dBA at 50 feet from the road.
Visual Resources and Light Emissions	Temporary	Visible equipment use and dust plumes from construction activities. Visibility of equipment during construction would be limited primarily to on-site personnel.
		Visibility from the NHT and Aleman Draw Historic District setting of vehicles and equipment being transported to and from the site, and dust plumes generated when traveling on dirt roads or working near entrance road.
Historical, architectural, archaeological, and cultural resources	Temporary	Noise along NHT and Aleman Draw Historic District from construction work or vehicle traffic on roads leading to site or near entrance road.
	Long-term	Direct physical impacts to 31 historic properties located within the Physical APE plus the potential for physical damage to an additional nine archaeological sites.
		Increased potential for inadvertent damage, vandalism, or illegal artifact collecting because of improved access to area and presence of workforce.
		Potential physical damage to buried archaeological resources within the Physical APE that have not yet been identified or recorded.
		Disturbance of relatively pristine setting of the NHT and Aleman Draw Historic District in this area through construction of Spaceport America facilities and infrastructure would affect the context and integrity of the properties, visitors' appreciation of the properties, and a person's understanding of the historical context and significance of the properties.

Exhibit 4.12-1. Potential Construction-Related Impacts from Implementation of the Proposed Action (cont'd)

Resource Area	Duration	Potential Impacts
Air quality	Temporary	Negligible impact on air quality from HAP and criteria pollutant emissions from: construction equipment, delivery trucks, and commuter vehicles; fugitive dust generated by vehicle and equipment travel on unpaved surfaces; and temporary operation of a hot asphalt mix plant.
Water quality, wetlands, wild & scenic rivers, coastal resources, and floodplains	Temporary	Withdrawal of 99.3 acre-feet of ground water over a 2.5-year period resulting in a 1.6-foot aquifer drawdown at 3 miles from the site.
	Long-term	Slightly altered storm water runoff patterns in the 100-year floodplain.
Fish, wildlife, and plants	Temporary	Disturbance of approximately 970 acres of Chihuahuan desert scrub, semi-desert grassland, and plains-mesa sand scrub plant communities, and associated wildlife.
		Displacement of small mammals and birds due to construction noise.
Hazardous materials, pollution prevention, and solid waste	Temporary	Generation of non-hazardous and hazardous waste including construction debris, empty containers, spent solvents, waste oil, spill cleanup materials (if used), lead-acid batteries from construction equipment, and sewage.
Socioeconomics, environmental justice, and children's environmental health & safety risks	Temporary	Peak in-migration of 220 workers to Sierra County resulting in population increase of 358.
		Total of $139 million of regional economic activity resulting in more than $7 million of indirect wages and salaries.
Energy supply and natural resources	Temporary	Use of gasoline, diesel, and electricity.
		Use of substantial amounts of locally-sourced aggregate for construction of runway, taxiway, apron, roads.

4.13 Secondary (Induced) Impacts

Major developments sometimes have the potential to cause secondary or induced impacts on surrounding communities. The CEQ defines secondary impacts as those that are caused by an action and are later in time and/or farther removed in distance, but still foreseeable. The FAA 1050.1E guidance requires assessment of the potential for and significance of such impacts. Potential secondary or induced impacts assessed for the proposed Spaceport America Project include:

- Shifts in patterns of population movement or growth,
- Public service demands,

- Changes in local or regional business or economic activity, and
- Changes in regional land use.

Issuing a Launch Site Operator License to NMSA for Spaceport America would not result in substantial induced impacts. Although the Proposed Action would result in beneficial economic impacts to the region by supporting and facilitating limited growth, it would not induce growth. Operation of the Spaceport would not support substantial numbers of workers. Construction would temporarily employ large numbers of workers during peak construction; however, these workers either would already live in the region or would be transient workers who would move away once the construction job was completed. Thus, population movement would not be affected. Implementation of Spaceport America would include development of all necessary infrastructure for water, wastewater, electricity, communications, and roads. Thus, there would be no changes in demand for public services, no strain on existing public service infrastructure, and no induced expansion of existing infrastructure. There are no known specific future development activities that would be dependent on the Proposed Action. Spaceport America would be constructed in a rural area with very sparse population, and would co-exist with the local ranching economy. Economic activity and regional land use in the region would not change due to the implementation of the Proposed Action.

Therefore, no secondary or substantial induced impacts are expected to result from the Proposed Action or Alternatives analyzed in this EIS.

5. CUMULATIVE IMPACTS

This chapter summarizes the cumulative environmental effects that could occur as a result of the construction and operation of the proposed Spaceport America. In its regulations for implementing the procedural provisions of NEPA, the CEQ defines cumulative impacts as "the impacts on the environment that result from the incremental impact of the action when added to other past, present, and other reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1508.7).

The Proposed Action has been evaluated for cumulative impacts on compatible land use; Section 4(f) properties and farmlands; noise; visual resources and light emissions; historical, architectural, archaeological, and cultural resources; air quality; water quality, wetlands, wild and scenic rivers, coastal resources, and floodplains; fish, wildlife, and plants; hazardous materials, pollution prevention, and solid waste; socioeconomics, environmental justice, and children's environmental health and safety risks; energy supply and natural resources; and construction impacts.

5.1 Identification of Cumulative Projects and Activities

5.1.1 Past or Current Projects

In researching projects that would be included in the analysis of cumulative impacts, the following past or current projects or activities were identified:

- Ranching operations;
- BNSF railroad construction, maintenance, and operations;
- County Road A013, A039, and A020 construction, maintenance, and use;
- 345 kV and 7.2 kV transmission lines construction and maintenance;
- Construction and operation of the existing amateur launch site;
- BLM habitat restoration activities; and
- Designation of El Camino Real as a NHT.

5.1.2 Future Projects

Sierra County does not have a land use or development plan for unincorporated portions of the county; therefore, information is limited on future county projects. Based on information from NMSA and other Federal and State government officials, the following future projects or activities were identified as having the potential to contribute to cumulative impacts.

- Temporary and permanent improvements to County Road A013;[6]
- Potential expansion of Spaceport America, including:
  - ⇨ Expansion of the airfield to include;

[6] If Spaceport America is built, reasonably foreseeable future actions would include permanent improvements to Sierra County Road A013. NMDOT would conduct the environmental analysis of the proposed permanent improvements to County Road A013. See Section 2.1.2.5 for discussion.

- Lengthening the main runway by 5,000 feet to the south;
- Re-aligning the primary access road to the south around the longer runway;
- Adding an east-west crosswinds runway;
- Re-aligning the security fence to include a longer main runway and a new crosswinds runway;
- Burying a portion (approximately 0.75 mile in length) of the 345 kV transmission line with a substation at each end of the buried portion to allow for the crosswinds runway; and
- Adding full parallel taxiways.

⇨ Adding buildings, hangars, and other facilities to a new development area in the southwest quadrant of the two runways;

⇨ Adding additional buildings and launch pads to the vertical launch area;

⇨ Extending utilities (water, electrical, fiber optic, wastewater) to the new facilities,

- Potential launching of new types of horizontal and vertical launch vehicles;
- Increasing the frequency of launches;
- Potential BLM leasing and development of oil and gas resources on lands open to this activity; and
- Development of visitor facilities along El Camino Real NHT through the Jornada del Muerto.

Any modifications to the Launch Site Operator License, including future, significant construction activities at the Spaceport America site, would be subject to the FAA's review, including an environmental review.

The cumulative impacts analyses for this EIS considers the aggregate impacts when the potential environmental impacts of the Proposed Action (as discussed in Chapter 4, pre-mitigation) are added to the potential impacts of the projects or actions listed above. There is environmental documentation describing the impacts of the temporary improvements to County Road A013 (NMDOT, 2008), for BLM oil and gas leasing (BLM, 2003), and for the designation of El Camino Real as a NHT and development of visitor facilities along the NHT (NPS and BLM, 2004a). There is no environmental documentation describing the impacts of the other projects and activities listed above, and most have not been defined, thus it was not possible for the FAA to quantify the impacts associated with them[7]. As such, the FAA has not conducted a detailed quantitative evaluation of the potential environmental impacts associated with these projects. However, reasonable estimates of impacts can be made for many of the projects and activities based on the potential impacts identified for the Proposed Action. The following sections discuss the potential cumulative impacts for the Proposed Action.

[7] Potential expansion of Spaceport America, launching new types of vehicles, or increasing the frequency of launches would require new application(s) for modification of the operator's license, which could trigger the need for additional NEPA compliance. FAA would determine whether additional or supplemental NEPA documents would be required and analysis of impacts would be conducted in accordance with FAA Order 1050.1E.

5.2 Compatible Land Use

The construction and operation of Spaceport America would retain most current land uses, while permanently changing land use in a small portion of the total Project area from rangeland used by wildlife and livestock to spaceport use and support facilities. Livestock grazing opportunities on adjacent lands may be reduced due to loss of base waters or temporarily due to required land resting during the growing season after the grassland projects are completed. These impacts have been determined to be not significant. Past cumulative projects and activities have been supportive of maintaining the historic and current land use for ranching and wildlife habitat and have not resulted in impacts to land use. The leasing and development of oil and gas resources by the BLM could change land use in the vicinity of the Project area, but there are no active applications or pending leases. The environmental documentation for the proposed fluid minerals development determined that impacts to rangeland would be minimal (BLM, 2003). Of the future cumulative projects listed in Section 5.1, the potential expansion of Spaceport America in the future would result in changes to land use, with additional lands being changed from ranching and wildlife habitat uses to spaceport and support facilities. Although this future Project could result in a doubling of the acreage taken out of ranching use, because the vicinity of the Project area includes a large amount of rangeland, the impacts of the Proposed Action on land use would be additive to the impacts from expansion of Spaceport America, but the cumulative impact would not be significant.

5.3 Section 4(f) Properties and Farmlands

No impacts under Section (4f) are expected from the Proposed Action. Since there would be no potential impacts from the Proposed Action, there are no cumulative impacts expected either.

There are no prime or unique farmlands located within or near the proposed Project site. Therefore, there would be no impacts expected from the Proposed Action on such resources. Because there would be no potential impacts from the Proposed Action, there are no cumulative impacts anticipated either.

5.4 Noise

The construction and operation of the proposed Spaceport America would result in minor noise impacts in the Project area; the increase in noise would be below the threshold for significance. Construction activities would create multiple, individual noise sources. The residences of the two ranches near the proposed Project area would be annoyed by the increase in ambient noise levels, but the impacts would be minor and temporary. During operations such as launches, rocket engine tests, and aircraft operations, high noise levels would be experienced by spectators and the two nearby residences. Sonic booms from supersonic vehicles at high altitudes would create minor impacts because of their relative low magnitude, relative infrequent occurrence, and occurrence over a sparsely populous area. Consequently, the impacts due to operations would be minor and temporary. Traffic noise would be about 50 dBA at 300 feet during the X Prize Cup event. No residences are closer than 300 feet along County Road A013 or State Highway 51, and impacts would be minor.

Of the past and current projects, the ones with the potential for noise impacts are the use and operation of the railroad and the county roads, and the operation of the existing amateur launch site. However, the amount of traffic on the roads is sparse due to the low population residing in the vicinity, the use of the railroad is sporadic, the use of the amateur launch site is sporadic, and the resulting noise from all three sources is very short-term, thus none of these sources results in much noise impact. Future projects with the potential for noise impacts include:

- *Construction and use of the temporary improvements to County Road A013* – Noise impacts from construction of County Road A013 improvements would be temporary. Use of the road would likely not increase just from the temporary improvements, so traffic noise would not increase.
- *Construction and use of the permanent improvements to County Road A013* – Noise impacts from construction of the permanent County Road A013 improvements would be temporary. Use of the road would likely increase somewhat because of the improvements; however, because of the sparse population in the vicinity, it would likely not increase substantially and traffic noise impacts would not increase due to the improvements.
- *Construction and operation of facilities and infrastructure for expansion of Spaceport America* – Noise impacts from construction of this Project would be very similar to the construction of the Proposed Action and thus would also be temporary and would not be significant. Operations activities, both launch and nonlaunch, would also be similar. However, use of the crosswinds runway for launches and aircraft would result in different noise impact contours, and use of new vertical launch/landing pads could result in different noise impacts. Also, the increased number of facilities would require an increased number of workers and the concomitant increase in vehicle traffic noise. These could result in significant noise impacts.
- *Increasing the frequency of launches* – Increasing the number of vertical and horizontal LV launches would result in greater noise impacts. Increased launches would cause an increase in the number of aircraft using the airfield for landings and takeoffs, and an increase in the number of workers traveling to the site. These two increases would also result in greater noise impacts. Thus increasing the frequency of launches could result in significant noise impacts.
- *BLM leasing and development of oil and gas resources* - The potential for development of these resources in the region of influence exists. The environmental documentation for the proposed resource development determined that the potential for noise impacts would be low (BLM, 2003).

The construction of temporary and permanent improvements to County Road A013 would likely only result in temporary noise impacts and thus are not considered further in the cumulative analysis. BLM development of fluid minerals has a low potential for noise impacts to sensitive receptors. Expansion of Spaceport America facilities and infrastructure, and increasing the number of launches, would likely result in significant increases in noise impacts. When the noise impacts of the Proposed Action are added to the likely noise impacts of these future projects, it is likely that the cumulative noise impacts would be significant.

5.5 Visual Resources and Light Emissions

The visual impacts and light emissions resulting from construction and operation of Spaceport America would not be significant for the Project area. VRM Class II objectives for the NHT would be maintained in the 5-mile visual buffer zone because of terrain, use of color schemes, distance, and camouflage in the facility design. There would be weak contrast between the current setting and the proposed Project facilities from the NHT. All new utility-infrastructure would be buried on-site. Road modifications and paving would be noticeable, but would not be a significant visual intrusion. The visual impacts of launches 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 lighting products and designs that are consistent with the standards of the International Dark-Sky Association (IDA, 2002). Visual impacts of roadway vehicles and fugitive dust would increase, but would have only minor impact on the NHT and the overall visual setting. In VRM Class IV areas, the new construction would increase visual contrast only slightly and would be consistent with the objectives for these areas.

Of the past and current projects, the ones with the potential for visual impacts are the use of the dirt county roads (fugitive dust) and operation of the amateur launch site. However, the amount of traffic on the roads is sparse due to the low population residing in the vicinity, the use of the amateur launch site is sporadic, and the resulting visual impacts from both sources is very short-term, thus neither of these sources results in much visual impact. Future projects with the potential for visual impacts include:

- *Construction and use of the temporary improvements to County Road A013* – Visual impacts (fugitive dust and activity) from construction of County Road A013 improvements would be temporary. Replacing the dirt road with a chip-seal surface would not result in a visual impact, and may improve visual resources by reducing the amount of ambient dust. Use of the road would likely not increase just from the temporary improvements, so visual impacts from vehicles on the road would not increase.
- *Construction and use of the permanent improvements to County Road A013* – Visual impacts (fugitive dust and activity) from construction of the permanent County Road A013 improvements would be temporary. Visual impacts due to changes to the road would be in direct relation to the extent of changes, with minor changes resulting in little visual impact, and major changes having greater visual impact. Paving of the road may improve visual resources by reducing the amount of ambient dust. Use of the road would likely increase somewhat because of the improvements; however, because of the sparse population in the vicinity, it would likely not increase substantially and visual impacts from traffic would not increase due to the improvements.
- *Construction and operation of facilities and infrastructure for expansion of Spaceport America* – Visual impacts from construction of the expansion would be similar to the construction of the Proposed Action. However, the new runway would cross-cut contours and would be much more visible than the currently planned runway. Light emissions from security and safety lights would be kept to a minimum using the same standards as the Proposed Action, resulting in a minimum impact. Operations activities, both launch and nonlaunch, would also be similar. However, use of the crosswinds runway for launches and aircraft would result in more visibility, especially from the NHT. Also, the increased number of facilities would require an increased number of workers and the concomitant increase in vehicle traffic, resulting in visual impacts both on-site and off-site. Expansion of the spaceport could result in significant visual impacts.
- *Increasing the frequency of launches* – Increasing the number of vertical and horizontal LV launches would result in greater visual impacts from these operations. Though they

would still be temporary in nature, with a greater density of launches the impact would be greater. Increased launches would cause an increase in the number of aircraft using the airfield for landings and takeoffs, and an increase in the number of workers traveling to the site. These two increases would also result in greater visual impacts. Thus increasing the frequency of launches could result in significant visual impacts.

- *BLM leasing and development of oil and gas resources* - There are no active applications or pending leases in the vicinity of the Project area; however, BLM land is open to this activity with stipulations. If allowed, future exploration and development would be required to maintain the applicable VRM classification. The environmental documentation for the proposed resource development determined that impacts would not be visually evident (BLM, 2003).

The construction of temporary improvements to County Road A013 would likely only result in temporary visual impacts and thus is not considered further in the cumulative analysis. Permanent improvements to the road could result in visual impacts depending on the extent of changes made. Development of BLM fluid mineral resources would have minimal visual impacts. Expansion of Spaceport America facilities and infrastructure, and increasing the number of launches, would likely result in significant increases in visual impacts. The amount of man-made surfaces, the number of buildings, and the density of facilities would essentially double from the Proposed Action. In addition, the cross-winds runway would cross-cut contours and would be much more visible than the currently planned runway. Use of the cross-winds runway would also be much more visible than the runway currently planned under the Proposed Action. These factors would result in a Spaceport America facility that is much more visible and contrasting with the surrounding environment, and operations that are more visible. Increased operations, especially launches, landings, and aircraft use of the runways, would also result in more visual impacts. Thus, when the visual impacts of the Proposed Action are added to the likely visual impacts of these future projects, it is likely that the cumulative visual impacts would be significant.

5.6 Historical, Architectural, Archaeological, and Cultural Resources

Impacts to historic properties, including physical damage, changes to setting, and visual and auditory effects, would occur as a result of the Proposed Action. These impacts, without mitigation measures, would include minimal impacts to setting, moderate impacts to setting, and significant impacts to setting and physical resource integrity. In compliance with Section 106 of the NHPA, the FAA will consult with the New Mexico SHPO to develop measures to avoid or mitigate the adverse effects. While the adverse effects would remain, the mitigation measures would resolve these effects and reduce the impacts to a level that is not significant.

Of the past projects, railroad construction, county road construction, and construction of the amateur launch site have all resulted in impacts to the physical integrity of historic properties. Construction of the two transmission lines has likely also had impacts to historic properties. Ranching operations have impacted historic properties in the past and likely continue to have inadvertent impacts on historic properties. These impacts from past and current activities are significant because they were not mitigated prior to being impacted. Designation of El Camino Real as a NHT has had a beneficial impact to this historic property by adding additional protection measures to its management. However, designation of the NHT has also brought public attention to its location, which may have resulted in illegal artifact collecting along the route. Future projects with the potential for visual impacts include:

- *Construction and use of the temporary improvements to County Road A013 –* Construction of the temporary improvements would not have an adverse physical impact on historic properties (NMDOT, 2008). Visual and noise impacts from construction of road improvements would be temporary. Replacing the dirt road with a chip-seal surface would not result in a visual impact. Use of the road would likely not increase just from the temporary improvements, so visual and noise impacts from vehicles on the road would not increase. Thus there would not be a significant impact to the setting of the NHT or Aleman Draw Historic District from these improvements.
- *Construction and use of the permanent improvements to County Road A013 –* Construction of permanent improvements would likely have an adverse physical impact on historic properties. Such adverse impacts could occur to the NHT since the historic Trail parallels, and at times is adjacent to and crosses, the county road. Visual and noise impacts to the settings of historic properties from construction of the permanent County Road A013 improvements would be temporary. Visual impacts due to changes to the road would be in direct relation to the extent of changes, with minor changes resulting in little visual impact, and major changes having greater visual impact. Use of the road would likely increase somewhat because of the improvements; however, because of the sparse population in the vicinity, it would likely not increase substantially and visual and noise impacts from traffic would not increase due to the improvements. Thus some impact would occur to the settings of the NHT and District, though the significance of the impact would be dependent on the extent of changes to the road. Any adverse impacts would be mitigated to a level that is not significant through compliance with the Section 106 process.
- *Construction and operation of facilities and infrastructure for expansion of Spaceport America –* Construction of new facilities and infrastructure would likely have an adverse physical impact on historic properties. Visual and noise impacts to historic property settings from construction of the expansion would be similar to the construction of the Proposed Action. However, the new runway would cross-cut contours and would be much more visible than the currently planned runway. Light emissions from security and safety lights would be kept to a minimum using the same standards as the Proposed Action, resulting in a minimum impact. Operations activities, both launch and non-launch, would also be similar. However, use of the crosswinds runway for launches and aircraft would result in more visual and noise impacts on the setting, especially from the NHT. Use of the new vertical launch pads would also result in potentially increased noise impacts. Also, the increased number of facilities would require an increased number of workers and the concomitant increase in vehicle traffic, resulting in visual and noise impacts both on-site and off-site. Thus it is likely that significant impacts would occur to the settings of the NHT and District. Any adverse impacts would be mitigated to a level that is not significant through compliance with the Section 106 process.
- *Increasing the frequency of launches –* Increasing the number of vertical and horizontal LV launches would result in greater visual and noise impacts to historic property settings from these operations. Though they would still be temporary in nature, with a greater

density of launches the impacts would be greater. Increased launches would cause an increase in the number of aircraft using the airfield for landings and takeoffs, and an increase in the number of workers traveling to the site. These two increases would result in greater visual and noise impacts to the setting. Additional launches would also result in more visitors, which could lead to inadvertent impacts to historic properties both on-site and off-site. The additional traffic both on-site and on County Road A013 would also result in visual and noise effects. Thus significant impacts to the settings of the NHT and District would be likely to occur from the increase in launches. Any adverse impacts would be mitigated to a level that is not significant through compliance with the Section 106 process.

- *BLM leasing and development of oil and gas resources* - The potential for development of these resources in the region of influence exists. The environmental documentation for the proposed resource development determined that impacts to cultural resources could be significant (BLM, 2003). Although develop of such resources would not be allowed within 0.25 mile of the NHT, there would likely be impacts to the settings of the NHT and El Camino Real-related resources.
- *Development of NHT visitor facilities* – Development of visitor facilities along El Camino Real NHT would result in increased visitor use and access. This could result in increased vandalism, inadvertent damage, or illegal artifact collecting along this historic property and to other historic properties nearby.

The construction of temporary improvements to County Road A013 would likely only result in temporary visual impacts to historic property settings and thus is not considered further in the cumulative analysis. Permanent improvements to the road would likely result in physical impacts to historic properties and impacts to the settings of the NHT and District. Expansion of Spaceport America facilities and infrastructure would likely result in significant physical impacts to historic properties and impacts to the settings of the NHT and District. The amount of man-made surfaces, the number of buildings, and the density of facilities would essentially double from the Proposed Action. In addition, the cross-winds runway would cross-cut contours and would be much more visible than the currently planned runway. Use of the cross-winds runway would have more visual and noise impacts than the runway currently planned under the Proposed Action. These factors would result in a Spaceport America facility with much more visual and noise impacts and contrast with the surrounding environment, and operations that have more visual and noise impacts to the NHT and District. Increased operations, especially launches, landings, and aircraft use of the runways, would also result in more visual and noise impacts to historic property settings. Finally, BLM development of fluid minerals in the area could result in significant impacts to cultural resources, in particular the NHT.

All adverse impacts from the Proposed Action and these future projects could be individually mitigated to a level that is not significant through compliance with the Section 106 process. However, when the remaining impacts to the physical integrity and settings of historic properties from the Proposed Action are added to those of the future projects, it is likely that the cumulative impacts to historic properties would be significant, particularly to the settings of the NHT and District.

5.7 Air Quality

The criteria pollutant and HAP emissions from construction and operation of Spaceport America would have a negligible impact on air quality and would not impair visibility along El Camino Real NHT. The emissions of CO_2 and ozone depleting substances in the stratosphere would have a negligible impact on climate change and ozone depletion. In addition, construction and operation of Spaceport America would have no impact on the mesosphere or ionosphere.

There are three past and current projects or activities that could affect air quality in the vicinity of Spaceport America, the railroad (engine emissions), motor vehicles (engine emissions and fugitive dust from unpaved county roads), and launches from the existing amateur launch site. The area of the proposed Spaceport America is in attainment of Federal and New Mexico Ambient Air Quality Standards with these activities taking place. As stated above, the Proposed Action would have negligible impacts on the current air quality when added to these current activities. Future projects with the potential for impacts to air quality include:

- *Construction and use of the temporary improvements to County Road A013* – Construction of the temporary improvements would not have long-term adverse impacts on air quality (NMDOT, 2008). Temporary impacts from fugitive dust and emissions from vehicles and construction equipment would occur during construction activities. Replacing the dirt road with a chip-seal surface would improve air quality by removing fugitive dust caused by traffic. Use of the road would likely not increase just from the temporary improvements, so air impacts from motor vehicle engine emissions would not increase from the Project. Thus there would not be a significant impact to air quality from this Project.
- *Construction and use of the permanent improvements to County Road A013* – Construction of permanent improvements would likely have temporary impacts on air quality from fugitive dust and emissions from vehicles and construction equipment. If the road is paved, the improvements would improve air quality by removing fugitive dust caused by traffic. Use of the road would likely increase somewhat because of the improvements; however, because of the sparse population in the vicinity, it would likely not increase substantially and air quality impacts from motor vehicle emissions would not increase due to the improvements. Thus there would not be a significant impact to air quality from this Project.
- *Construction and operation of facilities and infrastructure for expansion of Spaceport America* – Construction of new facilities and infrastructure would likely have similar impacts to air quality as under the Proposed Action because the new facilities are approximately of the same magnitude as the facilities in the Proposed Action. These emissions would occur mostly from fugitive dust and emissions from vehicles and construction equipment. These impacts would be temporary, lasting only as long as construction activities. Operation of the expanded portion of the facilities would also be at a similar level of activity as the Proposed Action, with the addition of one runway and two or three vertical launch pads. Thus the impact to air quality would be similar to that for the Proposed Action, i.e., negligible impacts.
- *Increasing the frequency of launches* – Increasing the number of vertical and horizontal LV launches would result in impacts to air quality due to emissions from additional launches, emissions from additional aircraft using the airfield, motor vehicle emissions

from additional workers and visitors, and fugitive dust from additional traffic on unpaved roads. The significance of the impacts to air quality would be dependent on the magnitude of the increase in number of launches.

- *Development of NHT visitor facilities* – Development of visitor facilities along El Camino Real NHT would result in increased visitor use and access. This could result in increased engine emissions from motor vehicles, though this impact would likely be negligible.
- *BLM leasing and development of oil and gas resources* - The potential for development of these resources in the region of influence exists. The environmental documentation for the proposed resource development determined that impacts to air quality cannot be determined until a specific project is designed. There is the potential for significant impacts in certain areas, but there are mitigation measures that could address these impacts (BLM, 2003).

The construction of temporary and permanent improvements to County Road A013 would likely only result in temporary air impacts and thus are not considered further in the cumulative analysis. The air quality impacts from construction of additional Spaceport America facilities and infrastructure would also be temporary. Operation of an expanded Spaceport America, increasing the number of launches, and development of visitor facilities along the NHT would likely result in air impacts. The level of impact to air quality from operation of the expanded facility and from development of visitor facilities would likely be negligible. The increase in numbers of vertical and horizontal launches is unknown. However, if the numbers were to increase by the same number of launches assumed under the Proposed Action, the increased number of launches would also likely have the same negligible air quality impacts. BLM development of fluid mineral resources could have significant impacts on air quality. When these mostly negligible impacts are added to the negligible impacts of the Proposed Action, it is likely the cumulative air quality impact would not be significant.

5.8 Water Quality, Wetlands, Wild and Scenic Rivers, Coastal Resources, and Floodplains

There are no wetlands, designated wild or scenic rivers, or coastal resources within or near the proposed Project site. Therefore, there would be no impacts expected from the Proposed Action on such resources. In addition, there are no impacts to floodplains or water quality expected under the Proposed Action. Since there would be no potential impacts from the Proposed Action on these resources, there would be no cumulative impacts anticipated either.

Ground water modeling data indicate that aquifer drawdown would be 4.5 feet at 2 miles from the spaceport facilities after 2 years of construction withdrawal. The available water supply is 50 feet at 2 miles, thus the drawdown would be less than 10 percent. Aquifer drawdown during construction would be transitory with the drawdown recovering to operating levels at the conclusion of the construction phase. Drawdown during operation of the proposed Spaceport America would be 2.1 feet at 2 miles from the spaceport facilities after 20 years of operation. These impacts are considered to be minor.

Ranching operations are the only past or current activity that could affect ground water supply in the vicinity of Spaceport America. Impacts to water supply from ranching activities are negligible. Future projects with the potential for impacts to ground water quantity include:

- *Construction and use of the temporary improvements to County Road A013* – Construction of the temporary improvements would result in use of ground water for construction activities. It is likely that the water would be supplied from someplace away from the proposed spaceport Project area and thus would not impact local ground water supply. This use would be temporary and would have negligible to no impact on ground water supply (NMDOT, 2008).
- *Construction and use of the permanent improvements to County Road A013* – Construction of permanent improvements would result in use of ground water for construction activities. It is likely that the water would be supplied from someplace away from the proposed spaceport Project area and thus would not impact local ground water supply. This use would be temporary and would have negligible to no impact on ground water supply.
- *Construction and operation of facilities and infrastructure for expansion of Spaceport America* – Construction of new facilities and infrastructure would likely have similar impacts to water supply as under the Proposed Action because the new facilities are approximately of the same magnitude as the facilities in the Proposed Action. Thus drawdown could be expected at approximately 10 percent at 2 miles away during the construction period, and would recharge after construction is completed. These impacts would be temporary and not significant. Operation of the expanded portion of the facilities would also be at a similar level of activity as the Proposed Action, with the addition of one runway and two or three vertical launch pads. Thus the impact to ground water supply could be expected at an additional 2.1 feet at 2 miles away after 20 years of operation. These impacts would not be significant.
- *Increasing the frequency of launches* – Increasing the number of vertical and horizontal LV launches would result in additional water use due to expanded operations. The significance of the impact to water supply would be dependent on the magnitude of the increase in number of launches.
- *BLM leasing and development of oil and gas resources* – The potential for development of these resources in the region of influence exists. The environmental documentation for the proposed resource development determined that impacts to surface water or ground water would be minimal (BLM, 2003).

The construction of temporary and permanent improvements to County Road A013 would likely result in negligible to no impacts to ground water quantity, and any impacts would be temporary and thus are not considered further in the cumulative analysis. The water supply impacts from construction of additional Spaceport America facilities and infrastructure would also be temporary and not significant. Operation of an expanded Spaceport America would have impacts that are not significant. The increase in numbers of vertical and horizontal launches is unknown. However, if the numbers were to increase by the same number of launches assumed under the Proposed Action, the increased number of launches would also likely have the same impacts to water quantity. Development of BLM fluid mineral resources would have minimal impacts. Based on the water usage and drawdown calculations of the Proposed Action, when the impacts of these future projects are added to the impacts of the Proposed Action, it is likely the cumulative ground water quantity impacts would not be significant.

5.9 Fish, Plants, and Wildlife

There are no fish within or near the proposed Project site. Therefore, there would be no impacts expected from the Proposed Action on such resources. Since there would be no potential impacts from the Proposed Action on these resources, there would be no cumulative impacts anticipated either.

There would be impacts from construction and operation on regional plant and wildlife species under the Proposed Action; however, these impacts would be less than significant. Construction and operation would not jeopardize the continued existence of special status species of plants or wildlife, or result in the destruction or adverse modification of designated critical habitat. No special status species or critical habitat were identified in the Project area, and thus are not considered further in this cumulative analysis.

Impacts from past or current projects or activities on biological resources include interruption of travel corridors by construction and use of the railroad and county roads. Also, operation of the amateur launch site temporarily displaces wildlife from an existing water source located approximately 100 yards away from the pad. These impacts are not significant. BLM land management activities have resulted in the beneficial restoration of parcels of grassland habitat in the Project area. Future projects with the potential for impacts to plants and wildlife include:

- *Construction and use of the temporary improvements to County Road A013* – Construction of the temporary improvements would result in temporary disturbance of vegetation and wildlife during construction activities. Use of the road would likely not increase just from the temporary improvements. Increased speeds on the road could result in more frequent vehicle/wildlife accidents. It is likely that long-term impacts to wildlife or plants would be minor (NMDOT, 2008).
- *Construction and use of the permanent improvements to County Road A013* – Construction of permanent improvements would result in temporary disturbance of vegetation and wildlife during construction activities. Use of the road would likely increase somewhat because of the improvements; however, because of the sparse population in the vicinity, traffic would likely not increase substantially. Increased speeds on the road could result in more frequent vehicle/wildlife accidents. It is likely that long-term impacts to wildlife or plants would be minor.
- *Construction and operation of facilities and infrastructure for expansion of Spaceport America* – Construction of new facilities and infrastructure would likely have similar impacts to vegetation and wildlife as under the Proposed Action because the new facilities are approximately of the same magnitude as the facilities in the Proposed Action. Thus the impacts would be the same, i.e., not significant. Operation of the expanded portion of the facilities would also be at a similar level of activity as the Proposed Action, with the addition of one runway with its associated security fencing and two or three vertical launch pads. Thus the impact to wildlife and vegetation could be expected to be the same, i.e., not significant.
- *Increasing the frequency of launches* – Increasing the number of vertical and horizontal LV launches would not result in significant impacts to wildlife or vegetation. Noise from launches would temporarily disturb wildlife, but they should return and resume normal activities after the disturbance (launch noise) ceases.

- *BLM leasing and development of oil and gas resources* - The potential for development of these resources in the region of influence exists. The environmental documentation for the proposed resource development determined that impacts to vegetation, wildlife and wildlife habitat, and special status species would be minimal (BLM, 2003).
- *Development of NHT visitor facilities* – Development of visitor facilities along El Camino Real NHT would result in temporary impacts to vegetation and wildlife during construction. There would be no long-term impacts to wildlife or vegetation (NPS and BLM, 2004a).

The construction of temporary and permanent improvements to County Road A013 would likely result in no long-term impacts, thus these projects are not considered further in the cumulative analysis. The wildlife and vegetation impacts from construction of additional Spaceport America facilities and infrastructure would not be significant. Operation of an expanded Spaceport America would have impacts, including increased traffic on County Road A013 and an increase in numbers of vertical and horizontal launches, but would not have a significant impact. BLM development of fluid minerals would have minimal impacts. And the development of NHT visitor facilities would result in only temporary impacts to wildlife and vegetation. When the impacts of these future projects are added to the impacts of the Proposed Action, it is likely the cumulative impacts to wildlife and vegetation would be additive, but not significant.

5.10 Hazardous Materials, Pollution Prevention, and Solid Waste

There are no expected impacts stemming from the management of hazardous materials or hazardous and non-hazardous wastes under the Proposed Action. Because there are no potential impacts expected from the Proposed Action, there are no cumulative impacts anticipated either.

Off-site impacts from disposal of spaceport-generated waste would be negligible to minimal under the Proposed Action due to the small quantities of waste in comparison to waste disposal capacity available in the region. The construction waste generated would be 0.13 percent of the District 3's 2004 disposal rate.

Ranching operations are the only past or current activity that would contribute to waste generation. However, the amounts would be so small that they would be negligible. Future projects with the potential for waste impacts include temporary and permanent improvements to County Road A013, expansion of Spaceport America, increasing the frequency of launches, and launching new types of vehicles. In all cases, the quantities of waste generated would have negligible to minimal impacts on the waste disposal capacity in the region. When the small impacts of these future projects are added to the impacts of the Proposed Action, it is likely the cumulative impacts to waste disposal capacity in the region would not be significant.

5.11 Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety Risks

There are no disproportionate high and adverse impacts to minority or low-income populations expected from construction or operations. The potential environmental health impacts and safety risks from construction and operation would not be expected to disproportionately affect children. Since there are no potential impacts expected from the Proposed Action in these two resource areas, there are no cumulative impacts anticipated either.

During construction under the Proposed Action, impacts would be beneficial and temporary for population, economics, employment, housing, and tax revenues. Adverse impacts to community services would be small and temporary. During operations, impacts would be beneficial and long-term for population, economics, employment, housing, and tax revenues. Adverse impacts to community services would be small and long-term. These adverse impacts could be mitigated through use of increased tax revenues to fill community service positions.

Most of the past, current, and future projects and activities would result in the same types of beneficial and adverse impacts to socioeconomics as the Proposed Action. When these impacts are combined with the impacts of the Proposed Action, it is likely that the cumulative beneficial impact to socioeconomics would be significant.

5.12 Energy Supply and Natural Resources

There are no expected impacts to energy supply and use or natural resources supply and availability from implementation of the Proposed Action. Since there are no potential impacts expected from the Proposed Action, there are no cumulative impacts anticipated either.

5.13 Construction Impacts

All construction impacts from the Proposed Action, when considered together, would be either temporary and significant or long-term and not significant. The past, current, and future projects and activities would likely have the same types of impacts from construction as those under the Proposed Action. When the construction impacts from the Proposed Action are combined with the construction impacts from these cumulative projects, the cumulative impacts of the Proposed Action would remain the same – either temporary and significant (lasting only as long as the construction activities) or long-term and not significant due to implemented mitigation and avoidance measures.

6. MITIGATION

As discussed in Chapter 4, the only resource area for which the impact from the Proposed Action would exceed the applicable threshold of significance is Historical, Architectural, Archaeological and Cultural Resources. A conceptual mitigation plan for affected cultural resources is presented in Section 6.2. No significant impacts were identified for Visual Resources and Light Emissions; Air Quality; Water Quality, Wetlands, Wild and Scenic Rivers, Coastal Resources, and Floodplains; Fish, Plants, and Wildlife; Hazardous Materials, Pollution Prevention, and Solid Waste; and Energy Supply and Natural Resources.

This chapter summarizes measures that NMSA could take to reduce or offset the potential environmental consequences of construction and operational activities. Measures described in the following sections include administrative or management controls and engineered systems that would be implemented through operating procedures. Further measures may be developed in consultation with Federal and State agencies and implemented, if necessary.

Development of the specific erosion and sediment control plans and other Best Management Practices during construction would be the responsibility of the general contractor hired by NMSA to construct the spaceport. The general contractor would be required to apply the current construction industry Best Management Practices in accordance with Federal requirements, NPDES General Permit requirements, and applicable regulations of the New Mexico Environment Department. NMSA would act in an oversight capacity to ensure that contractor performance meets these requirements.

6.1 Visual Resources and Light Emissions

Measures that would reduce impacts on visual resources and light emissions would include:

- Minimizing the use of security and safety lighting, and ensuring that all essential lighting would meet lighting standards consistent with the Outdoor Lighting Code Handbook published by the International Dark-Sky Association (IDA, 2002) and Night Sky Protection Act [74-12-1 to 74-12-10 New Mexico Statutes Annotated 1978];
- Providing buses for visitors and tourists, especially during the X Prize Cup event, and controlling vehicle use associated with Spaceport America activities and events within the limited developed land areas; and
- Using earthen berms, vegetation, non-glare material, color, and height and distance measures to disguise facilities to the extent practicable to minimize impacts within areas visible from the NHT.

6.2 Historical, Architectural, Archaeological, and Cultural Resources

Adverse effects to historic properties, including physical impacts, changes to setting, and visual and audible effects, would occur as a result of the construction and operation of Spaceport America. Prior to construction, an MOA would be developed for signature by the FAA, NMSA, SHPO, ACHP, and other consulting parties, which would document the measures to be completed. This MOA would also describe the processes to be followed when previously unknown cultural resources or human remains are discovered during construction or operation of Spaceport America, and would address processes to be followed when inadvertent physical damage to a property is discovered. While the adverse effects to the properties would remain, the MOA and the measures contained within it would resolve these effects and reduce them below significant levels.

The following measures to avoid, minimize, or mitigate adverse effects could be considered and included in the MOA:

- Conducting data recovery excavations of archaeological sites;
- Conducting in-depth background research and field investigations of historical resources;
- Implementing standard Best Management Practices during construction and maintenance activities to control erosion and changes to erosion patterns;
- Training Spaceport America construction, maintenance, and operations personnel, as well as contractors and tenant organizations, to recognize when archaeological resources or human remains have been discovered or when inadvertent damage has occurred to a resource, to halt ground disturbing activities in the vicinity of the discovery, and to notify appropriate personnel;
- Educating Spaceport America construction, maintenance, and operations personnel, as well as contractors and tenant organizations, on the importance of cultural resources, the need to stay within defined work zones, and the legal implications of vandalism and artifact collecting;
- Educating visitors and the general public on the importance of cultural resources, the need to stay within defined access areas, and the legal implications of vandalism and artifact collecting;
- Developing a State management plan for those portions of the NHT located on State Trust Land;
- Developing a Cultural Resource Management Plan to ensure long-term protection of cultural resources within the Spaceport America boundaries;
- Establishing a Design Committee, with membership to include agency and public stakeholders, to develop ways to reduce the visibility of proposed facilities through use of specific color, texture, topography, orientation, and materials; and
- Developing joint marketing and education programs that benefit both Spaceport America and the NHT, such as:
    - Providing educational outreach to the public about the region’s cultural heritage through programs and publications;
    - Developing public activities in coordination with El Camino Real International Heritage Center and the New Mexico Museum of Space History; and
    - Developing and maintaining road-side interpretive signs and foot trails to enhance the visitor experience.

6.3 Air Quality

Best Management Practices would address any potential air quality impacts during construction or operations. During construction, water would be applied to disturbed areas and dirt road surfaces for dust suppression. Dust abatement would be applied to gravel roads for dust suppression. During operations, the cement batch plant would incorporate particulate control features such as the enclosure of conveyors and elevators, filters on storage bin vents, and the use of water sprays.

6.4 Water Quality, Wetlands, Wild and Scenic Rivers, Coastal Resources, and Floodplains

Water conservation measures would be incorporated into the design of facilities and infrastructure and operations standards for Spaceport America (DMJM/AECOM, 2007). Such measures could include:

- Incorporating water-efficient fixtures and appliance into facility design, such as dual flush toilets, waterless urinals, aerated faucets, and low flow showers;
- Incorporating desert landscaping with water-efficient irrigation where needed;
- Using wastewater effluent to meet a portion of the nonpotable water needs, such as for vehicle washing, toilet flushing, and landscaping; and
- Collection of rain water and storm water runoff for nonpotable uses.

6.5 Fish, Plants, and Wildlife

NMSA is consulting with BLM, NMDGF, and NMSLO to develop measures within a ranch management plan to reduce potential impacts. These measures could include, but are not limited to:

- Enhancement of off-site desert grassland habitats as per BLM (2007) to replace wildlife habitat potentially impacted by spaceport construction and/or operation;
- Creation and/or refurbishment of off-site watering areas to replace those potentially made un-usable by Spaceport America construction and/or operation;
- Development of cattle fences in accordance with BLM guidelines to allow continued movement of wildlife;
- Reconstruction and/or modification of existing on-site fences; and
- Monitoring of wildlife populations within the Project area to examine for potential shifts in density and diversity.

6.6 Hazardous Materials, Pollution Prevention, and Solid Waste

Possible actions to minimize the potential effects of hazardous materials and solid and hazardous wastes at the Spaceport America facility include:

- Taking advantage of all pollution prevention opportunities, including recycling and purchase of environmentally-friendly products whenever possible;
- Having spill response materials (e.g., sorbents, drain covers, mops, brooms, shovels, drum repair materials and tools, warning signs and tapes, and personal protective equipment) readily available for use in storage areas, during fueling, and during transport in the event of an unplanned release;

- Storing hazardous materials in protected and controlled areas with containment and impermeable ground cover;
- Using spill containment berms during fueling operations;
- Inspecting hazardous materials daily; and
- Purchasing hazardous materials in appropriately size containers (e.g., if the material is used by the can, it would be purchased by the can rather than in bulk-sized containers) and in appropriate quantities.

6.7 Energy Supply and Natural Resources

Energy conservation measures would be incorporated into the design of facilities and infrastructure and operations standards for Spaceport America (DMJM/AECOM, 2007). Such measures could include:

- Incorporating energy efficient building design for natural cooling, heating, and lighting; and
- Developing alternate power sources such as geothermal and photovoltaic.

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10. GLOSSARY

airspace	Airspace is the defined space above a nation, which is under its jurisdiction. Airspace is limited horizontally, vertically, and temporally, and is regulated by the FAA.
amateur rocket activities	Certain rocket launches, known as "amateur rocket activities," are exempt from FAA licensing or permitting. The term "amateur rocket activities" is defined in 14 CFR 401.5 as "launch activities conducted at private sites involving rockets powered by a motor or motors having a total impulse of 200,000 pound-seconds or less and a total burning or operating time of less than 15 seconds, and a rocket having a ballistic coefficient, i.e., gross weight in pounds divided by frontal area of rocket vehicle, less than 12 pounds per square inch."
ambient air quality standards	Standards established on a State or Federal level, that define the limits for airborne concentration of designated "criteria" pollutants (nitrogen dioxide, sulfur dioxide, carbon monoxide, particulate matter, ozone, and lead), to protect public health and an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility, and materials (secondary standards).
apogee	The highest point in a launch vehicle's trajectory.
apron	A defined area intended to accommodate aircraft for loading or unloading passengers or cargo, refueling, parking, or maintenance.
aquifer	Underground layers of rock, sand, or gravel that contain water.
archaeological site (resource)	Any location where humans have altered the terrain or discarded artifacts during either prehistoric or historic times.
area of critical environmental concern (ACEC)	A BLM land use designation where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect humans from natural hazards.
artifact	An object produced or shaped by human workmanship that is of archaeological or historical interest.
attainment area	A region that meets the Environmental Protection Agency's National Ambient Air Quality Standards for a criteria pollutant under the Clean Air Act.
C-weighted sound level (dBA)	A number representing the sound level that is frequency weighted according to a prescribed frequency response established by the American National Standards Institute and accounts for the response of the human ear for low frequency sounds.

centrifuge	A device that rotates at various speeds about a fixed, central point. It can separate liquids from solids or liquids of different densities by using the centrifugal force resulting from its rotation.
criteria pollutant	A pollutant determined to be hazardous to human health and regulated under the Environmental Protection Agency's National Ambient Air Quality Standards. The 1970 amendments to the Clean Air Act require the EPA to describe the health and welfare impacts of a pollutant as the "criteria" for inclusion in the regulatory regime.
cryogenic liquid	Liquefied gases kept at extremely low temperatures.
cultural resources	Archaeological materials (artifacts) and sites that date to the prehistoric and historic periods and that are currently located on the ground surface or buried beneath it; standing structures or their component parts that are over 50 years in age; and cultural and natural places, select natural resources, and sacred objects that have important for Native Americans.
cumulative impacts	The combined impacts resulting from all activities occurring concurrently at a given location.
day night level (DNL)	The average sound level over an entire day with 10 dB added between 10 pm and 7 am to account for the increased annoyance caused by noise during these hours.
decibels (dB)	A unit for describing the ratio of two powers or intensities, or the ratio of a power to a reference power. In measurement of sound intensity, the pressure of the reference sound is usually taken as 2×10^{-4} dyne per square centimeter (equal to one-tenth bel).
distance zones	In visual resource management, landscapes are subdivided into three distance zones based on relative visibility from travel routes or observation viewpoints: foreground-middleground, background, and seldom-seen. The foreground-middleground zone includes areas seen from viewing locations that are less than three to 5 miles away. Areas beyond the foreground-middleground zone, but usually less than fifteen miles away, are in the background zone. Areas not seen as foreground-middleground or background (i.e., hidden from view) are in the seldom-seen zone.
endangered species	A plant or animal that is in danger of extinction throughout all or a significant portion of its range.
Environmental Justice	No group of people, including racial, ethnic, or socioeconomic groups, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of Federal, State, local, and tribal programs and policies. Executive Order 12898 directs Federal agencies to make achieving environmental justice part of their missions.

experimental permit	"An experimental permit authorizes launch or reentry of a reusable suborbital rocket (14 CFR 437.7). The FAA will issue an experimental permit for (1) research and development to test new design concepts, new equipment, or new operating techniques; (2) showing compliance with requirements for obtaining a license; or (3) crew training before obtaining a license for a launch or reentry using the design of a rocket for which the permit would be issued." (14 CFR 437.5)
flight corridor	An area on the Earth's surface estimated to contain the hazardous debris from nominal flight of a launch vehicle, and non-nominal flight of a launch vehicle assuming a perfectly functioning flight termination system or other flight safety system.
Flight Safety System	The system that provide a means of control during flight for preventing a launch vehicle and any component, including any payload, from reaching any populated area in the event of a launch vehicle failure.
hazardous waste	A category of waste regulated under the Resource Conservation and Recovery Act (RCRA). To be considered hazardous, a waste must be a solid waste under RCRA and must exhibit at least one of four characteristics described in 40 CFR 261.20 through 40 CFR 261.24 (i.e., ignitability, corrosivity, reactivity, or toxicity) or be specifically listed by the Environmental Protection Agency in 40 CFR 261.31 through 40 CFR 261.33.
historic resources	Archaeological sites, architectural structures, and objects produced after the advent of written history, dating to the time of the first Euro-American contact in an area.
impacts	An assessment of the meaning of changes in all attributes being studied for a given resource, an aggregation of all of the adverse effects, usually measured using a qualitative and nominally subjective technique.
igneous rock	Rocks derived from molten material such as magma.
ionosphere	The part of the Earth's upper atmosphere which is sufficiently ionized by solar UV radiation so that the concentration of free electrons affects the propagation of radio waves; its base is at approximately 70 or 80 kilometers and it extends to an indefinite height.
land use	Land use refers to the current or proposed use or classification of land tracts for economic production; for residential, recreational or other purposes; and for natural or cultural resource protection.

launch	To place or try to place a launch vehicle or reentry vehicle and any payload from Earth – (a) in a suborbital trajectory; (b) in Earth orbit in outer space; or (c) otherwise in outer space, including activities involved in the preparation of a launch vehicle or payload for launch, when those activities take place at a launch site in the United States.
launch operator	A person who conducts or will conduct the launch of a launch vehicle and any payload.
launch operator license	"A launch operator license authorizes a licensee to conduct launches from one launch site, within a range of launch parameters, of LVs from the same family of vehicles transporting specified classes of payloads. A launch operator license remains in effect for 5 years from the date of issuance." (14 CFR 415.3[b])
launch point	A point on the Earth from which the flight of a launch vehicle begins, and is defined by the point's geodetic latitude, longitude, and height on an ellipsoidal Earth model.
launch site	The location on Earth from which a launch takes place as defined in a license the FAA issues or transfers and necessary facilities at that location.
Launch Site Operator License	A license granted by the FAA that authorizes launches from a specific location, within a range of launch parameters of specific launch vehicles, transporting specific classes of payload. The launch vehicles must meet all FAA safety, risk, and indemnification requirements. In addition, the grant of a license to operate a launch site does not guarantee that a launch license will be granted for any particular launch proposed for the site. All launches will be subject to separate the FAA review and licensing.
launch-specific license	"A launch-specific license authorizes a licensee to conduct one or more launches, having the same launch parameters, of one type of LV from one launch site. The license identifies, by name or mission, each launch authorized under the license. A licensee's authorization to launch terminates upon completion of all launches authorized by the licensee or the expiration date stated in the license, whichever occurs first." (14 CFR 415.3[a])
mesosphere	The atmospheric shell between about 45-55 kilometers and 80-85 kilometers, extending from the top of the atmosphere to the mesopause; characterized by a temperature that generally decreases with altitude.

National Register of Historic Places	The official list of the Nation's cultural resources that are worthy of preservation. The National Park Service maintains the list. Buildings, structures, objects, sites, and districts are included in the National Register for their importance in American history, architecture, archaeology, culture, or engineering. Listed properties can be significant at the national, State, or local level.
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.
operation of a launch site	The conduct of approved safety operations at a permanent site to support the launching of vehicles and payloads.
oxidizer	A substance such as chlorate, perchlorate, permanganate, peroxide, nitrate, oxide, or the like that yields oxygen readily to support the combustion of organic matter, powdered metals, and other flammable material.
ozone	The tri-atomic form of oxygen, comprising approximately one part in three million of all of the gases in the atmosphere. Ozone is the primary atmospheric absorber of UV-B radiation.
payload	The material carried by a vehicle over and above what is necessary for its operation.
prehistoric resources	The physical remains of human activities that predate written records. They generally consist of artifacts or other resources that may alone or collectively yield otherwise inaccessible information about the past.
prime farmland	Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, fiber, forage, oilseed, and other agricultural crops with minimum inputs of fuel, fertilizer, pesticides, and labor, and without intolerable soil erosion, as determined by the Secretary of Agriculture, upon the recommendation of the Natural Resources Conservation Service (NRCS).
propellants	Balanced mixture of fuels and oxidizers designed to produce large volumes of hot gases at controlled, predetermined rates, once the burning reaction is initiated.
public	People or property that are not involved in supporting a licensed launch; includes those people or property that may be located within the boundary of a launch site, such as visitors, any individual providing goods or services not related to launch processing of flight, and any other launch operator and its personnel.

reentry	Returning or attempting to return, purposefully, a reentry vehicle and its payload, if any, from Earth orbit or from outer space to Earth. A reentry will not occur from a suborbital launch, and the terminology used in this document fro the return of a suborbital vehicle is "land."
region of influence	A geographic area within which the principal direct and indirect effects of actions are likely to occur.
resource management plan (RMP)	A land use plan conducted for BLM lands as described and required by the "Federal Land Policy and Management Act" (FLPMA).
reusable launch vehicle	"A launch vehicle that is designed to return to Earth substantially intact and therefore 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." (14 CFR 401.5)
RLV mission-specific license	"A mission-specific license authorizing an RLV mission authorizes a licensee to launch and reenter, or otherwise land, one model or type of RLV from a launch site approved for the mission to a reentry site or other location approved for the mission. A mission-specific license authorizing an RLV mission may authorize more than one RLV mission and identifies each flight of an RLV authorized under the license. A licensee's authorization to conduct RLV missions terminates upon completion of all activities authorized by the licensee or the expiration date stated in the reentry license, whichever comes first." (14 CFR 431.3[a])
RLV mission operator license	"An operator license for RLV missions authorizes a licensee to launch and reenter, or otherwise land, any of a designated family of RLVs within authorized parameters, including launch sites and trajectories, transporting specified classes of payloads to any reentry site or other location designated in the license. An operator license for RLV missions is valid for a two-year renewable term." (14 CFR 431.3[b])
scenic quality	Scenic quality is a measure of the visual appeal of a tract of land. In the visual resource inventory process, public lands are given a rating based on the apparent scenic quality, which is determined using seven key factors: landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications.

Section 4(f) lands	Section 4(f) lands are a special class of public lands or resources whose use by agencies in the Department of Transportation is restricted unless no feasible and prudent alternative exists. Section 4(f) lands include publicly owned parks, recreational areas, wildlife or waterfowl refuges, or cultural resources that are listed on or are eligible for listing on the National Register of Historic Places (NRHP).
sedimentary rock	Rocks formed from pre-existing rocks or pieces of once-living organisms that are deposited on the Earth's surface often in distinctive layers.
socioeconomics	The basic attributes and resources associated with the human environment, in particular population and economic activity. Socioeconomic resources consist of several primary elements including population, employment, and income. Other socioeconomic aspects that are often described may include housing, community services, and the local economy.
soil	Unconsolidated mineral or organic surface material that serves as a natural medium for the growth of plants. Soil is composed of minerals, organic matter, water, and air. Soil and sediments are typically described in terms of their composition, slope, and physical characteristics. Differences among soil types potentially affect their ability to support or sustain agriculture, filtration, and natural detoxification processes.
soil quality	Soil quality refers to organic matter content, nutrient and water-holding capacity, soil tilth (the physical condition of the soil with respect to its fitness for the growth of a specific crop), structure, and internal drainage
special designations	BLM land use classifications that result from the recognition and need for protection of the unique natural and cultural resource qualities of certain areas. The Federal Land Policy and Management Act" (FLPMA) directs the BLM to consider, evaluate and recommend lands for a variety of special designations during the land use planning process. Areas with special designations are managed with additional protections and considerations in order to maintain the values and resources that have been identified.
State Trust Lands	Lands managed by the State of New Mexico that were granted to the State by Congress "in trust" to support education. Revenues are earned from energy production, agriculture and economic development projects on trust lands.
stratosphere	The layer of the Earth's atmosphere 20 to 50 kilometers above the surface, where ozone forms.
suborbital rocket	A rocket-propelled vehicle intended for flight on a suborbital trajectory whose thrust is greater than its lift for the majority of the powered portion o fits flight.

sonic boom	Sound, resembling an explosion, produced when a shock wave formed by the noise of an aircraft or launch vehicle traveling at supersonic speed reaches the ground.
telemetry	Automatic data measurements and transmission from remote sources, such as space vehicles, to receiving stations for recording and analysis.
threatened species	Plant and wildlife species likely to become endangered in the foreseeable future.
trajectory	The path described by an object moving through space.
troposphere	The portion of the atmosphere from the Earth's surface to the tropopause, that is, the lowest 10 to 20 kilometers of the atmosphere.
unique farmland	Unique farmland is land other than prime farmland that is used for production of specific high-value food and fiber crops, as determined by the Secretary of Agriculture. It has the special combination of soil quality, location, growing season, and moisture supply needed to economically produce sustained high quality or high yields of specific crops when treated and managed according to acceptable farming methods.
viewpoint	In visual resource management, a point from which the scenic values are observed or likely to be observed.
viewshed	The area visible from a particular point of view.
visual resources	The aesthetic qualities of natural landscapes and modifications to them, the perceptions and concerns of people for landscapes and landscape change, and the physical or visual relationships that influence the visibility of proposed landscape changes.
Visual Resource Management (VRM)	A classification system used by the BLM to ensure that the scenic values of public lands are considered before allowing uses that may have negative visual impacts. This two-part system (1) inventories the scenic values of an area and assigns certain management objectives, and (2) evaluates proposed activities to determine if they conform to the area's management objectives, or if the Proposed Action needs adjustment.
VRM Class II	A visual resource management classification with the objective of retaining the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

visual sensitivity	Visual sensitivity levels are a measure of public concern for scenic quality. Public lands are assigned high, medium, or low sensitivity levels by analyzing the various indicators of public concern such as type of users, amount of use, public interest, adjacent land uses, and special land management areas.

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11. INDEX

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APPENDIX A
AGENCY, TRIBAL, AND ENTITY CORRESPONDENCE

Note: Not all correspondence between the FAA and Agencies, Tribes, and Entities is included. Correspondence between the FAA and the Applicant is also not included.

Agency/Entity	Purpose of Correspondence	Corresponding Agency	Date of Correspondence
FEDERAL AGENCY CORRESPONDENCE			
Advisory Council on Historic Preservation (ACHP)	The FAA initiates consultation per New Mexico State Historic Preservation Officer's request.	FAA	4/3/07
	ACHP's reply containing comments on Section 106 process and encouraging the FAA to consult with all consulting parties.	ACHP	5/21/07
	The FAA's request for review of on-site cultural survey report.	FAA	8/31/07
	ACHP's response that they received the cultural survey report and will informally monitor the consultation process.	ACHP	9/17/07
	The FAA's request for review of off-site cultural survey report.	FAA	5/30/08
National Aeronautics and Space Administration	Memorandum of Agreement.	FAA	8/3/07
	The FAA's request for comment on cultural survey reports and attendance at September 2007 meeting.	FAA	8/15/07
	The FAA's request for review of on-site cultural survey report.	FAA	8/31/07
	The FAA's request for review of off-site cultural survey report.	FAA	5/30/08

Agency/Entity	Purpose of Correspondence	Corresponding Agency	Date of Correspondence
U.S. Army Corps of Engineers (USACE)	The FAA’s request for determination of whether the project vicinity contains waters of the U.S.	FAA	5/1/07
	USACE’s concurrence that the project vicinity does not contain waters of the U.S.	USACE	5/23/07
U.S. Department of Agriculture – Natural Resources Conservation Service (NRCS)	The FAA’s request for review of project vicinity and whether Farmland Protection Policy Act applies.	FAA	3/24/06
	NRCS statement of no prime or important farmland in project vicinity.	NRCS	3/23/07
U.S. Department of Defense – Army, White Sands Missile Range (WSMR)	The FAA’s request for WSMR to participate as a cooperating agency.	FAA	1/11/06
	Memorandum of Agreement.	FAA	9/11/06
	WSMR’s comments on Preliminary Draft EIS.	WSMR	9/26/06
	The FAA’s request for comment on cultural survey reports and attendance at September 2007 meeting.	FAA	8/15/07
	The FAA’s request for review of on-site cultural survey report.	FAA	8/31/07
	The FAA’s request for review of off-site cultural survey report.	FAA	5/30/08

Agency/Entity	Purpose of Correspondence	Corresponding Agency	Date of Correspondence
U.S. Department of the Interior – Bureau of Land Management (BLM)	The FAA's request for BLM to participate as a cooperating agency.	FAA	1/11/06
	BLM's acceptance to participate as a cooperating agency.	BLM	2/6/06
	Memorandum of Agreement.	FAA	6/20/06
	BLM's comments on Preliminary Draft EIS.	BLM	10/11/06
	BLM's comments on Preliminary Working Draft EIS.	BLM	10/13/06
	The FAA's request for comment on cultural survey reports and attendance at September 2007 meeting.	FAA	8/15/07
	The FAA's request for review of on-site and off-site cultural survey reports.	FAA	8/31/07
	BLM's comments on off-site cultural survey report.	BLM	10/10/07
	BLM's comments on on-site cultural survey report.	BLM	10/12/07
	The FAA's request for review of off-site cultural survey report.	FAA	5/30/08
U.S. Department of the Interior - Fish and Wildlife Service (USFWS)	The FAA initiation of informal consultation in accordance with Endangered Species Act.	FAA	3/8/06
	The FAA's request for review of on-site and off-site biological survey reports.	FAA	12/5/2007
	USFWS's comments on determination of "not likely to jeopardize" for experimental population of northern Aplomado falcon.	USFWS	1/23/08

Agency/Entity	Purpose of Correspondence	Corresponding Agency	Date of Correspondence
U.S. Department of the Interior – National Park Service (NPS)	NPS's request to participate as a cooperating agency.	NPS	5/3/06
	The FAA's response to NPS's request to participate as a cooperating agency.	FAA	6/2/06
	Memorandum of Agreement.	FAA	7/17/06
	NPS's comments on Preliminary Draft EIS.	NPS	10/11/06
	The FAA's request for comment on cultural survey reports and attendance at September 2007 meeting.	FAA	8/15/07
	The FAA's request for review of on-site cultural survey report.	FAA	8/31/07
	NPS's comments on on-site cultural survey report.	NPS	10/12/07
	The FAA's request for review of off-site cultural survey report.	FAA	5/30/08
STATE AGENCY CORRESPONDENCE			
New Mexico Department of Transportation (NMDOT)	The FAA's request for comment on cultural survey reports and attendance at September 2007 meeting.	FAA	8/15/07
	The FAA's request for review of on-site cultural survey report.	FAA	8/31/07
	NMDOT's comments on on-site cultural survey report.	NMDOT	11/5/07
	The FAA's request for review of off-site cultural survey report.	FAA	5/30/08
New Mexico State Historic Preservation	The FAA initiates Section 106 consultation requesting concurrence on Area of Potential Effect (APE).	FAA	10/16/06

Agency/Entity	Purpose of Correspondence	Corresponding Agency	Date of Correspondence
Officer (SHPO)	SHPO's response including clarifying questions on APE and EIS.	SHPO	11/20/06
	The FAA's request for comment on cultural survey reports and attendance at September 2007 meeting.	FAA	8/15/07
	The FAA's request for review of on-site cultural survey report.	FAA	8/31/07
	SHPO's comments on on-site cultural survey report.	SHPO	10/31/07
	The FAA's request for review of off-site cultural survey report.	FAA	5/30/08
New Mexico State Land Office (NMSLO)	NMSLO's request to participate as a consulting party.	NMSLO	4/19/07
	The FAA's request for comments on biological survey reports.	FAA	7/16/07
	NMSLO's comments on cultural survey report.	NMSLO	8/13/07
	The FAA's request for comment on cultural survey reports and attendance at September 2007 meeting.	FAA	8/15/07
	The FAA's request for review of on-site and off-site cultural survey reports.	FAA	8/31/07
	NMSLO's comments on on-site cultural survey report.	NMSLO	10/30/07
	NMSLO's comments on off-site cultural survey report.	NMSLO	11/13/07
	The FAA's request for review of off-site cultural survey report.	FAA	5/30/08

Agency/Entity	Purpose of Correspondence	Corresponding Agency	Date of Correspondence
LOCAL GOVERNMENT CORRESPONDENCE			
Sierra County Commission	The FAA's request for comment on cultural survey reports and attendance at September 2007 meeting.	FAA	8/15/07
	The FAA's request for review of on-site cultural survey report.	FAA	8/31/07
	The FAA's request for review of off-site cultural survey report.	FAA	5/30/08
TRIBAL CORRESPONDENCE			
Apache Tribe of Oklahoma	The FAA initiates consultation under National Environmental Policy Act (NEPA) and National Historic Preservation Act (NHPA).	FAA	2/3/06
Comanche Tribe	The FAA initiates consultation under NEPA and NHPA.	FAA	2/3/06
	Comanche's request for information on project progress and archaeological reports and findings.	Comanche Tribe	3/9/06
	The FAA re-initiates consultation and provides updates on the Project.	FAA	3/22/07
	Comanche's request, again, for information on project progress and archaeological reports and findings.	Comanche Tribe	4/16/07
	The FAA's request for comment on cultural survey reports and attendance at September 2007 meeting.	FAA	8/15/07
	The FAA's request for review of on-site cultural survey report.	FAA	8/31/07

Agency/Entity	Purpose of Correspondence	Corresponding Agency	Date of Correspondence
	The FAA's request for review of off-site cultural survey report.	FAA	5/30/08
Fort Sill Apache Tribe	The FAA initiates consultation under NEPA and NHPA.	FAA	2/3/06
	The FAA re-initiates consultation and provides updates on the Project.	FAA	3/22/07
Hopi Tribe	The FAA initiates consultation under NEPA and NHPA.	FAA	2/3/06
	Hopi's request for additional consultation and copy of cultural survey reports.	Hopi Tribe	2/24/06
	The FAA re-initiates consultation and provides updates on the Project.	FAA	3/22/07
	Hopi's request, again, for copies of cultural survey reports.	Hopi Tribe	4/2/07
	The FAA's request for comment on cultural survey reports and attendance at September 2007 meeting.	FAA	8/15/07
	Hopi's third request for copies of cultural survey reports.	Hopi Tribe	8/27/07
	The FAA's request for review of on-site cultural survey report.	FAA	8/31/07
	Hopi's reply that they are unable to attend September meetings, have reviewed the surveys, look forward to seeing the determination of effect, and hope that the sites can be avoided by the project.	Hopi Tribe	9/5/07

Agency/Entity	Purpose of Correspondence	Corresponding Agency	Date of Correspondence
	The FAA's request for review of off-site cultural survey report.	FAA	5/30/08
Jicarilla Apache Nation	The FAA initiates consultation under NEPA and NHPA.	FAA	2/3/06
Kiowa Tribe of Oklahoma	The FAA initiates consultation under NEPA and NHPA.	FAA	2/3/06
	The FAA re-initiates consultation and provides updates on the Project.	FAA	3/22/07
Mescalero Apache Tribe	The FAA initiates consultation under NEPA and NHPA.	FAA	2/3/06
	The FAA re-initiates consultation and provides updates on the Project.	FAA	3/22/07
Navajo Nation	The FAA initiates consultation and provides updates on the Project.	FAA	3/22/07
Pawnee Nation of Oklahoma	The FAA initiates consultation under NEPA and NHPA.	FAA	2/3/06
Pueblo of Isleta	The FAA initiates consultation under NEPA and NHPA.	FAA	2/3/06
	The FAA re-initiates consultation and provides updates on the Project.	FAA	3/22/07
	Pueblo of Isleta's reply for no need to send additional information unless a discovery of sites/items.	Pueblo of Isleta	7/20/07
Pueblo of Zia	The FAA initiates consultation under NEPA and NHPA.	FAA	2/3/06

Agency/Entity	Purpose of Correspondence	Corresponding Agency	Date of Correspondence
San Carlos Apache Tribe	The FAA initiates consultation under NEPA and NHPA.	FAA	2/3/06
White Mountain Apache Tribe	The FAA initiates consultation under NEPA and NHPA.	FAA	2/3/06
	White Mountain Apache's reply for no need to send additional information unless a discovery of sites/items.	White Mountain Apache Tribe	2/22/06
	The FAA re-initiates consultation and provides updates on the Project.	FAA	3/22/07
	The FAA's request for comment on cultural survey reports and attendance at September 2007 meeting.	FAA	8/15/07
	The FAA's request for review of on-site cultural survey report.	FAA	8/31/07
	The FAA's request for review of off-site cultural survey report.	FAA	5/30/08
Yselta Del Sur	The FAA initiates consultation under NEPA and NHPA.	FAA	2/3/06
	The FAA re-initiates consultation and provides updates on the Project.	FAA	3/22/07
	The FAA's request for comment on cultural survey reports and attendance at September 2007 meeting.	FAA	8/15/07
	The FAA's request for review of on-site cultural survey report.	FAA	8/31/07
	The FAA's request for review of off-site cultural survey report.	FAA	5/30/08
Zuni Tribe	The FAA initiates consultation under NEPA and NHPA.	FAA	2/3/06

Agency/Entity	Purpose of Correspondence	Corresponding Agency	Date of Correspondence
OTHER ENTITY CORRESPONDENCE			
El Camino Real de Tierra Adentro Trail Association (CARTA)	The FAA's request for comment on cultural survey reports and attendance at September 2007 meeting.	FAA	8/15/07
	The FAA's request for review of on-site cultural survey report.	FAA	8/31/07
	CARTA's comments on on-site cultural survey report.	CARTA	10/17/07
	The FAA's request for review of off-site cultural survey report.	FAA	5/30/08
National Trust for Historic Preservation (NTHP)	NTHP's request to participate as a consulting party with recommendations for the EIS.	NTHP	12/11/06
	The FAA accepts NTHP's request to act as a consulting party.	FAA	3/16/07
	NTHP submits questions for the FAA concerning consultation under NEPA and NHPA.	NTHP	7/5/07
	The FAA's request for comment on cultural survey reports and attendance at September 2007 meeting.	FAA	8/15/07
	The FAA's response to questions concerning consultation under NEPA and NHPA.	FAA	8/20/07
	The FAA's request for review of on-site cultural survey report.	FAA	8/31/07
	NTHP's comments on on-site cultural survey report.	NTHP	10/31/07
	The FAA's request for review of off-site cultural survey report.	FAA	5/30/08

Agency/Entity	Purpose of Correspondence	Corresponding Agency	Date of Correspondence
New Mexico Heritage Preservation Alliance (NMHPA)	NMHPA's request to participate as a consulting party.	NMHPA	5/14/07
	The FAA's request for comment on cultural survey reports and attendance at September 2007 meeting.	FAA	8/15/07
	The FAA's request for review of on-site cultural survey report.	FAA	8/31/07
	The FAA's request for review of off-site cultural survey report.	FAA	5/30/08
Representative for Ranchers	The FAA's request for comment on cultural survey reports and attendance at September 2007 meeting.	FAA	8/15/07
	The FAA's request for review of on-site cultural survey report.	FAA	8/31/07
	The FAA's request for review of off-site cultural survey report.	FAA	5/30/08

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APPENDIX B
PUBLIC INVOLVEMENT

In order to provide adequate opportunity for public participation in the NEPA process, the FAA has and will continue to conduct public outreach during the preparation of this Draft EIS. The FAA adheres to the CEQ regulations implementing NEPA (40 CFR 1506.6) and FAA Order 1050.1E when conducting all public involvement activities. Public participation in the NEPA process not only provides for and encourages open communication between the FAA and the public, but also promotes better decision-making.

B.1 Scoping

Scoping for the development of this EIS began with the publication of the Notice of Intent (NOI) in the Federal Register (71 FR 3915) on January 24, 2006. The NOI is shown in Exhibit B-1. During scoping, the FAA invited the participation of Federal, State, and local agencies, Native American tribes, environmental groups, citizens, and other interested parties to assist in determining the scope and significant issues to be evaluated in this EIS.

Two scoping meetings were held in February 2006 to request input from the public on concerns regarding the proposed activities as well as to gather information and knowledge of issues relevant to analyzing the environmental impacts associated with the Proposed Action. The scoping meetings were held on February 15 in Truth or Consequences, New Mexico and on February 16 in Las Cruces, New Mexico. Exhibit B-2 shows the notifications for these meetings that were published in local newspapers in the Legal Notices sections. The notices published are shown in Exhibit B-3, Exhibit B-4, Exhibit B-5, Exhibit B-6, and Exhibit B-7. The fact sheet distributed at these meetings is shown in Exhibit B-8. The posters displayed at these meetings may be viewed at the FAA web site discussed in Section B.2.

Exhibit B-1. Notice of Intent (71 FR 3915) Published January 24, 2006

Federal Register / Vol. 71, No. 15 / Tuesday, January 24, 2006 / Notices **3915**

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Agency Information Collection Activity Under OMB Review, Request for Comments; Approval of a New Information Collection Activity, International Survey of Human Factors in Maintenance Organizations

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice and request for comments.

SUMMARY: Organizations that are approved to conduct aircraft maintenance are certified and regulated under CFR 14, Title 49, FAR part 145, or international equivalent (Henceforth referred to as part 145). The information collected will be used to assess what companies have done, are doing or are planning to do regarding the human factors elements of part 145. A partial list of subjects includes training, error management, fatigue management, and additional human factors metrics. Additionally, respondents will be asked to describe their organization's support of their human factors program. This will involve collecting data from companies world-wide. The FAA invites public comments about our intention to request the Office of Management and Budget's (OMB) approval of this new information collection. A notice for public comment was published in the **Federal Register** on 7/6/2005, vol. 70, #128, page 39000.

DATES: Please submit comments by February 23, 2006.

FOR FURTHER INFORMATION CONTACT: Judy Street on (202) 267–9895.

SUPPLEMENTARY INFORMATION:

Federal Aviation Administration (FAA)

Title: International Survey of Human Factors in Maintenance Organizations.

*Type of Request:*Approval of a new collection.

OMB Control Number: 2120–xxxx.

Form(s): Human Factors Survey Form.

Affected Public: A total of 1,080 respondents.

Frequency: Conducted on an as-needed basis.

Estimated Average Burden Per Response: Approximately 30 minutes.

Estimated Annual Burden Hours: An estimated 540 hours annually.

Abstract: Part 145 organizations will receive an invitation via e-mail to complete a web-based survey. The information collected will be used to assess what companies have done, are doing or are planning to do regarding the human factors elements of part 145. A partial list of subjects includes training, error management, fatigue management, and additional human factors metrics. Additionally, respondents will be asked to describe their organization's support of their human factors program. This will involve collecting data from companies world-wide.

ADDRESSES: Send comments to the Office of Information and Regulatory Affairs, Office of Management and Budget, 725 17th Street, NW., Washington, DC 20503, Attention FAA Desk Officer.

Comments are invited on: Whether the proposed collection of information is necessary for the proper performance of the functions of the Department, including whether the information will have practical utility; the accuracy of the Department's estimates of the burden of the proposed information collection; ways to enhance the quality, utility and clarity of the information to be collected; and ways to minimize the burden of the collection of information on respondents, including the use of automated collection techniques or other forms of information technology.

Issued in Washington, DC, on January 13, 2006.

Judith D. Street,

FAA Information Collection Clearance Officer, Information Systems and Technology Services Staff, ABA–20.

[FR Doc. 06–596 Filed 1–23–06; 8:45 am]

BILLING CODE 4910–13–M

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Notice of Extension of the Public Comment Period for the Draft Supplemental Environmental Assessment for the Proposed Modification to the Four Corner-Post Plan at Las Vegas McCarran International Airport

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Extension of public comment period.

SUMMARY: This notice advises the public that the comment period for the Draft Supplemental Environmental Assessment (DSEA) for the proposed modification to the Four Corner-Post Plan at Las Vegas McCarran International Airport, Las Vegas, Nevada is extended.

DATES: The comment period of the DSEA, originally ending on December 30, 2005, and then extended to January 13, 2006, is now extended to March 14, 2006.

SUPPLEMENTARY INFORMATION: On November 22,2005, the Federal Aviation Administration (FAA) issued a notice of the availability of the DSEA for the Las Vegas McCarran International Airport. The notice published on December 5, 2005, FR Vol. 70, page 72497, also announced the schedule for public workshops regarding the DSEA, and advised that the public comment period would close Friday, December 30, 2005. The public workshops were held on November 12 and 13, 2005. A Notice of Extension of the Public Comment Period, published on December 16, 2006, FR Vol. 70, page 74864, extending the public comment period to January 13, 2006. The public comment period is further extended to March 14, 2006.

All written comments are to be submitted to Ms. Sara Hassert, Landrum & Brown, Inc., 8755 W. Higgins Rd., Ste. 850, Chicago, IL 60631, fax: 773–628–2901, E-mail: *shassert@landrum-brown.com* and the comments must be postmarked and e-mail/fax must be sent by no later than midnight, Tuesday, March 14, 2006.

FOR FURTHER INFORMATION CONTACT: Ms. Kathryn Higgins, Environmental Specialist, Western Terminal Service Area Office, FAA Western Terminal Operations, 15000 Aviation Blvd., Lawndale, CA 90261, Ph. 310–725–6597, E-mail: *kathryn.higgins@faa.gov.*

Issued in Lawndale, California on January 12, 2006.

Stephen Lloyd,

Manager, Operations Support, Western Terminal Service Area.

[FR Doc. 06–590 Filed 1–23–06; 8:45 am]

BILLING CODE 4910–13–M

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Associate Administrator for Commercial Space Transportation; Notice of Intent To Prepare an Environmental Impact Statement (EIS) and Conduct Public Scoping Meetings

AGENCY: The Federal Aviation Administration (FAA), Associate Administrator for Commercial Space Transportation (AST) is the lead Federal agency. The Bureau of Land Management (BLM) is a cooperating agency. The FAA will ask the U.S. Department of the Army to participate as a cooperating agency.

ACTION: Notice of Intent.

SUMMARY: This Notice provides information to Federal, State, and local

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agencies, affected Native American tribes, and other interested persons regarding the FAA's intent to prepare an environmental impact statement (EIS) for the New Mexico Economic Development Department's (NMEDD's) proposal to develop and operate a commercial launch site near Upham, New Mexico. The FAA will prepare the EIS in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code (U.S.C.) 4321 *et seq.*), the Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations (CFR) parts 1500–1508), and FAA Order 1050.1E, Environmental Impacts: Policies and Procedures, as part of its licensing process for the proposed launch site. The BLM will participate in this NEPA process as a cooperating agency; the FAA will ask the U.S. Army White Sands Missile Range to participate as a cooperating agency.

Under the proposed action, the FAA would issue a launch site operator license to the NMEDD to operate a launch facility at the proposed site, termed the Southwest Regional Spaceport. The launch site operator license would authorize the NMEDD to operate a launch facility to support launches of horizontally and vertically launched, suborbital rockets.[1] The vehicles proposed to be launched from the Southwest Regional Spaceport may carry space flight participants,[2] scientific experiments or other payloads.[3] The issuance of a launch site operator license does not permit the NMEDD to conduct launches, only to offer the facility and infrastructure to launch operators. All individual launch operators would be subject to separate FAA licensing or permitting.

A license to operate a launch site authorizes a licensee to offer its launch site to a launch operator for each launch point for the type and weight class of launch vehicle identified in the license application and upon which the licensing determination is based. Issuance of a license to operate a launch site does not relieve a licensee of its obligation to comply with any other laws or regulations; nor does it confer any proprietary, property, or exclusive right in the use of airspace or outer space. (14 CFR 420.41) A launch site operator license remains in effect for five years from the date of issuance unless surrendered, suspended, or revoked before the expiration of the term and is renewable upon application by the licensee. (14 CFR 420.43)

SUPPLEMENTARY INFORMATION:

Background

The FAA is preparing an EIS to analyze the environmental impacts of the NMEDD's proposed operation of a launch facility near Upham, New Mexico. The proposed site is located approximately 45 miles north of Las Cruces, New Mexico. The EIS will consider the environmental impacts of the construction of facilities, ground activities (*e.g.*, component testing, transportation and storage of propellants and explosives, etc.), pre-flight vehicle and payload preparation activities, launch, and landing/recovery operations.

The successful completion of the environmental review process does not guarantee that the FAA would issue a launch site operator license to the NMEDD. The project also must meet all FAA safety, risk, and indemnification requirements. A license to operate a launch site does not guarantee that a launch license or experimental permit would be granted for any particular launch proposed for the site.

Proposed Action

The proposed action is for the FAA to issue a launch site operator license to the NMEDD that would allow the NMEDD to operate the Southwest Regional Spaceport for both horizontal and vertical suborbital launches. Nominally, the rockets would return and land within the Southwest Regional Spaceport or adjacent areas. Contingency landings may occur on lands administered by BLM.

As part of the proposed action, the NMEDD proposes to construct a vertical launch area, airfield, spectator area, landing and recovery area, and access road. The vertical launch area would include: Storage areas for explosives and propellants, three launch pads, two vehicle assembly areas, launch control building, and office areas. The airfield would include prevailing and cross wind runways, and a horizontal launch hangar. The spectator area would include parking and viewing areas. These facilities would be constructed on State property. Development of access and supporting utility infrastructure for the Southwest Regional Spaceport may occur on lands administered by the BLM. The impacts of all construction activities will be analyzed in this EIS.

In order to address the range of launch vehicles that could be launched from the proposed facility, the EIS will consider three types of horizontally launched concept vehicles and three types of vertically launched concept vehicles. The horizontal concept vehicles include:

- Concept H1 vehicles—These vehicles use jet-powered take off with subsequent rocket engine ignition and powered horizontal landing.
- Concept H2 vehicles—These vehicles use rocket-powered take off and flight and unpowered horizontal landing.
- Concept H3 vehicles—These vehicles are carried aloft via assist aircraft with subsequent rocket engine ignition and unpowered horizontal landing.

The vertical concept vehicles include:

- Concept V1 vehicles—These vehicles consist of a single-stage rocket in which the rocket stage and payload or crew/passenger modules return separately to Earth by parachute.
- Concept V2 vehicles—These vehicles consist of a single-stage rocket in which the rocket stage returns to Earth by parachute and the crew/passenger module returns with a powered or unpowered horizontal landing.
- Concept V3 vehicles—These vehicles consist of a single-stage rocket with rocket-powered vertical landing.

Alternatives

Alternatives under consideration include issuance of a launch site operator license to the NMEDD for the operation of a launch site to support

- Horizontal launch concept vehicles only,
- Vertical launch concept vehicles only, or
- A subset of the concept vehicles.

Based on comments received during the scoping period, the FAA may propose additional alternatives. The EIS will also analyze the no action alternative.

Scoping Meetings

Two public scoping meetings will be held to solicit input from the public on potential issues that may need to be evaluated in the EIS. The first scoping meeting will be held on February 15 at 6:30 p.m., at the Truth or Consequences City Council Chambers, 405 West 3rd St. in Truth or Consequences, New Mexico. The second scoping meeting

[1] A suborbital rocket is a vehicle, rocket-propelled in whole or in part, intended for flight on a suborbital trajectory, and the thrust of which is greater than its lift for the majority of the rocket-powered portion of its ascent. (49 U.S.C 70102(19)) Suborbital trajectory is the intentional flight path of a launch vehicle, reentry vehicle, or any portion thereof whose vacuum instantaneous impact point (IIP) does not leave the surface of the Earth.

[2] 'Space flight participant' means an individual who is not crew, carried within a launch vehicle or reentry vehicle.

[3] Payload is the item that an aircraft or rocket carries over and above what is necessary for the operation of the vehicle in flight.

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will be held on February 16, at 6:30 p.m., at the Physical Sciences Laboratory Auditorium, New Mexico State University in Las Cruces, New Mexico.

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 EIS. The public scoping period starts with the publication of this notice in the **Federal Register**. To ensure sufficient time to consider issues identified during the public scoping period, comments should be submitted to Ms. Stacey M. Zee by one of the methods listed below no later than March 3, 2006.

ADDRESSES: Comments, statements, or questions concerning scoping issues or the EIS process should be mailed to Ms. Stacey M. Zee, FAA Environmental Specialist, Southwest Regional Spaceport EIS c/o ICF Consulting, 9300 Lee Highway, Fairfax, VA 22031. Comments can also be sent by e-mail to *SRSEIS@icfconsulting.com* or by fax to (703) 934–3951.

Dated: January 13, 2006.

Herbert Bachner,

Manager, Space Systems Development Division.

[FR Doc. E6–757 Filed 1–23–06; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

[Summary Notice No. PE–2006–01]

Petitions for Exemption; Summary of Petitions Received

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of petitions for exemption received.

SUMMARY: Pursuant to FAA's rulemaking provisions governing the application, processing, and disposition of petitions for exemption part 11 of Title 14, Code of Federal Regulations (14 CFR), this notice contains a summary of certain petitions seeking relief from specified requirements of 14 CFR. The purpose of this notice is to improve the public's awareness of, and participation in, this aspect of FAA's regulatory activities. Neither publication of this notice nor the inclusion or omission of information in the summary is intended to affect the legal status of any petition or its final disposition.

DATES: Comments on petitions received must identify the petition docket number involved and must be received on or before February 13, 2006.

ADDRESSES: You may submit comments [identified by DOT DMS Docket Number FAA–200X–XXXXX] by any of the following methods:

- Web site: *http://dms.dot.gov.* Follow the instructions for submitting comments on the DOT electronic docket site.
- Fax: 1–202–493–2251.
- Mail: Docket Management Facility; U.S. Department of Transportation, 400 Seventh Street, SW., Nassif Building, Room PL–401, Washington, DC 20590–001.
- Hand Delivery: Room PL–401 on the plaza level of the Nassif Building, 400 Seventh Street, SW., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

Docket: For access to the docket to read background documents or comments received, go to *http://dms.dot.gov* at any time or to Room PL–401 on the plaza level of the Nassif Building, 400 Seventh Street, SW., Washington, DC, between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Tim Adams (202) 267–8033, Sandy Buchanan-Sumter (202) 267–7271, or John Linsenmeyer (202) 267–5174, Office of Rulemaking (ARM–1), Federal Aviation Administration, 800 Independence Avenue, SW., Washington, DC 20591.

This notice is published pursuant to 14 CFR 11.85 and 11.91.

Issued in Washington, DC, on January 11, 2006.

Anthony F. Fazio,

Director, Office of Rulemaking.

Petitions for Exemption

Docket No.: FAA–2005–23189.

Petitioner: Brooks Air Transport d.b.a. Brooks Fuel, Inc.

Section of 14 CFR Affected: 14 CFR 125.224.

Description of Relief Sought: To allow Brooks Air Transport d.b.a. Brooks Fuel, Inc., to operate its Douglas C54G–DC without having a collision avoidance system that meets TSO C–118 installed on that aircraft.

[FR Doc. E6–753 Filed 1–23–06; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Third Meeting: RTCA Special Committee 206: Aeronautical Information Services Data Link

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of RTCA Special Committee 206 meeting.

SUMMARY: The FAA is issuing this notice to advise the public of a meeting of RTCA Special Committee 206: Aeronautical Information Services Data Link.

DATES: The meeting will be held January 30–February 3, 2006, from 9 a.m. to 5 p.m.

ADDRESSES: The meeting will be held at CASTOR Conference Room (Plenary) EUROCONTROL Headquarters, Rue de la Fusée, 96 1130 Brussells, Belgium.

FOR FURTHER INFORMATION CONTACT: RTCA Secretariat, 1828 L Street, NW., Suite 805, Washington, DC, 20036–5133; telephone (202) 833–9339; fax (202) 833–9434; Web site *http://www.rtca.org.*

SUPPLEMENTARY INFORMATION: Pursuant to section 10(a)(2) of the Federal Advisory Committee Act (P.L. 92–463, 5 U.S.C., Appendix 2), notice is hereby given for a Special Committee 206 meeting. The agenda will include:

Monday, January 30:

- Opening Session (Chairman's Address, Welcome, Introductory and Administrative Remarks, Review Agenda, Approve minutes of the 2nd meeting,)
- Formal announcement of EUROCAE participation
- Working arrangements
- Nomination of chairman and secretary
- Status of Terms of Reference Overview and Discussions—Committee Chairmen
- Review of actions and discussion
- Presentations
- Communications Strategy
- Overview of the Cascade Program
- Future data Link applications
- Methodology and OSED development
- Breakout into Weather Data Link and AIS Data Link Subgroups

Tuesday, January 31–Thursday, February 2:

- Continue in Weather Data Link and AIS Data Link Subgroups

Friday, February 3:

- Continue in Weather Data Link and AIS Data Link Subgroups
- Chairman of Weather Subgroup Summary Presentation of Results and Meeting Outcome

Exhibit B-2. Newspapers and Dates of Publication of Notices for the Public Scoping Meetings

Newspaper	City/County	Date
Sierra County Sentinel	Truth or Consequences	February 1, 2006
		February 8, 2006
Herald	Truth or Consequences	February 1, 2006
		February 8, 2006
Las Cruces Bulletin	Las Cruces	February 3, 2006
		February 10, 2006
Las Cruces Sun-News	Las Cruces	February 4, 2006
		February 11, 2006
Albuquerque Journal	Albuquerque	February 5, 2006
		February 12, 2006

Exhibit B-3. Public Scoping Meeting Notice in the Sierra County Sentinel Newspaper

STATE OF NEW MEXICO, ss.]

County of Sierra

Myrna Kohs, being first duly sworn, on her oath says: That she is the editor of the Sierra County SENTINEL, a newspaper published in the Town of Truth or Consequences, in the County of Sierra and State of New Mexico, and that said newspaper is now, and was at all times herein mentioned, a newspaper of general circulation.

That the advertisement, a copy of which is hereto attached, was published in said herein before mentioned newspaper once each and every week for TWO(2) consecutive weeks, the first publication thereof having been made on the 1st day of FEBRUARY, A.D. 2006. and the last publication thereof having been made on the 8th day of FEBRUARY, A.D. 2006.

That said newspaper was regularly printed, published and issued with said notice therein upon the following dates, to-wit: FEBRUARY 1,8, 2006.

Myrna Kohs

Subcribed and sworn to before me this 10 of February, 2006.

Mary Jane McKay

Notary Public

My commission expires AUGUST 15, 2007

LEGAL NOTICE

Federal Aviation Administration NOTICE OF PUBLIC MEETING

The New Mexico Economic Development Department proposes to construct and operate a commercial launch facility near Upham, New Mexico. The project requires preparation of an Environmental Impact Statement (EIS). The Federal Aviation Administration (FAA) invites interested parties to submit comments to assist in identifying significant environmental issues and in determining the scope of the EIS. The FAA will hold two public scoping meetings to collect input on the proposed project: Wednesday, February 15, 2006, 6:30 p.m. at the Truth or Consequences City Council Chambers, 405 West 3rd Street, Truth or Consequences, New Mexico (contact the Sierra County Economic Development Organization at (505) 894-9061 for directions); and Thursday, February 16, 2006, 6:30 p.m. in the Physical Science Laboratory Auditorium, Stewart St. at Espina, New Mexico State University, Las Cruces, New Mexico (contact Bill Gutman at (505) 521-9573 for directions). The scoping meeting will include a presentation followed by a public statement period in which members of the public may provide up to a three-minute statement. Comments or questions also can be mailed to Ms. Stacey Zee, FAA Environmental Specialist, SRS EIS c/o ICF Consulting, 9300 Lee Highway, Fairfax, VA 22031. Comments can also be sent by e-mail to SRSEIS@icfconsulting.com or by fax to (703) 934-3951.

Pub: Feb. 1, 8, 2006

Exhibit B-4. Public Scoping Meeting Notice in the Herald Newspaper

THIS IS A PROOF CLIPPING ONLY

If you see any errors, please bring them to our attention as soon as possible. You will receive your proof of publication as soon as the publication has run its required number of times in The HERALD, the official legal publication in Sierra County.

THE HERALD
(505) 894-2143
Fax (505) 894-7824

Thank you for trusting The HERALD with your legal publication needs.

Loretta Tooley
Legal Advertising Manager
P.O. Box 752
Truth or Consequences, New Mexico 87901

Federal Aviation Administration
NOTICE OF PUBLIC MEETING

The New Mexico Economic Development Department proposes to construct and operate a commercial launch facility near Upham, New Mexico. The project requires preparation of an Environmental Impact Statement (EIS). The Federal Aviation Administration (FAA) invites interested parties to submit comments to assist in identifying significant environmental issues and in determining the scope of the EIS. The FAA will hold two public scoping meetings to collect input on the proposed project: Wednesday, February 15, 2006, 6:30 pm at the Truth or Consequences City Council Chambers, 405 West 3rd Street, Truth or Consequences, New Mexico (contact the Sierra County Economic Development Organization at (505) 894-9061 for directions); and Thursday, February 16, 2006, 6:30 pm in the Physical Science Laboratory Auditorium, Stewart St. at Espina, New Mexico State University, Las Cruces, New Mexico (contact Bill Gutman at (505) 521-9573 for directions). The scoping meeting will include a presentation followed by a public statement period in which members of the public may provide up to a three-minute statement. Comments or questions also can be mailed to Ms. Stacey Zee, FAA Environmental Specialist, SRS EIS c/o ICF Consulting, 9300 Lee Highway, Fairfax, VA 22031. Comments can also be sent by e-mail to SRSEIS@icfconsulting.com or by fax to (703) 934-3951.

Pub: February 1, 8, 2006.

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Exhibit B-5. Public Scoping Meeting Notice in the Las Cruces Bulletin Newspaper

Legal Advertising Affidavit

Stephanie L. Griffin, who, being duly sworn is the Assistant to the Publisher of the Las Cruces BULLETIN, a weekly newspaper of general distribution published in the City of Las Cruces, County of Doña Ana, State of New Mexico, disposes and states that the legal advertising for

Federal Aviation Administration
Dr. Bill Gutman
Notice of Public Meeting

In accordance with the laws of the State of New Mexico, the attached was published in its entirety 2 time(s) in the Las Cruces BULLETIN, the first publication date being 2-3-06 and subsequent publications being 2-10-06

Stephanie L. Griffin

Sworn to and subscribed before me this 10th day of February 2006 in the
CITY OF LAS CRUCES
COUNTY OF DONA ANA
STATE OF NEW MEXICO
My Commission expires: **August 11, 2007**

Jacqueline McCollum - Notary Public

$95.77
Advertising Costs

Federal Aviation Administration

NOTICE OF PUBLIC MEETING

The New Mexico Economic Development Department proposes to construct and operate a commercial launch facility near Upham, New Mexico. The project requires preparation of an Environmental Impact Statement (EIS). The Federal Aviation Administration (FAA) invites interested parties to submit comments to assist in identifying significant environmental issues and in determining the scope of the EIS. The FAA will hold two public scoping meetings to collect input on the proposed project: Wednesday, February 15, 2006, 6:30 pm at the Truth or Consequences City Council Chambers, 405 West 3rd Street, Truth or Consequences, New Mexico (contact the Sierra County Economic Development Organization at (505) 894-9061 for directions); and Thursday, February 16, 2006, 6:30 pm in the Physical Science Laboratory Auditorium, Stewart St. at Espina, New Mexico State University, Las Cruces, New Mexico (contact Bill Gutman at (505) 521-9573 for directions). The scoping meeting will include a presentation followed by a public statement period in which members of the public may provide up to a three-minute statement. Comments or questions also can be mailed to Ms. Stacey Zee, FAA Environmental Specialist, SRS EIS c/o ICF Consulting, 9300 Lee Highway, Fairfax, VA 22031. Comments can also be sent by e-mail to SRSEIS@icfconsulting.com or by fax to (703) 934-3951.

Pub# 2995
Dates 2/3, 2/10, 2006

Exhibit B-6. Public Scoping Meeting Notice in the Las Cruces Sun-News Newspaper

PROOF OF PUBLICATION

Wayne Barnard, being duly sworn, deposes and says that he is the Classified Manager of the Las Cruces Sun-News, a newspaper published daily in the county of Dona Ana, State of New Mexico; that the notice 35698 **per clipping attached was published once a week/day in regular and entire issue of said newspaper and not in any supplement thereof for** 2 **consecutive week(s)/day(s), the first publication was in the issue dated** 2-4-06 **and the last publication was** 2-11-06.

Deponent further states this newspaper is duly qualified to publish legal notice or advertisements within the meaning of Sec. Chapter 167, Laws of 1937.

Signed

[signature]

Classified Manager
Official Position

STATE OF NEW MEXICO
ss.
County of Dona Ana

Subscribed and sworn before me this

14 **day of** February 2006.

Cecilia Parmer

Notary Public in and for
Dona Ana County, New Mexico

01-10-10

My Term Expires

FEDERAL AVIATION ADMINISTRATION NOTICE OF PUBLIC MEETING

The New Mexico Economic Development Department proposes to construct and operate a commercial launch facility near Upham, New Mexico. The project requires preparation of an Environmental Impact Statement (EIS). The Federal Aviation Administration (FAA) invites interested parties to submit comments to assist in identifying significant environmental issues and in determining the scope of the EIS. The FAA will hold two public scoping meetings to collect input on the proposed project: Wednesday, February 15, 2006, 6:30 pm at the Truth or Consequences City Council Chambers, 405 West 3rd Street, Truth or Consequences, New Mexico (contact the Sierra County Economic Development Organization at (505) 894-9061 for directions); and Thursday, February 16, 2006, 6:30 pm in the Physical Science Laboratory Auditorium, Stewart St. at Espina, New Mexico State University, Las Cruces, New Mexico (contact Bill Gutman at (505) 521-9573 for directions). The scoping meeting will include a presentation followed by a public statement period in which members of the public may provide up to a three-minute statement. Comments or questions also can be mailed to Ms. Stacey Zee, FAA Environmental Specialist, SRS EIS c/o ICF Consulting, 9300 Lee Highway, Fairfax, VA 22031. Comments can also be sent by e-mail to SRSEIS@icfconsulting.com or by fax to (703) 934-3951.

Pub. No. 35698
Publish: Feb 4, 11, 2006

Exhibit B-7. Public Scoping Meeting Notice in the Albuquerque Journal Newspaper

NM STATE

FEDERAL AVIATION ADMINISTRATION NOTICE OF PUBLIC MEETING

The New Mexico Economic Development Department proposes to construct and operate a commercial launch facility near Upham, New Mexico. The project requires preparation of an Environmental Impact Statement (EIS). The Federal Aviation Administration (FAA) invites interested parties to submit comments to assist in identifying significant environmental issues and in determining the scope of the EIS. The FAA will hold two public scoping meetings to collect input on the proposed project: Wednesday, February 15, 2006, 6:30 pm at the Truth or Consequences City Council Chambers, 405 West 3rd Street, Truth or Consequences, New Mexico (contact the Sierra County Economic Development Organization at (505) 894-9061 for directions); and Thursday, February 16, 2006, 6:30 pm in the Physical Science Laboratory Auditorium, Stewart St. at Espina, New Mexico State University, Las Cruces, New Mexico (contact Bill Gutman at (505) 521-9573 for directions). The scoping meeting will include a presentation followed by a public statement period in which members of the public may provide up to a three-minute statement. Comments or questions also can be mailed to Ms. Stacey Zee, FAA Environmental Specialist, SRS EIS c/o ICF Consulting, 9300 Lee Highway, Fairfax, VA 22031. Comments can also be sent by e-mail to SRSEIS@icfconsulting.com or by fax to (703) 934-3951.
Journal: February 5, 12, 2006

STATE OF NEW MEXICO
County of Bernalillo SS

Bill Tafoya, being duly sworn, declares and says that he is Classified Advertising Manager of **The Albuquerque Journal**, and that this newspaper is duly qualified to publish legal notices or advertisements within the meaning of Section 3, Chapter 167, Session Laws of 1937, and that payment therefore has been made of assessed as court cost; that the notice, copy of which is hereto attached, was published in said paper in the regular daily edition, for 2 times, the first publication being on the 5 day of Feb, 2006 and the subsequent consecutive publications on Feb. 12, 2006

Sworn and subscribed to before me, a Notary Public, in and for the County of Bernalillo and State of New Mexico this 13 day of Feb, of 2006

PRICE $77.93

Statement to come at end of month.

ACCOUNT NUMBER C 82358

CLA-22-A (R-1/93)

OFFICIAL SEAL
Elyn Sloane
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: 4-5-06

Exhibit B-8. Fact Sheet Distributed at the Public Scoping Meetings in February 2006

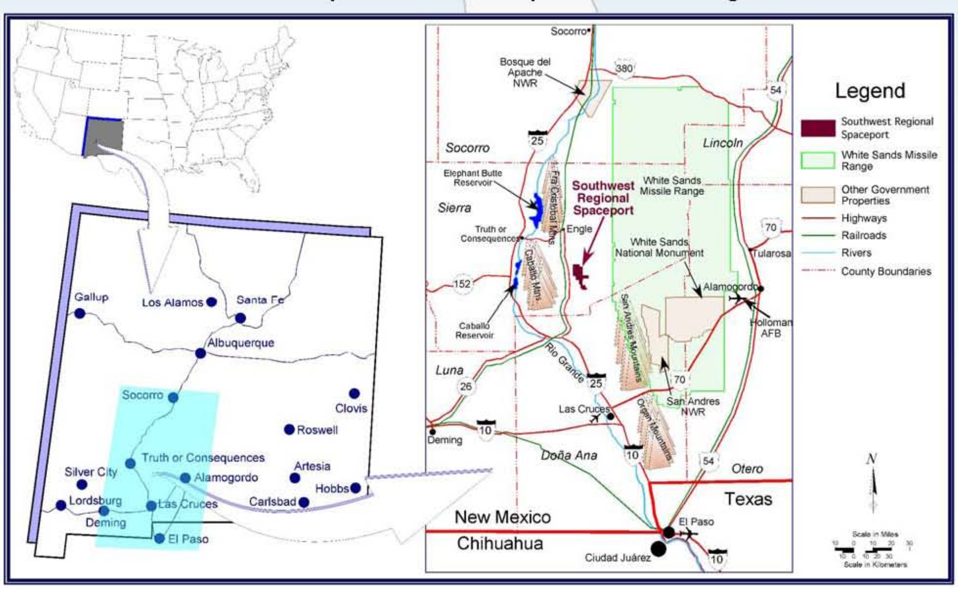
Southwest Regional Spaceport Fact Sheet

The State of New Mexico proposes to develop and operate a commercial space launch site, the Southwest Regional Spaceport (SRS), at a site located approximately 45 miles north of Las Cruces and 30 miles southeast of Truth or Consequences *(see map below)*. The State proposes to operate this site for horizontal and vertical launches of suborbital reusable launch vehicles that would launch from the SRS and return to the SRS or adjacent lands. Some expendable launch vehicles could be launched from the SRS safely if their components would not fall outside the SRS or adjacent lands, including White Sands Missile Range. To operate a commercial launch facility, the State must obtain a license from the Federal Aviation Administration (FAA) Office of Commercial Space Transportation (AST).

Issuing a license is considered a major Federal action and is subject to environmental review as required by the National Environmental Policy Act of 1969 (NEPA). For this proposed action, the FAA will prepare an Environmental Impact Statement (EIS) to meet the requirements of NEPA. The proposed Federal action for this EIS is for the FAA to issue a launch site operator license to the New Mexico Economic Development Department (NMEDD) or its designated state agency. If approved, the FAA license will remain in effect for five years from the date of issuance unless surrendered, suspended, or revoked before the expiration of the term and is renewable upon application by the licensee.

A vertically launched Concept V3 vehicle will be analyzed in the EIS. Concept V3 vehicles consist of a single stage rocket with rocket powered vertical landing. The EIS will analyze a total of six vehicles, three horizontally launched concept vehicles and three vertically launched concept vehicles.

Location of the Proposed SRS with Respect to Surrounding Areas



How to Submit Comments

For More Information

If you are interested in the topics discussed at tonight's meeting, we encourage you to visit the FAA's website available at http://ast.faa.gov.

You can request a copy of the Executive Summary or Draft EIS (when available) at the registration table tonight or by one of the methods described below. Please keep in mind that the Draft EIS is likely to be a large document and may include multiple volumes.

The Draft EIS will be available on the FAA's website and paper copies of the Draft EIS will be available in local libraries.

Proposed SRS airfield area, looking southeast

A Concept H2 vehicle is one of three horizontally launched vehicles that will be analyzed in the EIS. Concept H2 vehicles use rocket powered take off and flight and unpowered horizontal landing.

To Submit Comments

If you have written comments on the information provided tonight, please turn in your prepared comments or fill out one of the written comment sheets provided, and turn it in at the registration table before you leave tonight.

Written comments can be mailed by March 3, 2006 to the FAA at:

Stacey M. Zee
FAA Environmental Specialist
Southwest Regional Spaceport EIS
c/o ICF Consulting
9300 Lee Highway
Fairfax, VA 22031

Written comments can be faxed by March 3, 2006 to the FAA at (703) 934-3951.

E-mail comments by March 3, 2006 at SRSEIS@icfconsulting.com.

B.2 Summary of Scoping Comments Received

The FAA required that all scoping comments be received no later than March 3, 2006. This deadline was extended to March 10, 2006. There were 40 comments received. These were compiled by the FAA into a Scoping Comments Matrix, shown in Exhibit B-9. The most common concerns expressed were impacts of the proposed Spaceport America (then referred to as Southwest Regional Spaceport or SRS) on the El Camino Real National Historic Trail and further restriction of the airspace used by general aviation. These and all other concerns are considered and addressed in the EIS.

Exhibit B-9. Spaceport America EIS Scoping Comments Matrix

Comment Number	Last Name	First Name	Title	Company/ Organization	Date Authored	Comment Summary
P001	Twombly	Ian	Government Analyst, Air Traffic Services	Aircraft Owners and Pilots Association	1/24/06	Airspace: Will the site be contained within the restricted areas of WSMR?
P002	Graham	Janis	Launch Approval Engineer	NASA, Jet Propulsion Laboratory	1/26/06	Add to Distribution List
P003	Swanberg	Charles			2/3/06	Airspace: Too much restricted airspace in the State already; killing the general aviation industry
P004	Courtright	John			2/3/06	Airspace: Consider the impact of additional restricted airspace on general aviation
P005	Dyer	Jim			2/3/06	Airspace: The restricted airspace associated with WSMR should be enough for the spaceport
P006	Cummins	Joseph			2/3/06	Biological Resources: Questions the impact to desert bighorn sheep, other wildlife, and critical habitat. Socioeconomics: Concerns about tax dollars spent and jobs created.
P007	Preissler	Ken			2/3/06	General support
P008	Kislak	Phil			2/6/06	Airspace: Too much restricted airspace in the State already
P009	Weston	Denise		Taschek Environmental Consulting	2/9/06	Questions purpose of scoping meetings

Exhibit B-9. Spaceport America EIS Scoping Comments Matrix (continued)

Comment Number	Last Name	First Name	Title	Company/ Organization	Date Authored	Comment Summary
P010	Berg	Jeff			2/12/06	Biological and Water Resources: Concerns about impacts to desert habitat and ground water
P011	Billstone	Leon		EAA, Chapter 555	2/20/06	Add to Distribution List
P012	Doyle	Kevin			2/22/06	Add to Distribution List
P013	Wilson	John			2/22/06	Cultural Resources: Impacts to El Camino Real and need for archaeological surveys. NEPA: Public meeting not advertised well enough
P014	Loomis	Melissa			2/24/06	General support and invitation to consult
P015	McCutcheon	Barr			2/24/06	General support
P016	Loomis	William			2/28/06	General support
P017	Bloom	John				Cultural Resources: Impacts to El Camino Real.
P018	Everett	Barbara			3/1/06	Proposed Action: Expand the land area under analysis. NEPA: Advertise meetings on the NMEDD web site. Water: Address water rights impacts.
P019	Hanson	Jeffrey			3/1/06	Add to Distribution List. Wants paper copies of all public information materials.

Exhibit B-9. Spaceport America EIS Scoping Comments Matrix (continued)

Comment Number	Last Name	First Name	Title	Company/ Organization	Date Authored	Comment Summary
P020	Kestner	Richard		Starchaser Industries, Inc.	3/1/06	Proposed Action: Avoid bias toward other vehicle concepts. Questions the suitability of NMEDD to operate a spaceport. More detail on WSMR's role in the spaceport and if WSMR fees will be charged.
P021	Kestner	Richard		Starchaser Industries, Inc.	3/1/06	Proposed Action: Wants Concept V-1 vehicles to be given highest priority in licensing.
P022	anonymous				3/1/06	NEPA: Use the Desert Exposure for public notices
P023	Waters	Judy			3/1/06	Air and Noise: Concerns about impacts from "sulphuric acid fuel the Shuttle will be using", especially to the Elephant Butte Dam
P024	Goetz	Charles D.		Cutter Cattle Company, Inc.	3/2/06	Health and Safety: Concerns about evacuation of the WSMR Call-Up Area during launches and other safety impacts to local population. Noise: Impacts to livestock and human annoyance.
P025	Fulton	Jean		Camino Real de Tierra Adentro Trail Association	3/2/06	Cultural Resources: Impacts to El Camino Real and archaeological sites.
P026	Williams	Heidi		Aircraft Owners and Pilots Association	3/2/06	Airspace: Consider the impact of additional restricted airspace on general aviation. Cumulative impacts of additional airspace restrictions.

Exhibit B-9. Spaceport America EIS Scoping Comments Matrix (continued)

Comment Number	Last Name	First Name	Title	Company/ Organization	Date Authored	Comment Summary
P027	Haynsworth	Spencer		Camino Real de Tierra Adentro Trail Association	3/3/06	Cultural Resources: Impacts to El Camino Real and archaeological sites.
P028	Sanders	Tim	Assistant District Manager	Bureau of Land Management, Las Cruces District Office	3/3/06	Cultural Resources: Impacts to El Camino Real and archaeological sites. Land Use: Impacts to grazing allotments, including water rights. Biological Resources: Impacts to wildlife and habitat quality. Visual: BLM will strictly enforce a VRM II classification.
P029	Fuller	Eric			3/3/06	Socioeconomics: Concerns about viability of spaceport and number of jobs it will create. NEPA: Requests better public notification. Health and Safety: Concerns about debris and chemical hazards.
P030	Rundell	Linda	State Director	Bureau of Land Management, New Mexico State Office	3/3/06	Cultural Resources: Impacts to El Camino Real. Visual: BLM will strictly enforce a VRM II classification.
	Krakow	Jere	Superintendent	National Park Service, National Trails Office, IMR - Santa Fe		
P031	Waters	Judy			2/24/06	Concerns about damage to the Elephant Butte Dam. Air: Impacts from propellants.
P032	Wilson	Margot		Sierra Club	3/3/06	Mitigation: EIS should include mitigation plans for impacts to water, soils, wildlife and plants, and air.

Exhibit B-9. Spaceport America EIS Scoping Comments Matrix (continued)

Comment Number	Last Name	First Name	Title	Company/ Organization	Date Authored	Comment Summary
P033	Rivera	Leonardo			2/15/06	Socioeconomics: The economic impact of the spaceport and associated road improvements
P034	Worthington	Bob	President	New Mexico Pilots Association	2/15/06	Airspace: Consider impacts of any additional restricted airspace.
P035	Simcoe	Terry	Chief Aviation Planner	New Mexico Aviation Division	2/16/06	Airspace: Consider impacts of any additional restricted airspace, Notices to Airmen, and Safety in areas west of WSMR restricted area.
P036	Woods	Ben			2/1606	General support
P037	Wittern	Klaus			2/1606	Land use: Potential impacts from long-term infrastructure and expansion into surrounding areas. Cultural Resources: Impacts to El Camino Real.
P038	Kestner	Richard		Starchaser Industries, Inc.	2/1606	General support
P039	Beckett	Patrick	President	Camino Real de Tierra Adentro Trail Association	2/16/06	Cultural Resources: Impacts to El Camino Real.
P040	Berg	Sarah			2/16/06	Biological Resources: Impacts to Bosque del Apache National Wildlife Refuge and the migratory flyway.
P041	Fuller	Eric			3/12/06	Resent March 3rd comment and asked for acknowledgement of receipt.

B.3 Scoping Comments Received from the BLM and NPS

Scoping comments numbers P028 (from Tim Sanders, BLM, Las Cruces District Office) and P030 (Linda Rundell, BLM State Director; and Jere Krakow, NPS, National Trails Office, InterMountain Region - Santa Fe) are reproduced here because they are the detailed comments from two of the cooperating agencies in this EIS.

B.3.1 Comment from the BLM, Las Cruces District Office

This letter begins on the next page.

United States Department of the Interior
BUREAU OF LAND MANAGEMENT
Las Cruces District Office
1800 Marquess
Las Cruces, New Mexico 88005
www.nm.blm.gov

IN REPLY REFER TO:
2800 (03000)

Ms. Stacey M. Zee
FAA Environmental Specialist
Southwest Regional Spaceport EIS
c/o ICF Consulting
9300 Lee Highway
Fairfax, VA 22031

Dear Ms. Zee:

We appreciate the opportunity to provide our Scoping comments for the Southwest Regional Spaceport Environmental Impact Statement (EIS). As you are aware, the Las Cruces District Office (LCDO) of the Bureau of Land Management (BLM) has management responsibilities on public land surrounding the proposed Southwest Regional Spaceport (SRS).

We would like to reiterate that our comments and involvement are based on the requirement of not closing access of BLM land in support of the SRS. If the SRS proposal changes and BLM land is proposed for closure our comments and involvement as a cooperating agency for the SRS EIS would change dramatically.

With regard to the EIS, we did attend two of your public scoping meetings (Las Cruces and Truth or Consequences) and have reviewed the information provided at the meeting as well as the information provided in the Notice of Intent. We have the following questions and comments for your consideration as you develop the EIS. If further information is received, these comments may or may not apply.

1. The proposed spaceport facilities are located in the vicinity of El Camino Real de Tierra National Historic Trail. The facilities plan currently calls for improving the gravel county road that follows very closely the path of the El Camino Real de Tierra National Historic Trail, and for building facilities both to the east and west of the historic trail which is accessed most easily from that county road. Some of the proposed facilities appear to lie directly on top of the trail route and significant trail resources; others lie within the trail corridor that BLM has proposed to protect through the application of strict Visual Resource Management (VRM) II classification criteria.

2. BLM is promoting the gravel road as a back country experience for trail visitors, as we are asked to do under the National Trails System Act, the governing legislation for National historic trails. National historic trails are made up of three elements: the route, the history that the historic trail designation commemorates, and the significant sites along the route. While not strictly intended for use as continuous long-distance modern travel routes, in the sense of the "through-hiking" National scenic trails such as the Appalachian Trail or the Continental Divide trail, they are intended to afford the public opportunities to get out to see "where history happened," and where possible, to afford outdoor recreation opportunities.

3. Any access routes from the current county road running east to the proposed spaceport facilities will of necessity cut across the Camino Real historic trail. In this section of the route, the trail is preserved as the vestiges of the 300-year old wagon road that brought the earliest European immigrants to northern New Mexico, and indeed, to what would become the United States west of the eastern seaboard. The trail may be considered to be the single largest artifact of the colonial period in New Mexico, and one of the most valuable, if not the most valuable single marker of the Hispanic experience in the southwest.

4. The Camino Real historic resources in the vicinity of the spaceport facilities are the best-preserved sections of the historic road still extant along the 1,200 miles that make up the international route. There is no other place along the National historic trail where visitors will be able to experience the unchanged, historic landscape of the most perilous section of the trail, the infamous Jornada del Muerto. The current view sheds, the still-visible wagon road, and the density of historic sites--springs where the first colonists were able to assuage their overpowering thirst, trail landmarks that assured them that they were making progress towards their goals, campsites, and surface artifacts dating back hundreds of years--all these make this section of the trail particularly sensitive and invaluable for the National trails system.

5. We have worked with the local land-managing agencies, that is, with the BLM and the State of New Mexico, in the development of a comprehensive management plan for the trail that identifies this section and its associated sites as "high potential" trail sites and route segments. BLM has changed its VRM classification in this stretch of the trail to provide increased protections to the visual resources in the trail viewshed, and the BLM has committed to protecting a 5-mile wide corridor on either side of the historic route from visual intrusions.

6. The alternatives mentioned in the Federal Register Notice of Intent to prepare an EIS and conduct public scoping meetings suggest that the alternatives under consideration include issuing a launch site operator permit for horizontal launch concept vehicles only, or vertical only, or a subset of concept vehicles. The proposed horizontal launch facilities are currently sited directly atop the National historic trail and the trail resource of Paraje del Aleman. The proposed vertical launch components require an access route to be constructed across the National historic trail, in the vicinity of the historically significant

sites in the Yost Draw section of the trail. Any improvements of the country road will impact the back country experience, and given the proximity of the county road and the historic trail traces, may have a direct impact on historic road segments as well. In addition, any cross-country travel by members of the public seeking a closer vantage point for launch viewing, etc., will bring people directly across the historic route, trail segments, and historic sites associated with trail use.

7. Finally, we should encourage the FAA to consider alternative siting for the launch facilities and other proposed developments that will help BLM meet its commitments to preserving and protecting the National historic trail it administers and the historic sites it manages on public land in the vicinity of the proposed launch facilities. We can provide the FAA with maps of the trail, the VRM classification of the land in the vicinity of the development, scholarly reports on the trail resources, archaeological resource information on the trail resources, and the comprehensive management plan adopted by the Department of the Interior for the National historic trail.

8. Please address the issue of livestock grazing for each of the alternatives. We have concerns regarding BLM's management of the livestock program. If the designated State land outlined in the proposal are to be used for the Southwest Regional Spaceport (SRS), and are therefore removed from agricultural use, the State land grazing leases for the grazing permits for six associated BLM grazing allotments will be impacted. The potentially impacted allotments are illustrated in Table 1 with projected permitted use following adjustment.

Table 1. Summary of Allotments

Allotment Name/No.	**Operator Name**	**Current Total Permitted Use**	**Projected Permitted Use**
Bar Cross Ranch No. 06020	Ben and Jane Cain	740 Animal Units	470 Animal Units
Lewis Cain Ranch No. 16022	Phil and Judy Wallin	719 Animal Units	623 Animal Units
McClenan Ranch No. 16056	Robert Brown	294 Animal Units	287 Animal Units
Flat Lake Allotment No. 16053	Ranch Improvement Company	643 Animal Units	642 Animal Units
W Spear Bar No. 16019	Ronald C. Woolf	170 Animal Units	169 Animal Units
Buckhorn Allotment No. 16017	Doug Davis	504 Animal Units	0 Animal Units

The BLM determines the carrying capacity of these allotments by deriving forage acres from Federal, State, and deeded surface acres. It is assumed the identified State land would be removed from agricultural use, therefore, the allotments named above would decrease in acres, and subsequently, total permitted use. It is also assumed deeded land located within or adjacent to, the identified State land, would also be included in the proposal, therefore, the livestock numbers associated with these parcels of land would also be removed from agricultural use.

Reductions in grazing permits would cause the owner/rancher/permittee to incur a financial loss due to the reduction of operations; however, a more significant loss would be to the market value of the ranch, or allotment. The market value of a ranch is directly related to the number of livestock an allotment can graze, also known as the permitted use. For example, by removing the State land and associated deeded land from agricultural use on the Bar Cross Ranch, the grazing permit would decrease by approximately 36 percent. See Table 2 below for a summary of potential acreages and animals units that would be withdrawn from agricultural use.

Table 2. Summary of Allotments

BLM Grazing Allotment	State Land Acres	State Lease AUMs	State Lease CYLs	Deeded Acres	Deeded AUMs*	Deeded CYLs*	TOTAL AUMs	TOTAL CYLs
Bar Cross Ranch	10,022	3,195	266	120	42	4	3,235	270
Lewis Cain Ranch	5,570	1,143	95	180	6	1	1,149	96
McClenan Ranch	640	84	7	0	0	0	84	7
Flat Lake Allotment	0	0	0	100	9	1	9	1
W Spear Bar	550	17	1	0	0	0	17	1
Buckhorn Allotment	60	4	0	0	0	0	4	0
Definitions								
*AUM : Animal Unit Month or the amount of forage needed to sustain 1 mature cow, 1 cow/calf pair, 1 bull, 1 horse, 5 sheep, 5 goats, or 1 buffalo for 1 month.								
*CYL: Cattle Yearlong								

As Table 2 illustrates, the Bar Cross Ranch would lose approximately 3,195 animal unit months (AUMs) due the removal of State land for agricultural use; in addition, a decrease of approximately 42 AUMs would result due to loss of included deeded land within the designated State land. This decrease is equivalent to 266 Cattle Yearlong (CYL) from State land and 4 CYL from deeded land, or approximately a 36 percent decrease in the total permitted grazing on this allotment. The Lewis Cain Ranch No. 16022 would be reduced by 13 percent total permitted use.

9. Base waters and other range improvements associated with the land identified for use by the Spaceport would impact the allotments' grazing permits and overall livestock operations.

BLM grazing permits are derived from water-based grazing rights, therefore, the number of cattle an allotment can graze is not only tied to surface acres, but also to the water sources offered for base water when a permittee applies to graze an allotment. In other words, the permittee must show control of the base water associated with the allotment to receive full grazing preference. By showing control of base water(s), the owner/ranch becomes the grazing permit holder, referred to as the permittee. The Bar Cross Ranch No. 06020 has two base waters located on land identified for use by the Spaceport, and the Lewis Cain Ranch No. 16022 has three base waters. See Table 3 below for a summary of these base waters and the number of cattle yearlong associated with those water sources:

Table 3. Allotment Base Waters Potentially to be Withdrawn from Agricultural Use

Allotment	Legal Location	Base Water	Tenure	Range CYL
Bar Cross Ranch	T.15 S., R. 2 W., Section 24	Headquarters	Patented	4
Bar Cross Ranch	T. 15 S., R. 2 W., Section 28	Pipeline Tank	Patented	1
Lewis Cain Ranch	T. 16 S., R. 2 W., Section 16	Miller Tank	State	0
Lewis Cain Ranch	T. 16 S., R. 2 W., Section 25	Upham Well	Patented	60
Lewis Cain Ranch	T. 16 S., R. 1 W., Section 9	Fifty Nine Well	Patented	70

A total of 5 CYL would be subtracted from the Bar Cross Ranch grazing permit and a total of 130 CYL would be subtracted from the Lewis Cain Ranch grazing permit attributable the change in use of the State and deeded lands that would be utilized for the Spaceport.

In addition, numerous allotment boundary fences, interior pasture fences, pipelines, drinking troughs, earthen reservoirs, cattleguards, etc., and subsequent uses of these range improvements would be affected by this proposal.

10. Any other State and/or deeded land not identified in this proposal that later would be considered for use by the Spaceport would further affect BLM allotments and grazing permits.

11. BLM assumes that regardless of changes in use of State land for the construction and operation of the Southwest Regional Spaceport, multiple use of Federal land, and therefore, livestock grazing, will remain a viable use of Federal land.

12. Further restrictions may be imposed to livestock grazing due to operations of the Spaceport; however, without further information, it is difficult to speculate as to what those restrictions may include at this time.

13. All information in the previous five (#8-#12) comments apply to this proposal only; if the proposal changes in the future, it is expected to impact BLM grazing allotments and livestock grazing differently.

14. The Federal Register Notice makes reference to "contingency landings" that may occur on BLM land. It is not clear on what this means or what it might entail. It definitely needs to be elaborated on in the EIS.

15. This proposed action (with a larger footprint involving both State and BLM lands) had proceeded to a draft EIS and draft biological assessment stage approximately 10 years ago. There may be information in those earlier documents that could be useful in this EIS.

16. The proposed horizontal runways cross an existing 345Kv powerline. Powerline issues will require burying a portion or re-routing a portion to avoid the spaceport. Re-routing may involve public lands, depending on the desired re-route location.

17. It is unclear from the Federal Register Notice whether or not all or only portions of the spaceport facility will be fenced. The type of fence, area to be fenced, etc., will have to be analyzed in the EIS. For example, if the area is large enough to enclose water sources, this would have an impact to wildlife. If the larger State land parcel is to be fenced (rather than a smaller footprint within the larger State parcel), this may also have impacts to wildlife. For example, if the larger area is fenced and livestock grazing is excluded, wildlife habitat within the larger fenced area of State land may benefit. Again, access to water resources may be of concern. With a more clear picture of how the facility will be fenced and operate, the analysis can determine the need to mitigate such things as habitat fragmentation and potential loss of access to water sources.

18. There is an existing wildlife water development located very close to the southwest corner of the proposed vertical launch area. This project was developed with Habitat Stamp Program funds to benefit antelope and other wildlife in the area. The project is known as the Prisor Hill Catchment. This project will have to be relocated away from the proposed facility. At the same time, mitigation for loss of waters due to fencing of the spaceport facility (either by inclusion within a fenced area or impeded access due to project fencing) by developing additional waters might need to be considered.

19. Many other Habitat Stamp Projects have been developed on BLM land in the general project area to enhance habitat for pronghorn and other grassland species (i.e., water developments and brush control projects). The proposed spaceport is located on State land that occurs within higher quality grassland habitats within the Jornada Draw management area. The project could displace pronghorn onto adjacent lesser quality habitats. This needs to be considered in the EIS. Some consideration might be needed for potential off-site mitigation to enhance the quality of adjacent habitats.

20. It is proposed that in the future, daily launches were expected. Displacement of wildlife as a result of the noise and activity associated with launch and landing activities will have to be addressed in the EIS as well.

21. The proposed project is located within historic aplomado falcon habitat (federally listed endangered). The predictive model developed by the New Mexico Cooperative Fish and Wildlife Research Unit (Characterizing and Predicting Suitable Aplomado Falcon Habitat for Conservation Planning in the Northern Chihuahuan Desert) can be used to identify potential falcon habitat within the project area. In addition, historical nest site information can be related to habitat affected by the proposed action. The U.S. Fish and Wildlife Service (USFWS) service has been contacted regarding consultation requirements. One discussion point was the potential for displacement due to noise levels associated with the proposed spaceport facility. The EIS will have to determine the level of noise and distance from the facility that wildlife may be potentially affected.

If the aplomado falcon is listed as a non-essential experimental population under section 10j of the ESA (ruling expected sometime in May 2006), consultation may or may not be necessary (rules for consultation change to conferencing). A draft biological assessment had been prepared about 10 years ago when the first spaceport was proposed in this area.

22. The LCDO has a list of the other special status species that are known to occur within Sierra County. The BLM understands that the consultants have already conducted biological surveys in the project area. The consultant will have to compare their findings of species and habitat types against the LCDO list to determine which species may potentially occur within the project area.

23. One issue that should be addressed in the EIS is the potential for public and/or administrative access to be affected by the proposed facility.

24. The BLM understands that the State grazing lease is being purchased from the current lessee. This will undoubtedly have an impact on the BLM permit/lease. Any changes in grazing management such as new fences, new waters, change in season of use, etc., as a result of the State land being removed from the existing livestock operation will impact wildlife resources.

25. The lands described below are within Visual Resource Management (VRM) Class IV and VRM Class III:

T. 15 S., R. 1 W., T.15 S., R. 2 W.;
T. 16 S., R. 1 W., T. 16 S., R. 2 W.

Class III: The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

Class IV: The objective of this class is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities can dominate the landscape and be the major focus of viewer attention; however, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

The BLM has proposed to protect the El Camino Real de Tierra National Historic Trail through the application of strict VRM II classification criteria. VRM Class II is described as: Retain the existing character of the landscape. The level of change to the character of the landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

26. The proposed project will include the need for additional roads and utilities across public land. SRS will have to apply for the use authorization (right-of-way) through the BLM, Las Cruces District Office. The proposed actions will have to be compatible with existing authorizations.

We thank you for the opportunity to provide these comments during the scoping period for the EIS, and look forward to assisting you in this effort as a Cooperating Agency. If we can clarify any of these comments or provide further information, please contact Lori Allen via telephone at (505) 525-4454 or via email: Lori_Allen@nm.blm.gov

Sincerely,

Tim L. Sanders
Assistant District Manager
Division of Multi-Resources

03000:LAllen:cp:3/3/06:x4375:SRSScopingCommLtr

B.3.2 Comment from the BLM, New Mexico State Office and NPS, National Trails Office

This letter begins on the next page.

BLM-STATE DIRECTOR ID:505-438-7452 MAR 06'06 9:53 No.001 P.02

United States Department of the Interior

El Camino Real de Tierra Adentro National Historic Trail

BUREAU OF LAND MANAGEMENT
Division of Resources
P.O. Box 27115
Santa Fe, New Mexico 87502-0115
(505) 438-7454

NATIONAL PARK SERVICE
National Trails Office, IMR - Santa Fe
P.O. Box 728
Santa Fe, New Mexico 87504-0728
(505) 988-6742

March 3, 2006

Ms. Stacey Zee
Federal Aviation Administration Environmental Specialist
Southwest Regional Spaceport EIS
c/o ICF Consulting
9300 Lee Highway
Fairfax, VA 22031

Dear Ms. Zee:

We appreciate the opportunity afforded us by the Federal Aviation Administration to provide input into the planning process for the proposed Southwest Regional Spaceport near Upham, New Mexico. The National Park Service (NPS) and the Bureau of Land Management (BLM) share administrative responsibilities for the congressionally-designated El Camino Real de Tierra Adentro National Historic Trail. We would like to bring the following information to your attention for your consideration as you prepare the Environmental Impact Statement (EIS) and develop mitigation measures for the impacts to resources that will arise from implementing the proposal in its current configuration.

The proposed spaceport, as described in the briefings led by you and by Mr. Richard Smith, includes facilities that will lie very near, and possibly directly atop the route and historic traces of El Camino Real de Tierra Adentro National Historic Trail. There are three significant areas of potential impact from the current facilities siting plan and the proposed improvements to local infrastructure.

First, the facilities plan currently calls for improving the gravel county road that follows very closely the path of the historic Camino. The BLM and NPS, as trail administrators, have been promoting the gravel road as a back country experience for trail visitors. This use of the gravel road fits the goals of the National Trails System Act, the governing legislation for national historic trails. National historic trails are made up of three elements: the route, the history that the historic trail designation commemorates, and the significant sites along the route. While not strictly intended for use as continuous long-

National Park Service
Bureau of Land Management
U.S. Department of the Interior

BLM-STATE DIRECTOR ID:505-438-7452 MAR 06'06 9:54 No.001 P.03

distance modern travel routes, in the sense of the "through-hiking" national scenic trails such as the Appalachian Trail or the Continental Divide trail, designated national historic trails are intended to offer the public opportunities to get out to see "where history happened," and, where possible, to offer outdoor recreation opportunities that help visitors connect with historic trail use. The National Trails System Act suggests trail travel should fit, as closely as possible, the modes of travel used in the period of trail significance. In this case, the rough gravel road surface helps the visitor capture some of the feeling of the trail travel experienced by the colonists in 1598 who traversed the trail on foot, in wagons, and on horses, mules, or burros. Improvements to the county road that create a paved surface will impact the back country experience, and, given the proximity of the county road and the historic trail traces, may have a direct impact on historic road segments as well.

If, as expected, the spaceport operations draw visitors to the area, we anticipate that they may use the county road as a remote viewing site for launches and landings. Cross-country travel by members of the public seeking a closer vantage point for launch viewing, etc., will bring people directly across the historic route, trail segments, and historic sites associated with trail use.

The second area of impact concerns the extant physical traces of the centuries-old wagon road. The current plan calls for building facilities both to the east and west of the historic trail, and accessing those facilities from the aforementioned gravel road, which lies to the west of the historic trail in this area. Any access routes from the current county road running east to the proposed spaceport facilities will of necessity cut across the Camino Real historic trail. In this section of the route, the trail is preserved as the vestiges of the 300-year old wagon road that brought the earliest European immigrants to northern New Mexico, and, indeed, to what would become the United States west of the eastern seaboard. The trail may be considered to be the single largest artifact of the colonial period in New Mexico, and one of the most valuable, if not the most valuable single marker of the Hispanic experience in the Southwest.

The Camino Real historic resources in the vicinity of the proposed spaceport facilities are some of the best-preserved sections of the historic road still extant along the 1,200 miles that make up the international route, and are the best-preserved sections in the United States. The proposed horizontal launch facilities are currently sited directly atop the national historic trail and the trail resource of Paraje del Aleman. The proposed vertical launch components require an access route to be constructed across the national historic trail, in the vicinity of the historically significant sites in the Yost Draw section of the trail.

The final area of potential impacts involves the landscape and viewsheds along the historic trail. There is no other place along the national historic trail where visitors will be able to experience the unchanged, historic landscape of the most perilous section of the trail, the infamous Jornada del Muerto. The current viewsheds, the still-visible wagon road, and the significant historic sites--springs where the first colonists were able to assuage their overpowering thirst, trail landmarks that assured them that they were

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making progress towards their goals, campsites, and surface artifacts dating back hundreds of years--all these make this section of the trail particularly sensitive and invaluable as part of our national trails system.

Many of the proposed facilities lie within the trail corridor that BLM has proposed to protect through the application of strict Visual Resource Management (VRM) stipulations in the Upham area. We have worked with the local land-managing agencies, that is, with the BLM and the State of New Mexico, in the development of a comprehensive management plan for the trail that identifies this section and its associated sites as "high potential" trail sites and route segments. BLM has changed its VRM classification in this stretch of the trail to provide increased protections to the visual resources in the trail viewshed, and the BLM has committed to protecting a five-mile wide corridor on either side of the historic route from visual intrusions.

In response to the preliminary scoping assessment, we have provided your planning team with maps of the trail, the VRM classification of the lands in the vicinity of the development, references to scholarly reports on the trail resources, archaeological resource information on the trail resources, and the comprehensive management plan adopted by the Department of the Interior for the national historic trail.

We look forward to commenting on the final EIS when it is transmitted for review. In the meantime, please do not hesitate to contact Michael Taylor (NPS) at 505-988-6742 or Sarah Schlanger (BLM) at 505-438-7454 if we can provide additional information.

Sincerely,

Linda S. C. Rundell, State Director
Bureau of Land Management
New Mexico, Texas, Oklahoma
New Mexico State Office

Jere L. Krakow, Superintendent
National Park Service
National Trails Office, IMR - Santa Fe

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APPENDIX C
ALTERNATIVE SITE LOCATIONS CONSIDERED

Considered but dismissed from further analysis were alternate sites for the spaceport outside New Mexico or at other locations within New Mexico but outside the area identified for Spaceport America in the Proposed Action in this EIS. This appendix describes those sites in detail. Exhibit C-1 shows the considerations and criteria that were used in this site evaluation process. The application of each of these considerations and criteria to the potential spaceport sites is described in this appendix.

Exhibit C-1. Site Selection Criteria

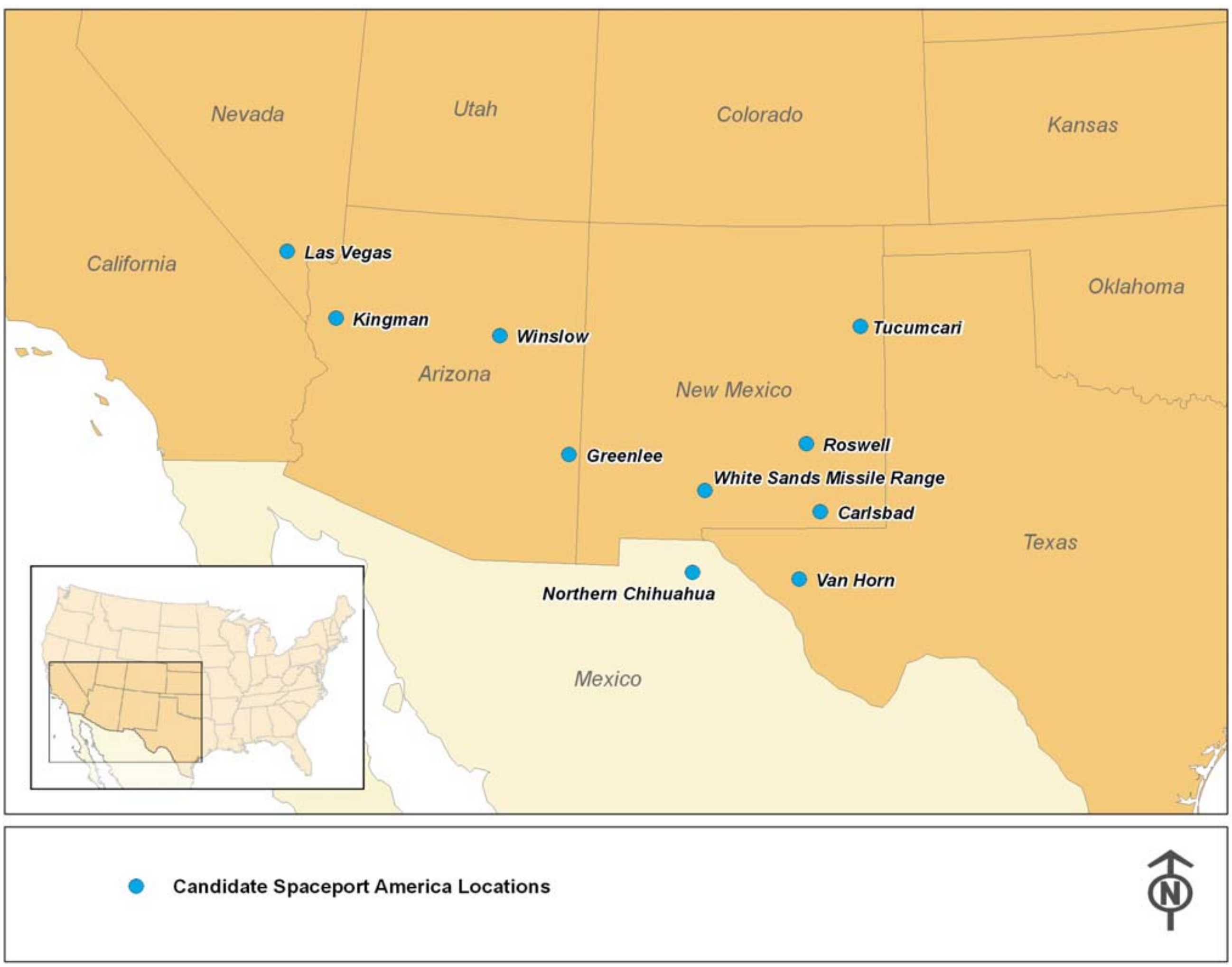
Consideration	Criteria
Trajectory Pathway	• Located in southern tier of States
Flight Safety	• Low population density • Availability of suitable land for safety buffer zone
New Mexico Economic Development Goals	• Located in New Mexico
Operational Considerations	• Weather • Airspace availability • Non-corrosive environment
Technical Considerations	• Availability of power • Transportation access • Suitability for construction of facilities
Restricted Airspace Needs	• Large volume of airspace that does not normally support heavy aircraft traffic • Bulk of airspace located east of the launch point
State Land Ownership	• Necessary amount of contiguous State-owned land to accommodate proposed Spaceport America
White Sands Missile Range (WSMR)	• Located as far west of WSMR (within call-up zone) as possible • Located to have minimal effects on critical flight operations and resulting debris dispersion impacts from WSMR launch complexes

C.1 Sites Outside of New Mexico

The first step in this process was a study by New Mexico State University (NMSU) (1995), which initially examined candidate spaceport locations in southern Nevada, Arizona, New Mexico, western Texas, and northern Mexico. Ten locations were selected for further investigation (Exhibit C-2). These sites were in the vicinities of:

- Las Vegas, Nevada
- Kingman, Arizona
- Winslow, Arizona
- Greenlee County, Arizona
- Northern Chihuahua, Mexico
- White Sands Missile Range, New Mexico
- Roswell, New Mexico
- Tucumcari, New Mexico
- Carlsbad, New Mexico
- Van Horn, Texas

Exhibit C-2. Candidate Spaceport America Locations Considered in the Southwest U.S. and Mexico



WSMR emerged as the preferred site in the early stages of the original NMSU study even though a number of other sites were considered. A variety of launch vehicle (LV) issues were added to the NMSU study.

Sites in the southwest but outside of New Mexico were not considered viable candidates for a facility to be developed by the State of New Mexico for economic development purposes. Also, sites outside of New Mexico would not satisfy the intent of the State and Congressional leadership supporting the potential spaceport concept and were not carried forward for further analysis.

C.2 New Mexico Sites

Four New Mexico sites, Tucumcari, Roswell, WSMR, and Carlsbad, were carried forward for consideration. The primary issue in considering the New Mexico sites was flight safety. Other considerations were payload lift capacity, which generally is improved by closeness to the equator and higher ground elevation; and operational considerations, which are influenced by a wide variety of factors including weather, airspace availability, and corrosiveness of the environment. For flight safety considerations, launch operations need a large volume of airspace that does not normally support heavy aircraft traffic. Based on these considerations, the site location west of WSMR, which uses the broad uninhabited land surface of WSMR and the airspace above it, was considered to be the most viable of the New Mexico sites.

Within this area, the most suitable sites were found to be east-northeast of Engle and in the area north of Point of Rocks and southwest of Prisor Hill. Determination of suitability was based mainly on technical criteria, which included availability of power, transportation, low population density, near but not on WSMR, location to the west of WSMR, suitability for construction of facilities, airspace control, and several other issues. At that time, considerations for a long runway did not exist for the vehicles that were under consideration, so topography played a relatively less important role in the selection process. It should be noted that the specific sites examined in this analysis were not located within large blocks of State-owned lands because at that time a much larger spaceport area was envisioned that contained very large buffer areas around facilities, requiring land managed by various agencies.

Sites located east-northeast of Engle (north of the current proposed site) were eliminated from consideration "due to non-availability of sufficient public land." There is a large block of State land northeast of Engle, bordered on the west by the private land of the Pedro Armendaris grant. However, the San Andres mountain range is 5 to 7 miles east of the potential runway location. This would potentially be a hazard to aircraft and horizontal LVs, especially suborbital vehicles returning for unpowered landings. This area also is within the safety fan of an important WSMR flight corridor for launches from Fort Wingate, NM.

C.3 Sites Near WSMR

Environmental investigations were conducted within a 387-section study area near WSMR in 1997. It was determined that a spaceport site in this region offered advantages in terms of the technical attributes, including low population in the immediate downrange area and location west of WSMR. However, it was determined that pursuing a land exchange with BLM was unlikely to be successful in a desired timeframe. Correspondence (Sekavec, 1997) indicated that public lands surrounding the proposed site were not available for the proposed use of a commercial space launch site. This correspondence states:

> "… the BLM has identified that all 189,209 acres proposed for use as the SRS [Southwest Regional Spaceport] will be retained under Federal Ownership as public lands and managed as also directed by the Federal Land Policy and Management Act of 1976 (FLPMA) under the principles of multiple use and sustained yield with emphasis on protecting the quality of scientific, scenic, historical, environmental, and ecological values. Currently, all 189,209 acres of public lands managed by the BLM are not available for use as the proposed SRS."

Since existing BLM lands were not available for spaceport use, and the possibility of a land exchange with BLM was not likely and could not occur in the time frame necessary for a viable project, a critical component of the State's position with regard to the spaceport, i.e., that the spaceport be located on State-owned land, was in jeopardy. The only viable solution was to identify an existing parcel of State-owned land large enough for the proposed Project.

In July 1998, Lockheed-Martin Company (LMC) issued a Request for Qualifications (RFQ) for sites within the U.S. to serve as the launch and recovery site for their VentureStar® single-stage-to-orbit launch vehicle that was then under development. Information contained in this RFQ was used to determine that a 26-section block of land would be adequate for its spaceport. New Mexico prepared and submitted a Statement of Qualifications to LMC in response to this solicitation. As part of the process, the State revisited its site selection process with the additional consideration of the unique LMC VentureStar® launch site criteria. Thirteen sites, all but one of which had been examined previously, were once again examined in detail. An additional site in the southeast corner of WSMR near Orogrande was considered. This site was added because it was close enough to El Paso, Texas, to provide access to its large labor market. WSMR subsequently asked the State to remove this site from the potential sites list due to Department of Defense operations conflict concerns. The specific site that was proposed to LMC, in addition to the site near Orogrande, was essentially the same site that is currently proposed in this EIS, taking into consideration differences in the infrastructure of the LMC program compared with current considerations.

C.3.1 Sites West of WSMR and WSMR MOA Area

A critical criterion of site selection for Spaceport America is that it must provide access to WSMR airspace, infrastructure, and equipment (e.g., radar). WSMR has two basic types of restricted airspace: areas of ground to infinity airspace under their direct control and areas restricted part time but available for use by notification to the FAA. All sites that had been considered in site selection screenings in the WSMR vicinity are in one of these two types of restricted airspace.

WSMR expressed concern about the prospect of having high-value assets associated with a spaceport located within their call-up zones. Risk of damage to such assets by WSMR missions could potentially affect WSMR's ability to conduct critical national security flight test and evaluation missions. WSMR's general requests were that spaceport facilities should be located as far west as possible and that the facilities should be located to have minimal effects on critical flight operations and resulting debris dispersion impacts from WSMR launch complexes, primarily the main launch complex area to the east of the Main Post area. Because the western call-up zone boundary is approximately coincident with available WSMR airspace, these requests have the effect of requiring the spaceport to be located as far west within the call-up zone as possible within a narrow north-south band.

A memorandum of agreement (MOA) was signed between WSMR and the State in 2002. As a condition of the MOA, the State agreed to locate the spaceport facilities in a specific part of the Abres 4A Extension Area (Exhibit C-3). Putting the facilities in the specified area would minimize the potential for damage or risk to life by impact of vehicle debris from WSMR launches and would minimize possible impacts on WSMR flight corridors that are used for testing activities for national security. As a result of the MOA, all potential sites west of WSMR on New Mexico State Trust Lands, but not within the area agreed to in the MOA with WSMR, were not carried forward for further analysis. Also shown in Exhibit C-3 is the Visual Resources Management (VRM) Class II viewshed for Federal lands that was established in 2004 by the El Camino Real de Tierra Adentro National Historic Trail Comprehensive Management Plan (NPS and BLM, 2004). The overlap of the WSMR MOA area of 2002 and the Camino Real viewshed of 2004 is coincidental, as the viewshed had not been established as of 2002.

C.3.2 Site Safety Criteria Considered

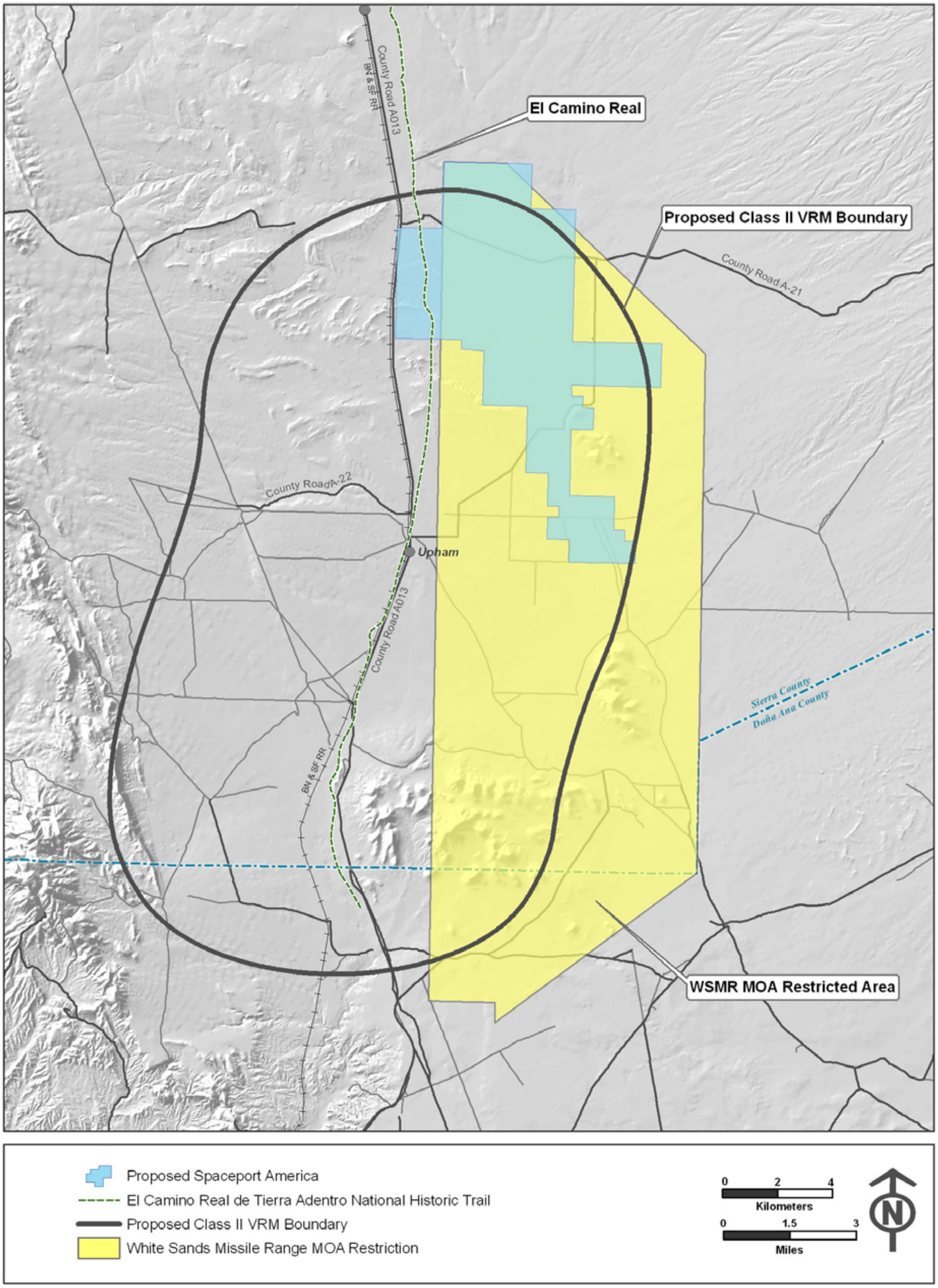
Safety considerations were of primary concern throughout the site selection process, and safety remains the most important criterion to be met by any potential commercial spaceport location. Operational safety analyses included: the length and desired orientation of the runway; potential approach and departure vector hazards; availability of protected safety zones at the ends of the proposed runway; restricted airspace in the vicinity; topography and soil conditions that would allow runway construction in the desired orientation; access to infrastructure to support runway operations; safe separation distances and orientation between horizontal and vertical launch areas; and available land for launch and recovery operations for both types of technology.

In the 1990s, the State funded WSMR Flight Safety to conduct qualitative analysis to assist with site down-selection (WSMR, 1998). More than 30 sites in southern New Mexico were compared from the perspective of least population within a corridor defined by a catastrophic hazard footprint. The specific failure scenario was a catastrophic on-board explosion from unspent propellants, followed by a vehicle breakup. The conclusion of the study was that the general Upham area was shown to be the optimum location for a launch site with respect to safety.

As specific sites within this general Upham area were evaluated, runway safety concerns eliminated several sites. Potential sites located northeast of Engle were eliminated from consideration due to the location of the San Andres Mountains only 5 to 7 miles east, and because this area is located outside the boundary of the area covered by the MOA with WSMR. Particular sites south of Prisor Hill ran into similar runway safety concerns with features such as Point of Rocks and Prisor Hill interfering with approach and departure paths, as well as limited orientation options. A site southwest of the current proposed site was eliminated because acquisition of land for buffer areas and safety zones could not be assured. A runway location west of Upham was eliminated due to multiple runway safety concerns, including orientation, topography, safety zones, and approach and departure vectors.

The current proposed site for Spaceport America was identified through safety analyses, in addition to the other considerations presented in this section. The current runway orientation and layout for Spaceport America was determined through wind analysis, in accordance with the FAA guidelines, using wind data collected over a 10-year period at the Truth or Consequences airport

Exhibit C-3. Area Included within WSMR MOA Restrictions and the VRM Class II Viewshed for El Camino Real de Tierra Adentro NHT



and from data collected from a weather observation station active at the Bar Cross Ranch since 2005. The runway is positioned on the site to maximize separation of the vertical and horizontal launch areas, as well as to protect the critical surfaces and safety areas associated with the runway.

C.4 Sites on State Trust Lands within the WSMR MOA Area

Between 2001 and 2003, New Mexico considered a number of small, entrepreneurial launch companies as potential tenants for its spaceport. In analyzing the specifications of these companies, it was determined that they too could be satisfied if the area of the spaceport was reduced to approximately 26 sections of New Mexico State Trust Land within the larger 387-section Project area identified earlier. This was consistent with the requirements for the VentureStar® program. This would allow the State to comply with the WSMR imposed restrictions and avoid the need for a land exchange with the BLM, a process for which timely success was unlikely. A contiguous block of New Mexico State Trust Land of the desired size was identified within the earlier identified 387-section Project area.

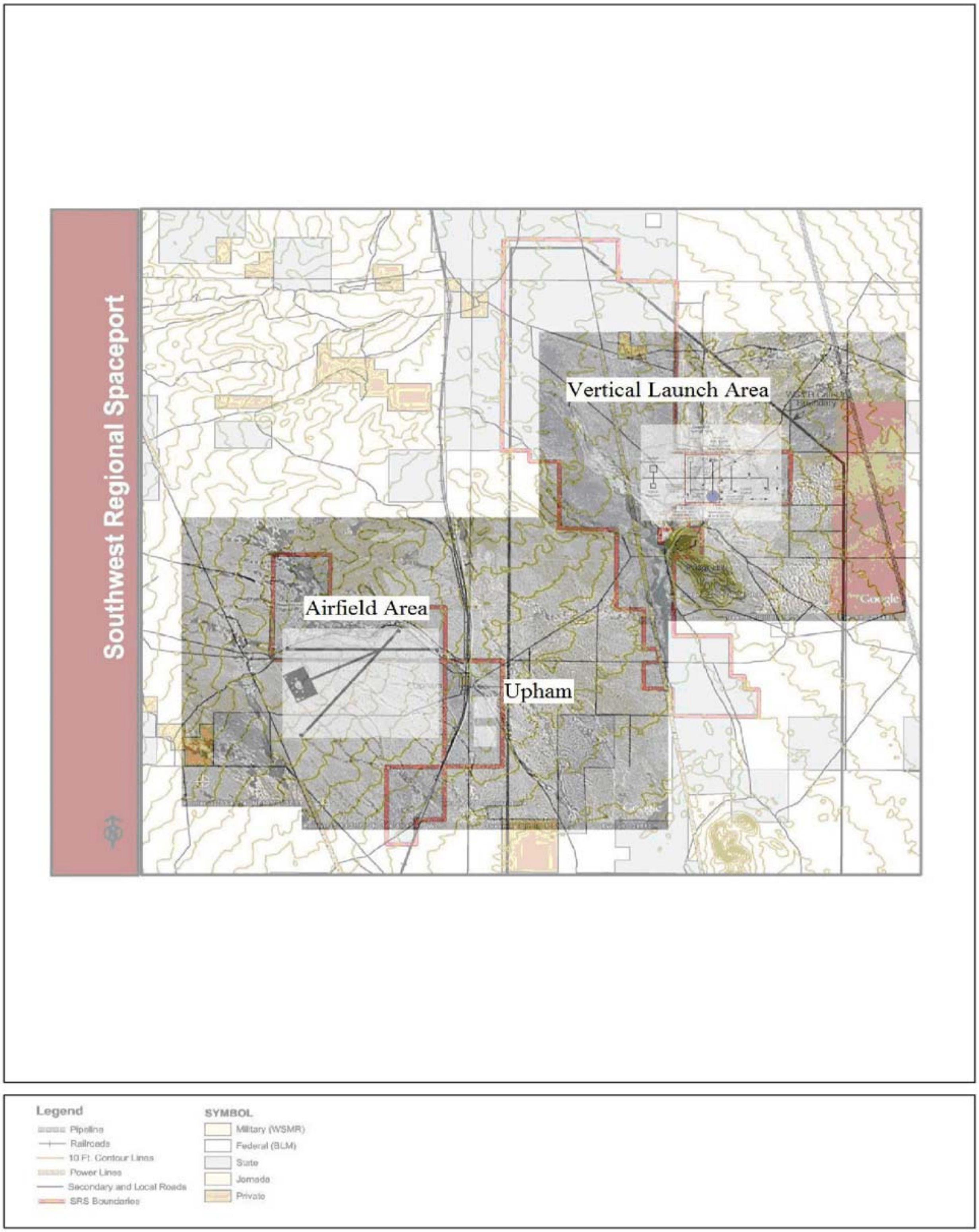
The selection of the contiguous block of State land for Spaceport America was also influenced by technical considerations. Potential sites in the southern part of the WSMR MOA area were less favorable or unsuitable for the following reasons:

- The region east of the El Camino Real viewshed but within the WSMR MOA area is just north of Flat Lake, the lowest point in the Jornada del Muerto basin. The Jornada Draw drains into this region and flat areas are prone to flooding and the formation of temporary shallow lakes in the playas.
- The flat land from the Upham Hills north to Prisor Hill is also dominated by the Jornada Draw, and floods in heavy rains.
- The area generally east of Upham is very flat and as a result has playas prone to flooding.

Engineering and topographic analyses of the State Trust Lands around the old Upham railroad junction site and west of County Road A013 found that these parcels were incompatible with facility needs, particularly for a horizontal launch support facility. This conceptual site layout is shown in Exhibit C-4. Topographic analysis of several sections of BLM-administered land to the south of this State land for the airfield made the BLM land look somewhat promising until discussions with the local BLM office indicated that the exchange process would be expected to take several years. In addition, BLM correspondence (Sekavec, 1997) indicated that public lands surrounding the proposed site were not available for the proposed use of a commercial space launch site.

Since a land exchange with BLM was not likely, the State concluded that only development on State-owned land would assure that the Project would move ahead at a pace necessary to allow the State's corporate partners to meet their individual pre-requisites in a timely way. This was also consistent with Spaceport America program objectives of having facilities on contiguous State Trust Land parcels for cost and control efficiency, security and convenient access, meeting WSMR airspace and call-up zone restrictions, and meeting commercial partner development

Exhibit C-4. Rejected Spaceport America Conceptual Facilities Layout with Airfield on State Land West of Upham



timelines. As a result, State land parcels west of Upham railroad junction, and both BLM land and State land to the south of Prisor Hill, were not carried forward for further alternative site analysis.

The current proposed location was identified, because the northern part of the WSMR MOA area contained a large block of State land and did not have the technical and environmental drawbacks of other potential spaceport sites in this area. This revised spaceport Project area is the one analyzed in this EIS.

This proposed spaceport Project area encompassed some 16,920 acres of State Trust land, all in Sierra County, which included State lands in and around Upham as well as farther north towards Aleman Ranch, but excluded any BLM lands surrounding and interspersed between these State Trust Land parcels.

The proposal noted that the State anticipated an approved-use permit from BLM for non-exclusive use of BLM-administered lands within safety buffer zones if necessary, but did not contemplate a State/BLM land exchange because of the previously described difficulties with this option. This reflected the State's understanding that any large land exchange between the State Land Office and BLM would entail extensive negotiations between the agencies and subsequent modification of the BLM's existing White Sands Resource Area Resource Management Plan and preparation of NEPA documents. In addition, previous BLM correspondence indicated that public lands surrounding the proposed site were not available for the proposed use of a commercial space launch site. All of these issues reaffirmed the State's determination that a land exchange was neither feasible nor responsive to the timeline required for the spaceport.

The State was ultimately successful in 2004 with its proposal to provide a host site for annual X Prize Cup events, and a number of additional potential users of a commercial spaceport in the State have come forward since then to negotiate with the State on terms and conditions of occupancy and use of such a commercial spaceport. These companies include Virgin Galactic, UP Aerospace, StarChaser, and the Rocket Racing League. Each potential user has its own unique facility pre-requisites, which have been factored into the location and facility planning process for Spaceport America. This resulted in a general conceptual facility layout with a vertical launch facility in the easternmost part of the State Trust Land Project area; this eastern placement was necessary so that vertical launches would take place as close to WSMR as possible for safety reasons. The horizontal launch support facility would need to be located a reasonable distance away from the vertical launch area for safety and launch azimuth reasons.

It was determined that the WSMR restrictions and economic development timeline could be met with facilities in this conceptual layout configuration. Previously identified general technical needs for variations of vertical and horizontal vehicles to be launched from the spaceport by these prospective client users were found to be compatible with the smaller Project area proposed for the X Prize Cup, and dormant discussions with the FAA about renewing the previously discontinued EIS process were revived in the summer of 2005.

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Sekavec, G. B. 1997. Letter from Glenn B Sekavec (U. S. Department of the Interior) to Nikos Himaras (U.S. Federal Aviation Administration, Office of the Associate Administrator for Commercial space Transportation), August 27.

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APPENDIX D
GEOLOGY AND SOILS

D.1 Affected Environment

D.1.1 Definition and Description

Geology and soils are those Earth resources that may be described in terms of landforms, geology, and soil conditions. The makeup of geology and soils within a given physiographic region influences the occurrence of vegetation types, the presence of mineral or energy resources, the presence of ground water resources, and the potential for seismicity and associated risks such as earthquakes and landslides.

D.1.1.1 Geology

Geology is the study of the composition and configuration of the Earth's surface and subsurface features. The general shape and arrangement of the land surface, including its height and position of its natural and man-made features, is referred to as topography. The topography of the land surface affects the general direction of surface water and ground water flow. Groundwater is stored and transmitted underground in aquifers that supply lakes and rivers and is often used for human purposes, such as drinking water and irrigation for crops.

D.1.1.2 Soils

Soil is defined as the surface of the Earth, composed of minerals and fine rock material disintegrated by geological processes, and humus, which is the organic remains of decomposed vegetation. Soil and sediments are typically described in terms of their composition, slope, and physical characteristics. Differences among soil types potentially affect their ability to support or sustain agriculture, filtration, and natural detoxification processes.

The three principle types of soils are clay, sand, and loam. Factors determining the nature of soils are vegetation type, climate, parent rock material, elevation, and the geological age of the developing soil.

D.1.2 Regulatory Setting

D.1.2.1 Geology

Outside of oil, gas, and mineral exploration, no specific regulatory standards pertain to geology other than best management practices (BMPs) and building codes that must be adhered to within seismic zones.

D.1.2.2 Soils

The USDA has designated specific soils as prime and unique farmlands, but the State has no additional regulations governing soils. None of these soils exist in the proposed Spaceport America site (see Section 3.2 for discussion). Impacts on soils from water runoff and hazardous waste are discussed in Sections D.2 and 4.9, respectively.

D.1.3 Existing Conditions

D.1.3.1 Geology

The proposed Spaceport America site is located in the central part of the Jornada del Muerto Basin, which is a structurally complex region of the Rio Grande rift. The rift lies within the larger physiographic zone known as the Basin and Range Province, which includes fault block mountains and plateaus; volcanoes and lava flows; and broad, flat alluvial basins. The Rio Grande rift is characterized by a series of north-south parallel faults that extends from southern Colorado to Texas that formed during the Laramide orogeny approximately 75 to 43 million years ago (Seager, 2004).

The Jornada del Muerto Basin is structurally bounded on the west by the east-tilted Caballo Mountains and on the east by the west-tilted San Andres Mountains. The Basin is a nearly level detrital valley plain 10 to 20 miles in width extending from Socorro to Las Cruces, New Mexico. The sedimentary rocks exposed in the mountain slopes on either side of the basin dip toward the axis of the basin, forming the Jornada del Muerto syncline (Harley, 1934).

The north-northwest-trending Jornada Draw Fault extends from the Engle area south-southeastward across the southern Jornada del Muerto Basin to south of Point of Rocks hills, a distance of nearly 40 miles (Seager and Mack, 1995). The fault has displaced the hinge area of the Jornada del Muerto syncline approximately midway between the Caballo and San Andres Mountains.

Because it crosses the broad, nearly featureless plains of the Jornada del Muerto Basin, the physiographic expression of the Jornada Draw Fault is subtle since the position of the fault is obscured by the basin-fill alluvium. However, the course of the fault is clearly marked by the Jornada Draw and by a series of eight playa lakes that formed by subsidence along the fault. Although the physiographic expression of the Jornada Draw fault is subtle, truncation of bedrock units by the fault is not, as seen on a geologic map (Exhibit D-1).

Bedrock beneath the Jornada del Muerto Basin ranges from Permian (oldest) to Pleistocene (youngest) in age. A summary of the geologic units underlying the Central Jornada del Muerto Basin is presented in Exhibit D-2.

At the proposed Spaceport America site, all three units (conglomerate, sandstone, and mudstone) of the Love Ranch Formation are derived from Permian-age and Cretaceous-age rocks of the Caballo and San Andres Mountains. The Love Ranch Formation crops out along the Jornada and Aleman Draws. In the subsurface, the Love Ranch Formation extends southwestward from the Jornada Draw Fault Zone, and to the north of Aleman (Exhibit D-1). Generally, there is an upward fining sequence, with red mudstone dominant near the top of the formation, and conglomerates dominant at the bottom (Kottlowski et al., 1956).

North and East of Prisor Hill, beneath the Pleistocene-age alluvium, is the Palm Park Formation, which consists of a varied lithology of mudstone, siltstone, sandstone, poorly-sorted conglomerate with boulders up to 10 feet in diameter (Seager and Hawley, 1973), and lenticular fresh limestone and associated travertine deposits.

A lithologic boring log from an oil-and-gas test well drilled about four miles southeast of the proposed Spaceport America site indicates that the combined thickness of the Love Ranch and Palm Park Formations is about 4,650 feet in the vicinity of the proposed Spaceport America site (Shomaker, 2006).

Exhibit D-1. Geologic Bedrock Map of the Proposed Spaceport America Site and Vicinity

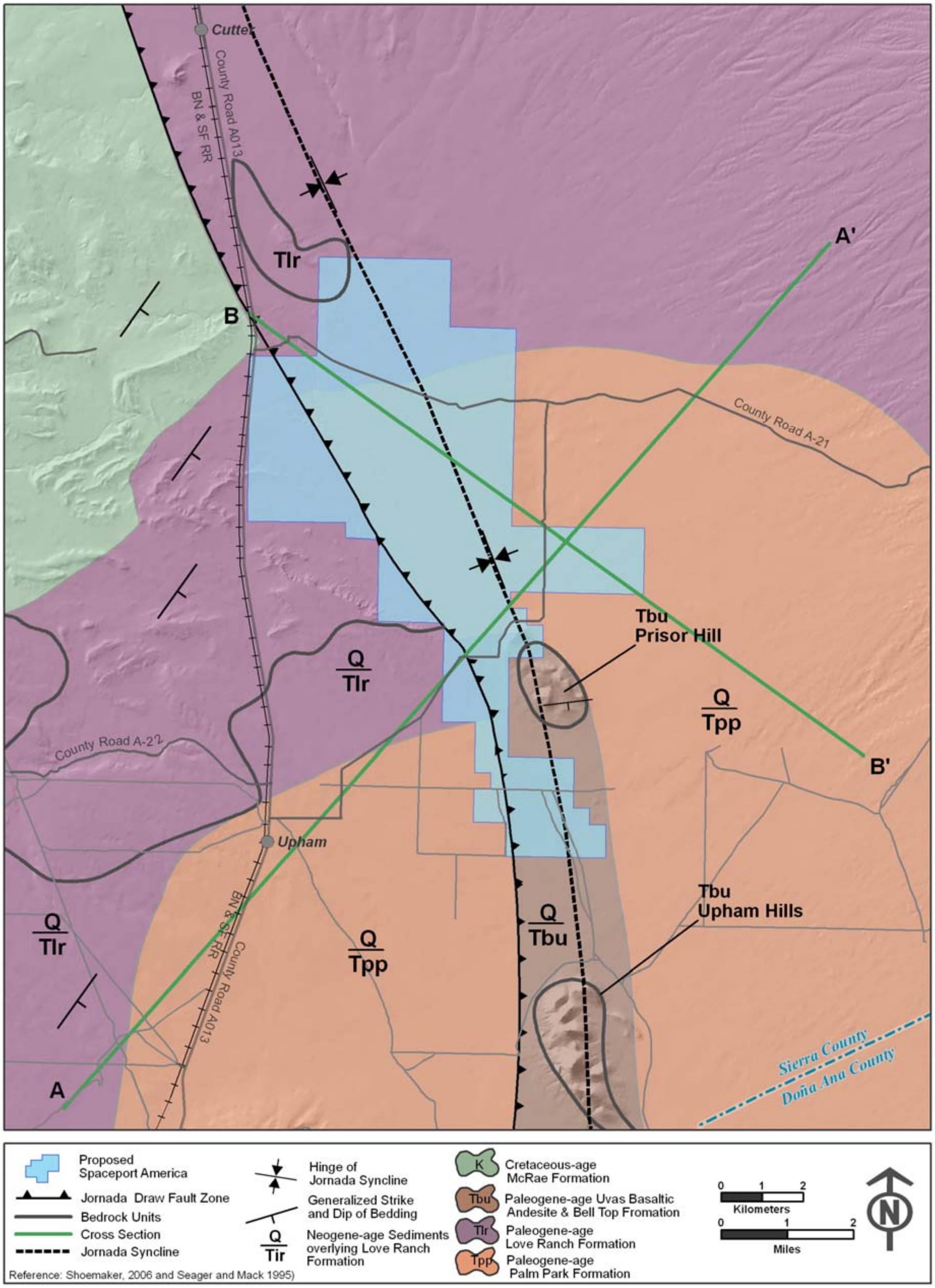


Exhibit D-2. Summary of Geologic Units Underlying the Central Jornada del Muerto Basin.

Geologic Time Period/Epoch	Age (million yrs)	Formation/ Unit Name	Description
Pleistocene/ Neogene	0 to 23	Younger Alluvium Camp Rice Formation	Unconsolidated sand, gravel, sandstone, conglomerate.
Tertiary/ Paleogene	23 to 65	Bell Top Formation	Volcanic ash and ash-rich sandstone.
		Palm Park Formation	Conglomerate, conglomeratic sand-stone, sandstone, freshwater limestone, ash, siltstone and mudstone.
		Love Ranch Formation	Conglomerate, sandstone, and mudstone
Cretaceous	65 to 145	Mesaverde Group	Interbedded conglomerate, sandstone, siltstone, and shale units.
		Dakota Sandstone	Medium-grained sandstone with thin beds of siltstone and shale.
Unconformity (either no deposition occurred between 248 and 145 million/yrs ago or erosion removed the soil and rocks deposited during this time period).			
Permian	248 to 299	San Andres Limestone	Limestone with gypsum and sand-stone.
		Yeso Formation	Sandstone with gypsum beds.
		Abo Formation	Mudstone

Source: Adapted from Shomaker (2006).

The Neogene-age alluvium size and composition significantly varies by location, but in general the Camp Rice Formation consists of volcanic conglomerates near Prisor Hill, and limestone and sandstone pebble or cobble gravel, and gravelly sand when derived from the San Andres and Caballo Mountains. Across the proposed Spaceport America site, a thin veneer (at least 10 feet thick) of gravel, sand, and silt buries the Camp Rice Formation (Shomaker, 2006; Seager, 2002).

Exhibits D-3 and D-4 depict southwest-to-northeast and northwest-to-southeast geologic cross sections, respectively, across the Jornada del Muerto Basin.

D.1.3.2 Soils

A review of the Soil Survey of the Sierra County Area, New Mexico (Neher, 1984) indicates that the proposed Spaceport America site is underlain by soils belonging to the Doña Ana-Stellar-Wink soil complex, which is composed of about 41 percent Doña Ana soils, 17 percent Stellar soils, and about 15 percent Wink soils. The remaining 27 percent consists of components of minor extent.

Exhibit D-3. Geologic Cross-Section A – A'. Southwest to Northeast

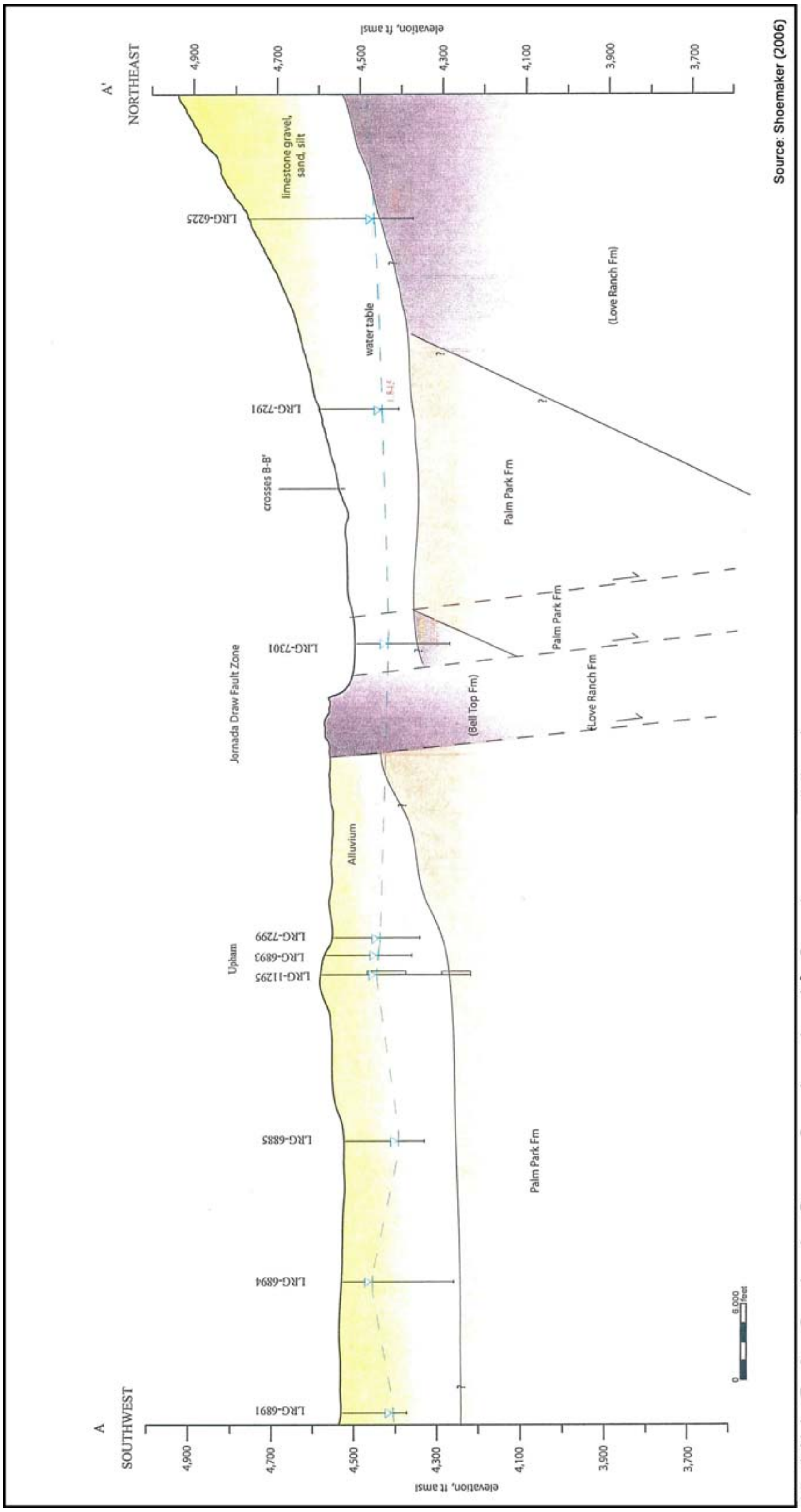
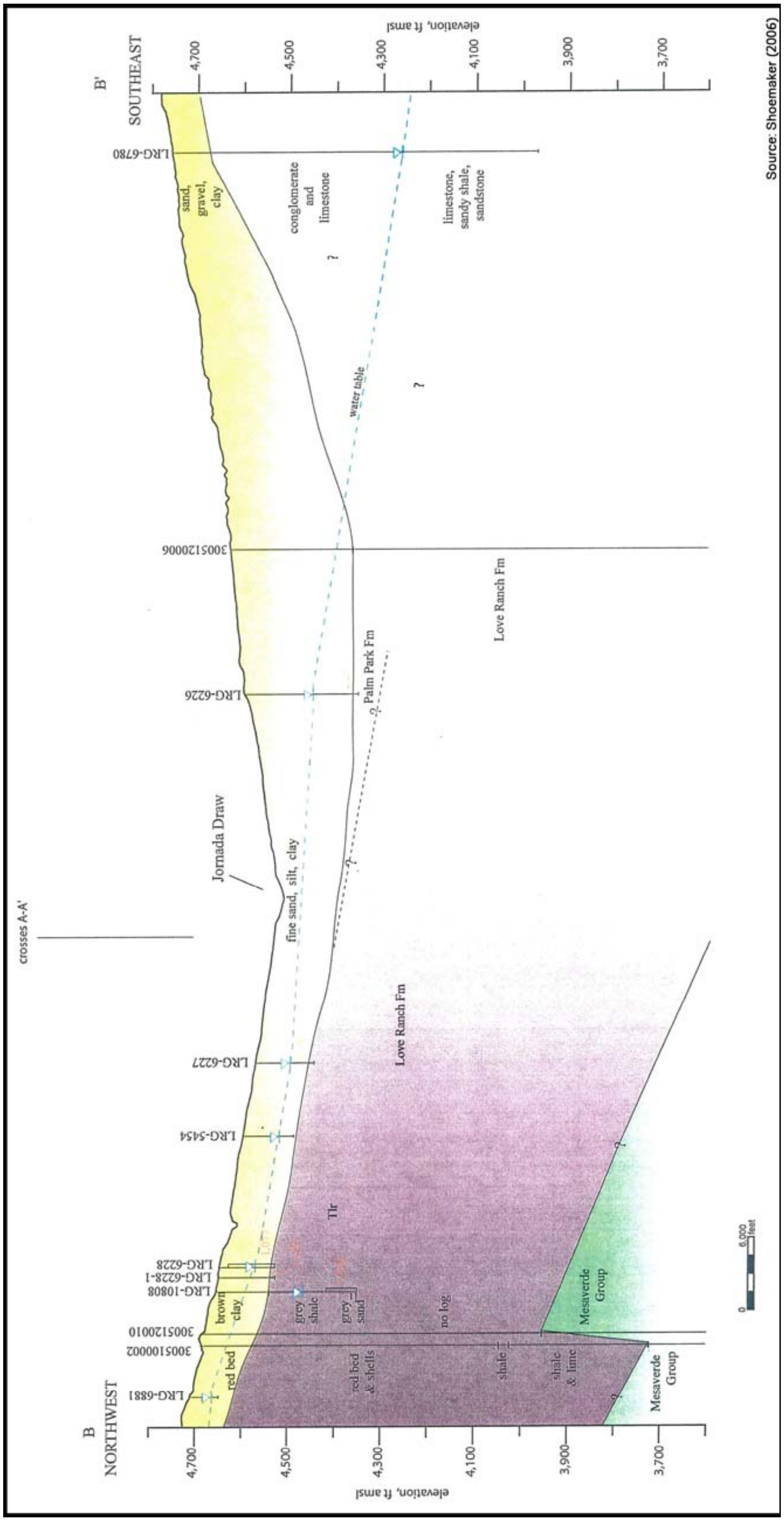


Exhibit D-4. Geologic Cross-Section B – B', Northwest to Southeast



The Doña Ana soils are described as deep and well-drained fine sandy loam developed on piedmonts from mixed alluvium. Stellar soils are deep and well-drained loam and clay loam developed in slightly depressional areas on piedmonts. Wink soils are deep and well-drained loamy fine sand and gravelly sandy loam produced on ridges and side slopes of piedmonts.

Soil limitations include high susceptibility of the sandy loam surface layers to soil blowing, and a moderate hazard of water erosion. However, these limitations are mostly controlled by proper rangeland management practices (Neher, 1984).

D.1.3.3 Seismicity

The proposed Spaceport America site is located within the Rio Grand rift, a major continental rift extending north-south through New Mexico from north of Taos to Las Cruces (Sanford et al., 2002). The overwhelming majority of Quaternary-age faults in New Mexico fall within the boundaries of the Rio Grande rift (Machette et al., 1998), and yet earthquakes are absent or nearly so over much of its extent; for example, from just south of Socorro to just north of Las Cruces. Of the 30 largest earthquakes for the period 1869 to 1998 with a moment of magnitude of 4.5 or higher, only one was recorded southeast of Socorro and it was recorded in the extreme southeast corner of the State adjacent to the Texas border.

The expected number of earthquakes with moment of magnitude 2.0 or greater for New Mexico is 19.1 each year, and for moment of magnitude 3.0 or greater it is 4.3 each year (Sanford et al., 2002). The latter are modest rates of activity for such a large region, and the resulting earthquake hazard is for the most part low.

According to Seager and Mack (1995), the Jornada Draw fault which crosses the proposed Spaceport America site, formed late during the history of the Rio Grande rift region, probably to help accommodate growing structural relief between the Caballo uplift and the Jornada del Muerto syncline. Most recent movement of the fault is estimated to be approximately 0.4 million years ago. Consequently, Seager and others view the fault as posing little earthquake risk, at least for the near future.

D.1.3.4 Hydrology and Drainage

Hydrology and drainage are discussed in Section 3.7.

D.1.3.5 Paleontology

Fossil-bearing sedimentary rocks underlying the Jornada del Muerto Basin include the Permian-age San Andres Limestone, the Cretaceous-age Mesaverde Group and Dakota Sandstone, and the Paleogene-age Park Palm Formation. However, the sedimentary rock is covered by a veneer of Quaternary-age alluvial sand and gravel largely devoid of fossils.

Reportedly, a few fossils consisting of marine shell fragments and petrified wood have been found at the proposed Spaceport America site; however, it is likely that these fossils were eroded from the Caballo and San Andreas Mountains and transported to the area by surface water.

Skeletal remains or traces of dinosaurs are known from very few localities in New Mexico. However, fragments of *Tyrannosaurus rex* have been discovered on the east side of Elephant Butte Reservoir (Wolberg et al., 1986), which is located approximately 16 miles northwest of the proposed Spaceport America.

D.1.3.6 Mineral Resources

The proposed Spaceport America area has been explored for geothermal resources, oil and gas, coal, metallic minerals, and construction minerals. However, based on discussions with the BLM's field office in Las Cruces (Allen, 2007; Merrill, 2007), the proposed Spaceport America area has very limited leasable, locatable, or salable mineral resources.

There currently are no commercial prospects for production of mineral resources within the proposed Spaceport America boundaries. Mineral resources in the proposed Spaceport America area are discussed in more detail in Appendix E.

D.2 Environmental Consequences

This section discusses impacts related to the geology, soils, seismicity, paleontology, and mineral resources from the construction and operation of the proposed Spaceport America. The Project is considered to determine whether the Proposed Actions and Alternatives could result in the following types of impacts:

- Alteration of geologic landforms
- Substantial erosion and loss of soil,
- Triggering seismic activity,
- Disturbance of significant paleontological sites, and
- Impacts to the extraction of existing and foreseeable mineral resources.

D.2.1 Proposed Action

D.2.1.1 Construction

<u>Geology</u>

Disruption of underlying bedrock is not likely due to the depth of the basin-fill alluvium in the proposed Spaceport America area. Alluvium may be removed during construction of building foundations and facilities. These materials may be used for roads or foundations and additional geologic material may be removed from borrow pits at the site. Impact to topography would be limited to clearing areas for facility construction and road building.

The proposed Spaceport America entrance road and adjacent utility corridor into the site from County Road A013 would cross Aleman Draw. The crossing of Aleman Draw, a 15-foot deep arroyo, would include channelization of the arroyo and installation of a bridge with culverts. Power lines, fiber optic cables, and a water pipeline would be buried in a utility corridor that crosses the Jornada Draw just before entering the vertical launch area. All construction activities that may alter a drainage feature would be conducted in accordance with applicable Clean Water Act permitting.

<u>Soils</u>

Soil erosion due to surface water and wind erosion would be a concern during construction. Approximately 970 acres have the potential to be cleared and graded for construction. Construction activities would include road improvements, utility installation, site grading, installation of foundations and buildings, and landscaping. Facility structures would be located away from drainage features to avoid potential impact to any of the site's ephemeral washes.

During construction, best management practices would be employed to limit soil loss. These could include:

- Soil stabilization (e.g., temporary and permanent seeding).
- Structural controls (e.g., hay bales and sediment fences).
- Management practices (e.g., construction sequencing, materials delivery sequencing, physical delineation of disturbed areas).

Seismicity

Construction activities are not anticipated to impact site seismicity.

Paleontology

Impacts to the site paleontology are expected to be minimal since no significant fossils are likely present at the site.

Mineral Resources

Based on discussions with the BLM's field office in Las Cruces (Allen, 2007; Merrill, 2007), the Spaceport America area has very limited leasable, locatable, or salable mineral resources. Therefore, the proposed Spaceport America construction activities would not result in a loss of known mineral resources. Mineral resources in the proposed Spaceport America area are discussed in more detail in Appendix E.

D.2.1.2 Operations

Geology

No impact on underlying bedrock is expected during launch or landing operations. There is a potential for LVs to crash or breakup during launching or landing operations, but the force related to falling debris would result in potential impacts to the underlying soil and alluvium only.

No impact to underlying bedrock is expected during the non-launch operations such as pre-and post-launch LV transport and preparation and day-to-day support services.

Soils

No significant impacts on site soils in the launch areas or in the landing/recovering areas are expected from propellant emissions.

The PEIS HL (FAA, 2005) states that launches of Concept H1 and H3 vehicles would not impact soils. Such vehicles would take off from a runway using conventional jet power, and subsequently would ignite rocket engines at altitude. The PEIS HL states that the launch of Concept H2 vehicles could result in ground-level rocket emissions and deposition that may impact soil by increasing the concentration of trace metals and decreasing the soil pH. Such emissions, however, are produced by solid propellant motors, which are not used for Concept H2 LVs evaluated in this EIS.

Vertical LVs would use several types of propellant systems (Exhibit 2-23). None of the vertical LV propellant systems would create launch emissions that would impact soils at the site. Solid propellant motors do emit hydrogen chloride vapor that can react with water in the atmosphere to produce hydrochloric acid (HCL), which may have the potential to impact soils near the launch site because of acidic deposition from the launch ground cloud. However, the PEIS LL (FAA, 2001) states that Desert-Arid Environment soils like those at the proposed Spaceport America site tend to be well-buffered, and a cumulative decline in soil pH is not expected.

The impact of vertical LV components landing on the ground would not significantly impact soil at the site. All such landings would occur in a designated rocket landing area on WSMR. In addition, the descent velocity of components would be slowed by parachutes which would minimize impact on soils.

The breakup of launch vehicles during a crash and subsequent recovery activities could directly impact soils. The force associated with falling debris might create craters. The specific impact on soils would depend on the force with which the debris impacts the ground. In addition, residual propellant in the damaged or destroyed launch vehicle could be absorbed by the soils thereby affecting soil quality in the impact area. Because the probability of a crash would be low and reportable quantities of hazardous material released would be remediated per the CERCLA guidelines, any debris or residual propellant would not be expected to significantly impact soils.

No impact on soils is expected during the non-launch operations. Airfield operations would take place on hard-surfaced areas (runway, taxiway, tarmac, and parking lots) and would not disturb soil. Static test firings of rockets would not include solid propellant systems and the test stand and blast area would be constructed to prevent blast effects from blowing soil. The transport and storage of fuel and propellants could contaminate soil in cases of spills; however, because the probability of a spill is low and reportable quantities of hazardous material released would be remediated per the CERCLA guidelines, any releases of propellant would not be expected to significantly impact soils.

Other activities such as pre- and post-launch LV transport and preparation, as well as day-to-day support services, also would not impact site soils.

D.2.1.3 Summary of Impacts from the Proposed Action

There would be minimal to no impacts to geology and soils from implementation of the Proposed Action.

D.2.2 Alternative 1 – Horizontal Launch Vehicles Only

There would be no impacts to geology, soils, seismicity, paleontology, and mineral resources expected from Alternative 1. The footprint of the disturbed area would be less than the Proposed Action because the vertical launch area would not be constructed. Potential impacts from vertical launch operations would be eliminated because there would be no such launches.

D.2.3 Alternative 2 – Vertical Launch Vehicles Only

There would be no impacts to geology, soils, seismicity, paleontology, and mineral resources expected from Alternative 2. The footprint of the disturbed area would be less than the Proposed Action because the airfield area would be smaller. Potential impacts from horizontal launch operations would be eliminated because there would be no such launches. Potential impacts from airfield operations, including aircraft usage, would be reduced.

D.2.4 No Action Alternative

Under the No Action Alternative, no launch site operator license would be issued, and no launch operation activities would occur. There would be no impact to site geology, soils, seismicity, paleontology, and mineral resources under this alternative.

D.3 Cumulative Impacts

Impacts to geology, soils, seismicity, paleontology, and mineral resources from construction and operation of the proposed Spaceport America are expected to be negligible. Thus, there would be no cumulative impact to these resources from the proposed Project.

D.4 Mitigation

Construction contractors would employ soil stabilization measures, structural controls, and construction management practices to reduce soil loss during the construction phase of the Project. Soil stabilization measures would include grading and seeding disturbed areas with a native grass mix. Structural controls, which could include silt fences and secured hay/straw wattles, would be designed to trap disturbed soil and prevent its movement off site or into washes. Management considerations would include timing and sequencing of construction work to reduce the amount of time areas remained exposed to the elements (seeding areas and installing controls quickly) and clearly marking areas that are to be avoided or protected because they are likely to erode due to slope or soil type.

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APPENDIX E
MINERAL RESOURCES

The proposed Spaceport America facility would be located in south-central New Mexico about 45 miles north of Las Cruces and 30 miles southeast of Truth or Consequences in the central part of the Jornada del Muerto Basin. The proposed Spaceport America facility is almost exclusively on New Mexico State Trust land. Approximately 280 acres are private deeded properties of two landowners. All the land owned by the State retains site mineral resources under State jurisdiction.

E.1 Affected Environment

Mineral resources include oil and gas, geothermal resources, coal, non-energy minerals such as metallic ore deposits, industrial minerals such as fluorite and gypsum, and construction materials such as sand and gravel.

E.1.1 Oil and Gas

Energy companies have shown intermittent interest in the Jornada del Muerto area since the 1920s. According to New Mexico Bureau of Mines & Mineral Resources records, Shomaker (2006) and Bieberman et al. (no date), 32 petroleum exploration wells have been drilled in Sierra County, but only three wells reported shows of oil or gas. Between 1927 and 1983, sixteen petroleum exploration wells were drilled within a 10-mile radius of the proposed Spaceport America site, but none of the wells encountered hydrocarbons. A summary of the well details is presented in Exhibit E-1 and the locations of the wells are shown in Exhibit E-2.

No production has occurred within or near the proposed Spaceport America site, and all exploration in the proposed Spaceport America site vicinity has ceased. There are no active Federal leases for oil and gas immediately adjacent to the proposed site; all leases either have been terminated, relinquished, or have expired.

E.1.2 Geothermal

Geothermal resources in New Mexico are generally associated with the Rio Grande rift. One geothermal lease existed within the southern portion of the proposed Spaceport America site during the mid-1970s but was withdrawn (Merrill, 2007). A hot spring reportedly occurs approximately 1.5 miles north of the proposed Spaceport America (Summers 1972). The town of Truth or Consequences was originally named Hot Springs for the hot mineral springs developed for the tourist trade.

Although it is possible that geothermal resources occur within the boundaries of the proposed Spaceport America, no active geothermal leases currently exist (Merrill, 2007). Because the area proposed for Spaceport America is owned by the State, State leasing would be required for geothermal exploration and development at the site.

Exhibit E-1. Oil and Gas Exploration Wells within a 10-Mile Radius of the Proposed Spaceport America Project Site

Well Name	API No.	Location	Date Installed
Beard Oil Co., Jornada del Muerto, No. 4	3005120005	T15S, R1E, S2	1976
Beard Oil Co., Jornada del Muerto, No. 1	3005120002	T14S, R1W, S17	1973
Wofford, Wofford, No. 1	3005100021	T14S, R2W, S7	1949
Wofford & Kaltenbach, No. 1	3005100020	T14S, R2W, S2	1944
Bruton Development Co., No. 2	3005100015	T16S, R2E, S21	1963?
Exxon Co., Prisor, No. 1	3005120006	T16S, R1E, S20	1976
Sunray Mid-Continent Oil Co., Sierra County Strat. Test No. 1	3005100011	T15S, R2W, S21	1960
Sunray Mid-Continent Oil Co., Federal "H", No. 1	3005100002	T15S, R2W, S23	1959
Overthrust Resources, LTD, Federal No. 23, No. 1	3005120010	T15S, R2W, S23	1983
Wofford, Wilson, & King, State B-8754, No. 1	3005100022	T14S, R2W, S8	1942
Wofford, Winslow, Wright, & Kaltenbach, State B-8754, No. 1	3005100024	T14S, R2W, S18	1943
Sunray Mid-Continent Oil Co., Sierra County Strat. Test No. 3	3005100013	T14S, R1E, S5	1960
Exxon Co., Beard-Federal, No. 1	3005120003	T14S, R1E, S5	1974
Beard Oil Co., Jornada del Muerto, No. 5	3005120007	T14S, R1E, S13	1977
Winslow & Wright, State E-1218, No. 1	3005100025	T14S, R2W, S19	1948
McCall Drilling Co., Park Bowers, No. 1	Not available	T14S, R2W, S19	1927

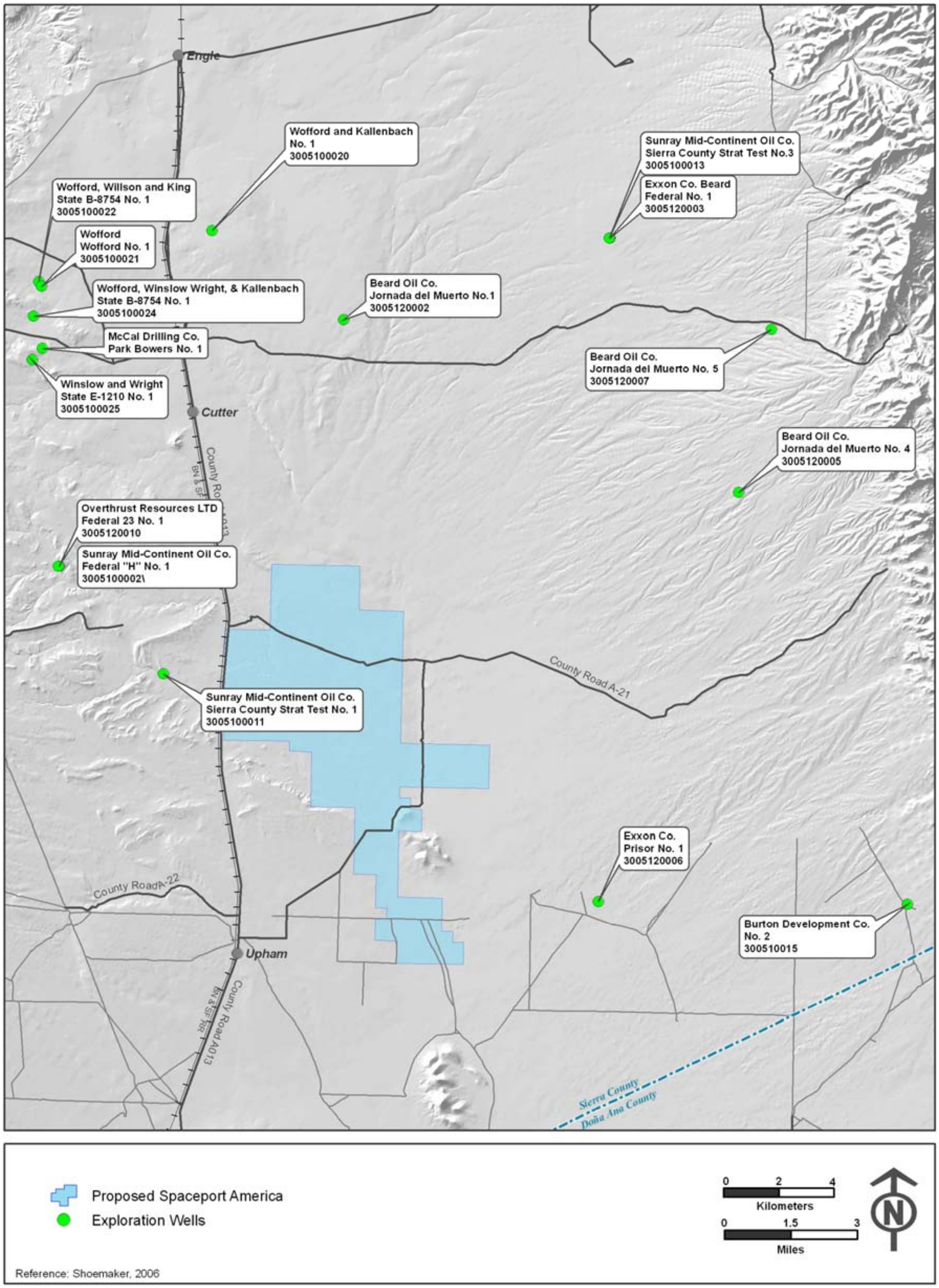
Adapted from Shomaker, 2006.
API = American Petroleum Institute

E.1.3 Coal

Coal in the vicinity of the proposed Spaceport America is restricted to the Engle coal field, which is roughly bounded by Truth or Consequences on the northwest, Engle on the northeast, Cutter on the southeast, and Palomas Gap on the southwest (Tabet, 1980). According to Tabet, the exposures of coal deposits are generally thin and the rank of the coal is subbituminous. The steep dips and thin and discontinuous nature of the coal beds make future production from the Engle field unlikely (Seager and Mack, 2003).

Lithologic boring logs from the sixteen petroleum exploration wells that have been drilled within a 10-mile radius of the proposed Spaceport America site indicate that coal was not encountered at depths up to11,000 feet below ground surface.

Exhibit E-2. Exploration Wells Located Within a 10-mile Radius of the Proposed Spaceport America Project Site



E.1.4 Metallic Ore Deposits

The known ore deposits of Sierra County are confined entirely to the mountainous areas (Harley, 1934). Gold, silver, copper, molybdenum, lead, zinc, manganese, tungsten, iron, vanadium, fluorite, and barite are present in the Caballo Mountains west of the proposed site. Of these, fluorite, barite, manganese, gold, molybdenum, copper, and vanadium have been produced in economic quantities (Seager and Mack, 2003).

Between 1910 and 1911, the Vanadium Mines Company operated a vanadium leaching plant at Cutter (located approximately 4.5 miles northwest of the proposed Spaceport America) to process vanadium mined from the Caballo Mountains (Palomas Gap) area. The plant was equipped with 10 acid-leach tanks, two evaporating furnaces, and one calcining furnace. However, the plant failed after one year due to an inefficient leaching process (Eveleth, 1986).

Gold placer deposits are present in arroyos, fans, and alluvium shed from the Caballo Mountains (Seager and Mack, 2003), and several claims existed for areas near the western margin of the proposed Spaceport America. None of these claims are active or valid (Merrill, 2007).

Metallic ore deposits have not been documented to occur within the boundary of the proposed Spaceport America.

E.1.5 Industrial Minerals

Gypsum was removed in limited quantities from an area near the southwest corner of the proposed Spaceport America. The gypsum was most likely removed over the course of many years and used for local agricultural purposes. Mineral prospecting for barite and fluorite has also occurred beyond the southwest corner of the proposed site (Merrill, 2007).

The former Wilcox mine, which consists of two calcite prospect pits, is located near the Point of Rocks to the south of the proposed site. There has been no recent mining activity on these prospects (Merrill, 2007).

E.1.6 Construction Materials

Sand and gravel have been mined from within the proposed Spaceport America boundary, but only for local use. No commercial production has been recorded within the proposed site boundaries (Merrill, 2007). The thickness of sand and gravel deposits (up to 30 feet) suggests that the potential to develop this resource within the boundary of the proposed site is moderate to high. There are vast high quality resources of sand and gravel elsewhere in the general area.

Mining of caliche within the proposed site boundary has not occurred, and no commercial production has been recorded within the proposed Spaceport America site. The thickness of caliche deposits suggests that the potential to develop this resource within the boundary of the proposed site is moderate to high. There are vast resources of caliche elsewhere in the general area (a caliche pit is located approximately 8.5 miles north of the proposed Spaceport America [Pfeil et al., 2001]).

E.2 Environmental Consequences

The area has been explored for geothermal resources, oil and gas, coal, metallic minerals, and construction minerals. There currently are no commercial prospects or production of mineral resources within the proposed Spaceport America boundaries (Merrill, 2007). The Proposed Action, Alternative 1, and Alternative 2 would not result in significant impacts to mineral resources because the proposed Spaceport America site either has very limited mineral resources, or, in the case of construction materials, there are large alternate sources off-site. The No Action Alternative also would not impact mineral resources or the development thereof. However, because the proposed Project site would not be developed as a commercial spaceport, development of construction material resources could occur under this alternative.

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APPENDIX F
AIRSPACE

F.1 Affected Environment

Airspace above Spaceport America and much of the surrounding area is restricted and is generally controlled by WSMR, although control of part of the airspace is transferred to the FAA Albuquerque Center when it is not in use by WSMR. Spaceport America would not require creation of any additional restricted airspace. Spaceport America has a memorandum of agreement (MOA) with WSMR that allows Spaceport America to schedule use of this airspace during Spaceport America operations. As part of the launch site operator's license application, and in accordance with 14 CFR Part 420, NMSA will develop an airspace letter agreement with the FAA Air Route Traffic Control Center (ARTCC) for operations in unrestricted airspace. Almost all Spaceport America spaceflight activity would be conducted while WSMR maintains full control of the airspace. Aircraft activities at Spaceport America when Albuquerque Center has control would be handled using approved FAA procedures.

F.1.1 Definition of Resource

Airspace is the defined space above a nation that is under its legal control. Airspace is limited horizontally, vertically, and temporally. The FAA designs and manages the national airspace based on guidelines from the Federal Aviation Regulations. The FAA has developed specific classifications for airspace to establish limits on its use. These classifications include Controlled, Uncontrolled, and Special Use airspace; military training routes; en route airways and jet routes; airports and airfields; and air traffic control. The FAA manages commercial and general aviation activity within the airspace and the military, with the FAA oversight, manages military aviation activity within Special Use and Other airspace.

As further described in the PEIS HL (FAA, 2005), the types of airspace are defined by the complexity or density of aircraft movements, the nature of operations conducted within the airspace, the level of safety required, and the national and public interest in the airspace. The classes of airspace are controlled, uncontrolled, special use, and other airspace, as defined in Exhibit F-1.

Restricted areas are airspace identified by an area on the surface of the Earth within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Activities within these areas are confined to permitted activities and limitations are imposed upon all other aircraft operations. Restricted areas generally are used to contain hazardous military activities. The term "hazardous" implies, but is not limited to, weapons deployment (these areas also are referred to as controlled firing areas and may be either live or inert), aircraft testing, and other activities that would be inconsistent or dangerous with the presence of non-participating aircraft.

Exhibit F-1. Definitions of Airspace Categories

Category	Definition	Examples
Controlled Airspace	Airspace used by aircraft operating under instrument flight rules that require different levels of air traffic service; Altitudes above FL 180 (18,000 feet above MSL)	Airport Traffic Areas, Airport Terminal Control Areas, Jet Routes, Victor Routes
Uncontrolled Airspace	Airspace primarily used by general aviation aircraft operating under visual flight rules	As high as 14,500 feet above MSL
Special Use Airspace	Airspace within which specific activities must be confined or access limitations are placed on non-participating aircraft	Restricted Areas, Military Operations Areas
Other Airspace	Airspace not included under controlled, uncontrolled, or special use categories	Military Training Routes

FL = flight level
MSL = mean sea level

Controlled airspace refers to airspace used by aircraft operating under instrument flight rules that require different levels of air traffic service. As shown in Exhibit F-1, examples of controlled airspace include the altitudes above Flight Level (FL)180 (18,000 feet above MSL), some Airport Traffic Areas, and Airport Terminal Control Areas. General controlled airspace includes the established Federal airways system, which consists of the high altitude (Jet Routes) system flown above FL180, and the low altitude structure (Victor Routes) flown below FL180.

F.1.2 Regulatory Setting

Use of the airspace above the potential launch site is regulated by the FAA pursuant to its regulations at 14 CFR 71. By prior agreement with the FAA, WSMR has control of all Restricted Airspace in a four-county area near WSMR, including the airspace above the Spaceport America site. When it is not required for operations, WSMR sometimes temporarily releases the use of this airspace. At these times, it is under the control of the FAA Albuquerque Center. Spaceport America would schedule all spaceflight activity with WSMR while the airspace is under WSMR control. Some limited aircraft and horizontal landing activity would be coordinated with the FAA Albuquerque Center when it is appropriate (when the WSMR airspace is under the control of Albuquerque Center or when operations would take place in controlled rather than restricted airspace). No Spaceport America flight activity is presently expected to occur in international airspace or the airspace of another sovereign nation.

All alterations and temporary closures of existing airspace are processed through the FAA. The FAA reviews and approves all such modifications. Use of restricted airspace and warning areas requires the issuance of a Notice to Airmen (NOTAM), which provides notice to all aircraft of the restricted or warning area via air traffic control. The FAA is the designated agency that coordinates the airspace activities with the International Civil Aviation Organization (ICAO).

F.1.3 Region of Influence

WSMR controls airspace above and around their controlled ground space at all times. They also control an area of adjacent airspace to the west when they are conducting military test operations on the test range. This restricted airspace includes the airspace above and around the proposed Spaceport America location. Aircraft flights from Holloman Air Force Base also use portions of WSMR restricted airspace. There are times, especially during night and weekend hours, when WSMR relinquishes the adjacent airspace to the FAA Albuquerque Center for use.

F.1.4 Existing Conditions

The proposed Spaceport America site is within WSMR restricted airspace.

F.2 Environmental Consequences

Spaceport America operations would, at most times, take place within Special Use Airspace of the WSMR restricted areas, as described in Section F.1. No additional restricted airspace would be required. Restricted airspace would be used for all vertical launch activities. There could be rare cases due to upper wind conditions in which horizontal launch vehicles returning from space flight would briefly enter the upper portion of Controlled Airspace (just below FL 600 [60,000 ft MSL]) just west of WSMR Restricted Airspace.

F.2.1 Proposed Action

Under the Proposed Action, the FAA would issue licenses for the horizontal and vertical launch of suborbital space vehicles and their reentry. Operation of facilities is implicitly included in such activities. Because the launch profiles and flight paths for each of these vehicles would be mostly within WSMR restricted airspace, impact to the FAA controlled airspace is expected to be very limited. It is expected that after a full FAA safety review and approval process, Spaceport America launch and reentry activities would not result in a significant impact on other FAA controlled airspace. The impact on WSMR Restricted Airspace becomes a scheduling issue that can be handled using the MOA processes already in place.

The FAA safety review and approval process determines whether a license applicant, payload owner, or operator has obtained all required licenses, authorizations, and permits. (See Appendix A of the PEIS HL, FAA Licensing Program, and Section 1.5 in this EIS for additional information.) Under this process, the applicant may be required to obtain airspace use authorizations to use military airspace or may be required to coordinate with the FAA ARTCC to provide for adequate airspace safety during launch or reentry activities. (See Appendix D of the PEIS HL, Regulatory Process Description.)

F.2.1.1 Construction Activities

All construction activities would use ground equipment without entering controlled airspace. Therefore, construction activities are not relevant to analysis of impacts to controlled airspace.

F.2.1.2 Launch Operations

Spaceport America is expected to operate as a commercial spaceport with launch and recovery of both horizontally- and vertically-launched vehicles. There would be a 10,000 foot runway complex that would accommodate standard aircraft, spacecraft launching aircraft, and landing of horizontally flown spacecraft. This would include the possibility that a spacecraft might return for a landing at the point of origination of its flight (runway or launch pad) under some emergency conditions. Spaceport America would schedule use of WSMR restricted airspace for all Spaceport America launch activity. Thus Spaceport America would become a user of WSMR airspace and schedule launch operations in the same manner that other WSMR customers currently schedule their activities.

Airport and Spaceport Airspace Use

Airspace at Spaceport America is ultimately controlled by WSMR. Spaceport America would not require creation of additional restricted airspace beyond that which already exists at WSMR. Any aircraft or spacecraft operations at Spaceport America would be scheduled with WSMR so that airspace use would be fully coordinated with WSMR schedules to assure that those operations would be carried out safely and successfully.

A typical large commercial airport has an operational control tower and approves and controls instrument approaches to the airport. The tower has control over aircraft ground operations, approaches to, departures from, and aircraft flying within a five-mile radius plus any extension required for instrument approaches. Airport control zones extend from the surface to 5,000 feet above ground level. En route instrument flight operations at cruise altitudes are monitored and controlled by regional FAA facilities linked to provide continuous transcontinental and international flight control. Aircraft performing instrument approaches to and departures from an airport are controlled by local control facilities at the same time as operating at intermediate altitudes.

Spaceport America spaceflight operational procedures would establish a control zone around the launch and landing areas similar to a commercial airport control zone. Spaceport America would perform functions similar to the airport control tower and approach/departure control authority. LV operations on the ground and during the initial phases of flight would be coordinated and controlled within the control zone by NMSA or another agency designated by the State of New Mexico. The launch operator would have the same responsibilities as an aircraft operator or pilot-in-command with regard to vehicle operations and flight safety. Launch operations at Spaceport America, after coordination with WSMR to schedule space vehicle flight times, would gain control of the required airspace and proceed with nominal flight operations. Upon conclusion of the flight operations, Spaceport America personnel would notify the proper WSMR officials and relinquish airspace control to WSMR.

It is expected that Spaceport America customer daily use of the airspace can be negotiated with WSMR to have a minimum impact on WSMR routine operations.

F.2.1.3 Non-Launch Operations

All ground operations are expected to have no impact on regional airspace. Normal aircraft operations at the Spaceport America airfield would be handled by the airfield operations control process and the FAA Albuquerque Center. During the five-year time period considered in this EIS, daily flight operations of aircraft are expected to be very limited. As discussed in Chapter 2, only 43 landings and take-offs are expected per week during the majority of the year. During yearly X Prize Cup, which would last about 7 days, up to 29 additional landings and take-offs could occur per day.

F.2.1.4 Summary of Impacts from the Proposed Action

The effects of Spaceport America activities on regional airspace would be minimal. No new restricted airspace would be required, and operations into Spaceport America would be controlled in the same manner as routine instrument flight rules traffic.

F.2.2 Alternative 1 – Horizontal Launch Vehicles Only

Under this alternative there would be no vertical launches. Even though the Proposed Action would not significantly impact the regional airspace, there would be even less impact in this alternative because there would be less use of the airspace.

F.2.3 Alternative 2 – Vertical Launch Vehicles Only

Under this alternative there would be no horizontal launches and there would be fewer aircraft flights. Even though the Proposed Action would not significantly impact the regional airspace, there would be even less impact in this alternative because there would be less use of the airspace.

F.2.4 No Action Alternative

Under the No Action Alternative, Spaceport America would not be constructed and operated. Use of the regional airspace would continue at its current levels for the foreseeable future. Airspace in the region would continue under WSMR restrictions.

F.3 Cumulative Impacts

The cumulative impacts of Spaceport America activities on regional airspace would be minimal. No new restricted airspace would be required and operations into Spaceport America would be controlled in the same manner as routine instrument flight rules traffic.

F.4 Mitigation

Because the impacts on regional airspace would be minimal, no mitigation measures would be necessary.

REFERENCES CITED

FAA (Federal Aviation Administration) 2005. Final Programmatic Environmental Impact Statement for Horizontal Launch and Reentry of Reentry Vehicles. Available at http://www.faa.gov/about/office_org/headquarters_offices/ast/licenses_permits/media/Final_FAA_PEIS_Dec_05.pdf.

APPENDIX G
HEALTH AND SAFETY

G.1 Affected Environment

G.1.1 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 general public. Overall public health and safety is controlled by a host of legislation that regulates transportation of hazardous cargo, provides for the protection of workers in the work place, protects the public from exposure to hazardous materials, and provides for emergency preparedness.

G.1.2 Regulatory Setting

The primary objective of the FAA's 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. The FAA licenses, regulations, and approvals are discussed in Section 1.5.

OSHA regulations 29 CFR Part 1910 (Occupational Safety and Health Standards) and Part 1926 (Safety and Health Regulations for Construction) would apply to all construction and operational activities at the proposed Spaceport America. Also applicable are the FAA regulations at 14 CFR Parts 400-450, which include the various commercial space transportation licensing programs of the FAA. DOT Hazardous Materials Regulations, 49 CFR Parts 171-173 (Hazardous Materials Safety) also would apply to the transport of hazardous materials by roadway vehicles.

The Emergency Planning and Community Right-to-Know Act (EPCRA, 42 U.S.C. 11001 et seq.) also is applicable. This national legislation on community safety was designated to help local communities protect public health, safety, and the environment from chemical hazards. To implement EPCRA, Congress required each State to appoint a State Emergency Response Commission. New Mexico's Commission is within the NM Department of Public Safety.

State regulations that would apply are contained in 11.5 NMAC, Occupational Health and Safety, particularly parts 11.5.2 (General Industry) and 11.5.3 (Construction Industry). There are no State regulations that apply to launch-specific health and safety considerations.

G.1.3 Region of Influence

The proposed Spaceport America location is exposed to risks from WSMR launch operations. WSMR has agreements with surface owners and lessees of land along its western and northern boundaries to "call-up" the land when needed for testing within the range. Under these agreements, owners and lessees are required to vacate these range extensions (the so-called call-up zones) on 24-hour notice to accommodate testing requirements. They are compensated for their expenses associated with these evacuations. In addition to firing rockets on WSMR, the range has developed launch facilities for long-range testing in other areas of New Mexico, Utah, and Idaho. In these tests, the missiles are fired from the remote location to impact on WSMR.

G.1.4 Existing Conditions

The location of the proposed Spaceport America lies within the Abres 4A Extension Call-up Area. Exhibit G-1 shows the WSMR call-up areas. As indicated in this map, most of lands west of WSMR are already subject to rocket launch risks to the degree that these areas may be evacuated (or "called up") up to 24 times each year. The actual number of times these areas have been "called up" in recent years has not been released by WSMR.

G.2 Environmental Consequences

Health and safety consequences would apply to three groups of people:

- On-site (persons involved in Spaceport America construction and operation, including visitors involved directly in operations, such as the FAA monitors and space flight participants),
- Visitors (members of the public at the proposed Spaceport America spectator area or in the viewshed of Spaceport America launches and events), and the
- General public (persons in surrounding areas not visiting the proposed Spaceport America).

Persons on-site could be exposed to potential hazards from construction activities, launch operations, and non-launch operations. These hazards would be minimized by following OSHA, the FAA, NASA, DOT, and State applicable regulations and guidelines. Hazards to visitors could result from launches, airspace operations, and some X Prize Cup activities, such as static rocket firings. These hazards would be minimized by strict safety and distance policies. There could be risks to the general public from launches, as launches could potentially affect areas many miles away in cases of catastrophic accidents.

For the reasons above, this discussion primarily addresses those activities that could affect the health and safety of visitors and the general public. Specific health and safety consequences from construction and operation of Spaceport America are discussed below for the proposed and alternative actions.

G.2.1 Proposed Action

In addition to the health and safety impacts presented below, the increased traffic resulting from construction and operation of the proposed Spaceport America could impact public health and safety due to an increase in the number of traffic accidents. Traffic accidents are analyzed separately in Appendix H.

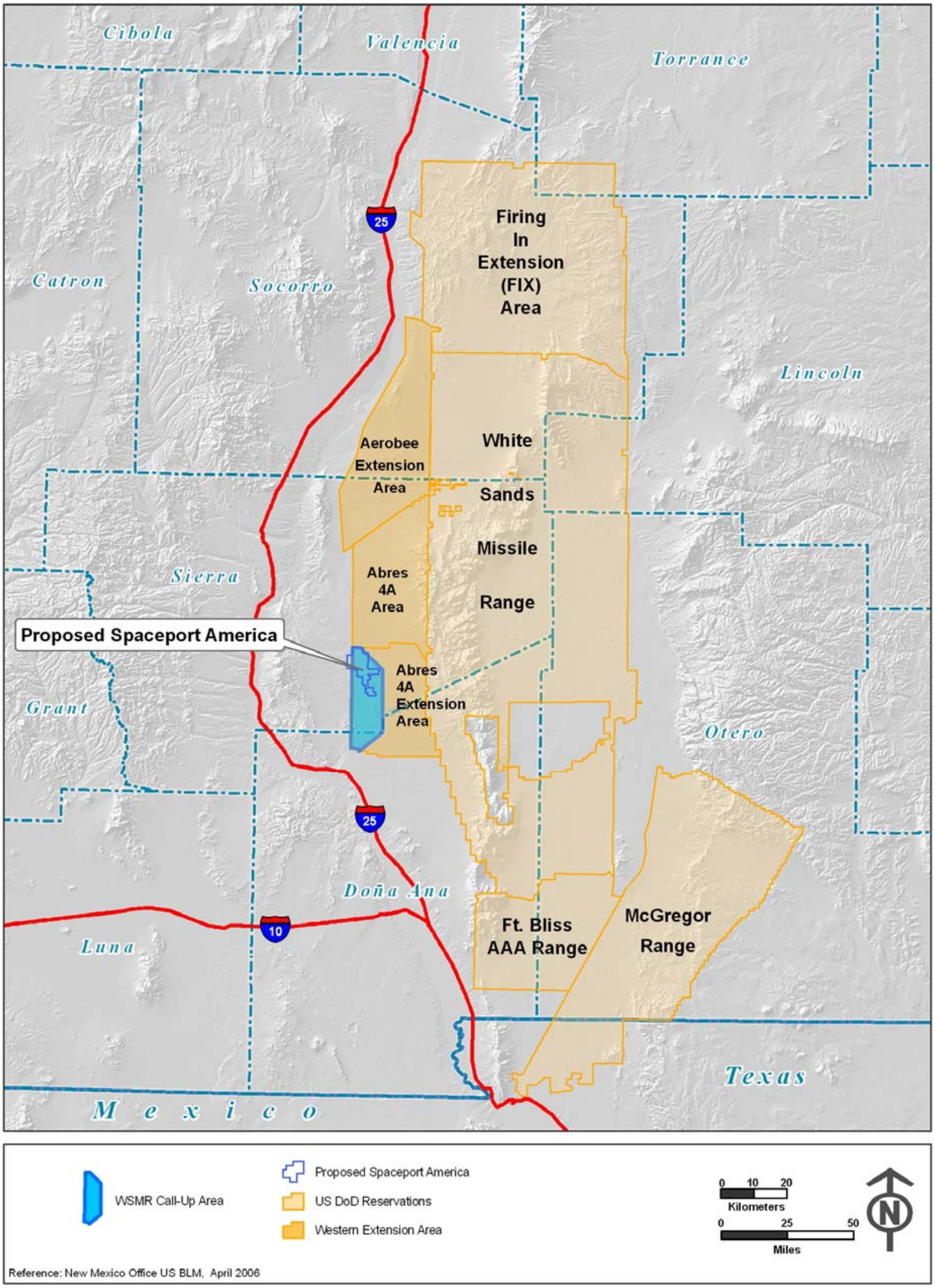
G.2.1.1 Hazard Analyses

Per FAA regulations (14 CFR 420), the ability to perform hazard analyses would be required at Spaceport America.

Chemical Hazards

For chemical hazards under normal operating conditions, or for foreseeable emergencies, this would be accomplished using chemical information, job hazard analysis, and chemical hazard analysis techniques. These are narrowly defined techniques whereby potential hazards are

Exhibit G-1. Location of Spaceport America within the WSMR Call-up Area



identified by examining elements of individual work tasks. Typically, these methods are useful for protecting the work force and demonstrating compliance with OSHA safety and health standards. In addition, they reveal information about chemical wastes that would be subject to EPA waste disposal regulations and to the EPCRA. Job hazard and hazardous chemical analyses would occur at the inception of Spaceport America and would be continually updated as the facility matures.

OSHA's Process Safety Management of Highly Hazardous Chemicals Standard (29 CFR 1910.119) mandates a systematic examination of "critical processes" as a whole. A critical process is a term used by OSHA to define processes that use large amounts of chemicals or chemicals that potentially are dangerous. Process safety management is a proactive approach that targets processes and operations that have the potential to cause a catastrophic incident. This standard would be implemented to prevent or mitigate chemical releases that could lead to a catastrophe in the workplace and possibly to the surrounding community. Possible examples at Spaceport America where this standard would apply include

- Fuel storage and refueling,
- Propellant storage and loading/unloading,
- Handling flight hardware, and
- Launch and recovery operations.

Systems Safety Engineering

Another form of hazard analysis is systems safety engineering. Generally, systems safety engineering would be applied to complex systems such as spacecraft design and procedural controls. Spaceport America would employ systems safety engineering techniques to design, equip, and operate the Spaceport America facility. The systems safety concept is defined by Roland and Moriarty (1983) as

> "…the application of special technical and managerial skills to the systematic, forward-looking identification and control of hazards throughout the life-cycle of a project, program, or activity. The concept calls for safety analyses and hazard control actions, beginning with the conceptual phase of a system and continuing through the design, production, testing, use, and disposal phases, until the activity is retired."

Examples at Spaceport America where systems safety engineering would be applied include:

- Launch facility design and operations,
- Launch facility and launch vehicle system interfaces,
- Routine and non-routine launch procedures,
- Emergency preparedness planning,
- Range safety planning,
- Launch and recovery planning, and
- Accident investigations.

G.2.1.2 Emergency Preparedness

Security, fire, safety, and emergency response capabilities would be provided by NMSA for operational activities. NMSA may enter into contracts with these service providers, or may rely on local police and fire departments. Spaceport America would provide, either by contract from off-site sources or by developing this capability on-site, a local firefighting capability in case of accidents on the airfield or the vertical launch pads, as well as suppression of wildfires caused naturally or by accidents. Whichever options are selected, such capabilities would be present at Spaceport America to handle emergencies.

G.2.1.3 Construction Activities

Components to be constructed include roads, utilities, concrete pads, a runway, various types of buildings, and fuel and propellant storage facilities. Construction would also entail activities at a borrow pit, quarry, and concrete batch plant, all in the proposed Spaceport America vicinity. Visitors and the general public (as defined above) would not be exposed to health and safety hazards at Spaceport America unless they intentionally and without permission went to construction sites. On-site persons would have to follow all applicable health and safety regulations. The general public would not be subjected to health and safety risks at the Spaceport America site as a result of construction activities.

G.2.1.4 Launch Operations

Commercial operators proposing to launch from Spaceport America must receive a mission license from the FAA prior to launch. Reusable launch vehicle operators must meet the safety requirements outlined in 14 CFR Part 431. Operations conducted under an Experimental Permit must comply with the requirements outlined in 14 CFR Part 437.

Risks Associated with Falling Debris Outside of Spaceport America Area

A potential impact to the general public outside Spaceport America area would be falling debris. Falling debris could result from a catastrophic failure after a launch vehicle has moved well away from the launch site, including failures during the descent phase. The proposed Spaceport America site is in an extremely sparsely populated area and would have vertical launch trajectories directed toward and over WSMR. Safety requirements would be met as part of the FAA licensing process.

Vertical concept vehicles could travel east from a Spaceport America launch pad to land within WSMR. There are currently no persons living immediately east of the proposed Spaceport America, although there could be persons visiting the area. Persons within WSMR would be notified of Spaceport America launches and would evacuate the recovery area according to the FAA and WSMR standard safety procedures for launches.

Risks Associated with Horizontal LV Failures within Spaceport America

Concept H1 and H3 vehicles could take off from Spaceport America airfield under jet power and would pose no greater risk than jet aircraft. Although Concept H2 vehicles would take off under rocket power, there are only two such launches estimated per year. Horizontal launches are inherently less risky than vertical launches because the vehicles are under manned guidance control during launch, and engines (both jet and rocket) can be throttled down or turned off if necessary to abort a launch. Once launched, this ability to control engine thrust would also allow an early abort of a launch.

Risks Associated with Vertical LV Failures within Spaceport America

A catastrophic failure of a vertical launch vehicle at or immediately following launch could occur on the pad, or after the vehicle has traveled several miles before impacting the ground. The FAA must issue a launch license or experimental permit for a specific type of launch before any launches could occur at Spaceport America, and a safety analysis would be required to obtain this license.

The types of persons who could be affected by a failure are outlined in Exhibit G-2. The type of persons, their locations, and distances from the closest and farthest vertical launch pads are outlined in the exhibit. These are the shortest distances, based on the proposed site layout. The closest persons not directly participating in the launch would be more than four miles northwest of the launch pad, and launch trajectories would be to the east.

Exhibit G-2. Locations of Persons and Shortest Distances to Vertical Launch Pads

Type of Persons	Location	Distance from Launch Pad 3 (Closest Pad)	Distance from Launch Pad 1 (Farthest Pad)
Launch personnel	Vertical launch area control center	0.56 miles	0.47 miles
Other Spaceport America personnel	Airfield facilities area	4.64 miles	5.40 miles
General public	Spectator area	4.83 miles	5.68 miles

Exhibit G-2 does not include members of the public outside of Spaceport America boundaries. Launches would not take place if the FAA risk criteria would be exceeded. All members of the public would be included in this analysis.

Risks Associated with Launch Vehicle Propellants

Impacts to the atmosphere from launch operations, including rocket exhaust products and accidents, are discussed in Section 4.6 and are considered to be not significant. Members of the public and uninvolved workers would never be permitted close enough to propellant loading operations or to a fueled vehicle to be in danger. The separation distance between non-launch personnel and vertical launch pads (more than three miles) would prevent exhaust products from having health consequences. If strong winds were blowing from the launch pad toward the airfield and spectator areas, the launch would not take place. Horizontal launches would be almost exclusively jet powered, with risks typical of commercial jets taking off at airports.

G.2.1.5 Non-Launch Operations

Non-launch operational activities that may potentially have health and safety consequences are discussed in this section.

Risks Associated with Potential Impacts on Air Quality

Several types of non-launch operations could potentially affect public health and safety by producing air pollutants. The activities and sources at Spaceport America that may potentially emit air pollutants include:

- Static test firing of rocket engines,
- Fuel and propellant storage and handling,
- Airfield and airspace operations, and
- Miscellaneous air pollutants.

The environmental consequences on air quality from these sources are discussed in Section 4.6.

Risks Associated with Airspace Operations

Horizontal launches and landings, which would use the proposed Spaceport America airfield, are discussed in Section G.2.1.4. Risks discussed here are those from normal (non-X Prize Cup) airspace operations by conventional aircraft. Neither general aviation nor regularly scheduled commercial aircraft would use the proposed Spaceport America airfield. Any risks to airfield staff would be minimized by following standard airport safety procedures. Risks to the general public or visitors would be extremely small and would be similar to a small airport located in an unpopulated rural environment.

Risks Associated with the Annual X Prize Cup

As many as 20,000 visitors per day are estimated to attend the annual seven-day X Prize Cup. Activities predicted to occur include horizontal and vertical launches, rocket racing, static rocket test firings, flight demonstrations, various exhibitions, and concessions. There are risks associated with any type of event in which large numbers of people converge on a single point. Every effort would be made by Spaceport America and the event managers to avoid any activities with significant risk to these visitors. Also, these visitors would be aware of the planned event activities, and would be going to the event to participate in those activities. None of the activities would cause significant risk to members of the general public not attending the event. If the risk associated with an activity were significant to either visitors or the general public, the activity would not take place.

G.2.1.6 Summary of Impacts of the Proposed Action

Persons working at Spaceport America would be exposed to potential hazards from construction activities, launch operations, and non-launch operations. These hazards would be minimized by following OSHA, the FAA, NASA, DOT, and State applicable regulations and guidelines. Also, Spaceport America policies and procedures manuals would be written to minimize health and safety risks. Hazards to visitors could result from launches, airspace operations, and some X Prize Cup activities, such as static rocket firings. These hazards would be minimized by strict safety and distance policies. There would be risks to the general public from launches, as launches could potentially affect areas many miles distant in cases of catastrophic accidents. Other hazards to the general public would be increased risk of traffic accidents due to increased Spaceport America-related traffic and risk of exposure to hazardous materials from trucks transporting fuel and propellants to and from Spaceport America (see Section 4.9).

During construction, on-site persons would have to follow all applicable health and safety regulations. The general public would not be subjected to health and safety risks at Spaceport America site as a result of construction.

Although there would always be risks associated with launches, the goal of the FAA, as issuer of the launch site operator license to Spaceport America and launch licenses to launch operators, is to make all efforts to minimize this risk. The key element in reducing risks from launches is extensive hazards analysis prior to issuing a launch license. Neither the FAA nor Spaceport America would allow a launch that exceeded risk thresholds. At a vertical launch, on-site launch personnel would be at least 0.47 miles away from the launch pad, and since all other persons would be more than four miles from the pad, the probability that a vertical launch would injure persons would be extremely low. Horizontal launches planned for Spaceport America would almost exclusively involve jet-powered takeoffs, which are similar to commercial jet aircraft takeoffs. The two Concept H2 (rocket powered takeoff) launches estimated each year would be limited to eastward takeoffs to avoid crossing over County Road A013 to the west, if deemed necessary.

G.2.2 Alternative 1 – Horizontal Launch Vehicles Only

Although already low, risks to health and safety would be reduced because the vertical launch area would not be constructed, there would be no vertical launches or storage of vertical LV propellants, and traffic would be decreased because of fewer staff and visitors at Spaceport America and fewer attendees at the X Prize Cup events. Also, since most launch accident scenarios involve vertical launches, risks from launch accidents would be reduced to near zero.

G.2.3 Alternative 2 – Vertical Launch Vehicles Only

Although already low, risks to health and safety would be reduced because the airfield area and facilities would be smaller (less construction), airspace operations would be less, there would be no horizontal operations or storage of horizontal LV propellants, and traffic would be decreased because of fewer staff and visitors at Spaceport America and fewer attendees at the X Prize Cup events.

G.2.4 No Action Alternative

Under this alternative, Spaceport America would not be developed and there would be no risks associated with the Project to either workers or the public. The area would continue, however, to be exposed to risks from WSMR launch operations.

G.3 Cumulative Impacts

Persons working at Spaceport America would follow all OSHA, the FAA, NASA, DOT, and State applicable regulations and guidelines. In addition, Spaceport America operating procedures would be developed that govern how the facility would be operated to ensure public safety and safety of property according to the FAA mandates. No cumulative health and safety impacts are expected from the Proposed Action.

G.4 Mitigation Measures

Hazards to visitors that could result from launches, airspace operations, and X Prize Cup event activities such as static rocket firings would be minimized by strict safety and distance requirements.

REFERENCES CITED

Roland, H. E., and B. Moriarty. 1983. System Safety and Engineering Management, Wiley-Interscience Publications, John Wiley & Sons, New York, 1983.

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APPENDIX H
TRAFFIC AND TRANSPORTATION

H.1 Affected Environment

H.1.1 Definition and Description

Transportation as a resource relates to the manner in which goods, equipment, and people move to and from an area of interest. Transportation would include all anticipated means such as transportation via vehicles on roads and highways, rail transportation, and airplane transportation. Traffic refers to the number of vehicles, trains, and airplanes utilizing the roads and highways, rail lines, and airspace and take-off/landing facilities.

H.1.2 Regulatory Setting

The Department of Transportation regulates transport of hazardous materials in 49 CFR Parts 171-179; however, there are no regulations affecting traffic other than local and State ordinances restricting speed and other vehicle operation parameters.

H.1.3 Existing Conditions

H.1.3.1 Region of Influence

The proposed spaceport would be located in south-central New Mexico in Sierra County about 45 miles north of Las Cruces and 30 miles southeast of Truth or Consequences. Interstate 25 traverses north-south, passing through Truth or Consequences and ending in Las Cruces. Interstate 10 lies south of the proposed site and, from the western side of New Mexico, passes through Lordsburg and Deming to Las Cruces and then turns south to El Paso, Texas. State roads in the area are to the west of Interstate 25 and State Road 51, which lies to the east of Interstate 25 and connects Engle, north of the proposed spaceport, to Interstate 25. Exhibits 2-1 and 2-2 show the counties, cities, towns, and roadways in the vicinity of the proposed Spaceport America. Exhibit H-1 provides the latest available traffic counts for these roads.

Exhibit 2-2 shows the roads in the nearby vicinity of the proposed spaceport. In the proposed spaceport area, the roads are unpaved, and the current vehicular traffic is low. The main road consists of a series of connecting Doña Ana County roads in the south (E070, E071, and E072) and Sierra County Road A013 in the north. This gravel-based and dirt north/south road system connects I-25 at the south to Engle at the north. Sierra County Road A013 is classified as a rural minor arterial road. Traffic counts are not available for this road; however, daily traffic on the road is primarily from persons traveling to and from five residences along the road, and is estimated at 20 vehicles daily (Dustin, 2007; Spalding, 2007).

As discussed in Section 2.1.2.5, the New Mexico Department of Transportation (NMDOT) has plans to improve this roadway. In the immediate future, a section of County Road A013 from its intersection with County Road A039 (the Spaceport America entrance road) northward would be chip-sealed and drainage improvements installed. The NMDOT plans to pave the road and install shoulders from Engle on the north to Rincon at Interstate 25 on the south. The NMDOT received funding for paving and associated improvements from the New Mexico legislature that calls for the completion of the Project by the end of 2010 (NM, 2007).

Exhibit H-1. Average Daily Traffic for Roads in the Vicinity of the Proposed Spaceport America

County	Roadway	2004 Annual Average Daily Traffic
Doña Ana	Interstate 25 just north of Las Cruces	6,970
Doña Ana	Interstate 10 just west of Las Cruces	17,586
Luna	State Road 26 nearly at the Doña Ana County line	2,208
Sierra	Interstate 25 just south of Truth or Consequences	7,459
Sierra	State Road 27	80
Sierra	State Road 51 between Engle and Truth or Consequences	198
Sierra	State Road 52	481
Sierra	State Road 142	138
Sierra	State Road 152	561

Sources: NMDOT (2007a, b, and c)

The Burlington Northern Santa Fe railroad main line parallels Sierra County Road A013 through most of the county (see Exhibit 2-2) and is approximately 1.6 km (2.5 miles) west of the proposed spaceport. Train stations exist at Doña Ana and Las Cruces.

Commercial international airports are located at Las Cruces and El Paso and a regional airport is located to the east near Alamogordo, the Alamogordo-White Sands Regional Airport.

H.1.3.2 Spaceport America Site

All of the roads at the proposed site are unpaved. County Road A039 connects County Road A013 to the spaceport site. The spaceport site is crossed by a portion of County Road A021 and existing ranch roads.

The airspace around and above the proposed Spaceport America is within WSMR-restricted airspace that is normally closed to general and commercial aviation. Operations in WSMR-restricted airspace would be subject to applicable laws, regulations, policies, and procedures.

H.2 Environmental Consequences

Construction of the proposed spaceport and its subsequent operation would increase traffic in the area. Impacts from increased traffic include air emissions from vehicle exhaust, noise, traffic congestion, road deterioration, traffic accidents, and exposure to hazardous materials following accidents. Methods for evaluating the impacts of vehicle exhaust are applicable to areas with population densities of greater than 3,300 persons per square mile The proposed Spaceport

America site is a sparsely populated rural area; the nearest urban area in the vicinity (Las Cruces) has a population density of 52 persons per square mile (USCB, 2007).

The Proposed Action includes improvement of existing County Road A039 and construction of roads on-site. County Road A039, which connects to County Road A013 and provides access to Spaceport America Project site, would be widened and paved. A primary road and a network of secondary roads would be constructed on-site. Roads would either be paved or gravel, and all would be capable of supporting heavy truck traffic. Road construction would be completed during Phase 2 of construction. Exhibits 2-2 and 2-15 show the existing off-site roads and the planned on-site roads.

H.2.1 Proposed Action

H.2.1.1 Construction

The roads in the vicinity of the proposed spaceport would be used by commuting workers and for delivery by truck of construction materials and equipment. Exhibit H-2 shows estimated traffic levels along this road system for construction based on the peak number of construction workers (see Section 4.10) and delivery of materials and equipment. Traffic was estimated based on the assumption that workers would carpool (two persons per vehicle) and vanpool. This assumption is based on experience at a similar remote construction site in the region.

Exhibit H-2. Estimated Traffic Levels (both directions) attributable to Spaceport America based on peak employment levels

	Traffic Level (vehicles/hour)							
	Phase 1 Construction		Phase 2 Construction		Operations		X Prize Cup	
Vehicle Type	Peak	Off-peak	Peak	Off-peak	Peak	Off-peak	Peak	Off-peak
Automobile	168	16	27	4	7	3	5	3
Van or Bus	12	0	5	0	6	3	211	200
Medium Truck	2	2	1	2	1	1	16	7
Heavy Truck	9	6	2	2	1	1	1	3
Water Truck[a]	1	2	1	0	0	1	1	2

Source: Spalding and Gutman, 2008

Peak hours 7 to 8 am, 5 to 6 pm; off-peak hours, 8 am to 5 pm

[a] If wells are not installed, but water is trucked in 4,000-gallon tank trucks.

An estimated total of 309 vehicles per day would travel to and from Spaceport America during peak Phase 1 construction. All of this traffic would use County Road A013. It was assumed that 70 percent of the construction workforce would commute from the north and the remainder from the south. This is consistent with the residencies of the workers that were used in the socioeconomic analysis (see Sections 3.10 and 4.10). Concrete trucks were assumed to originate in Truth or Consequences, thus they would be coming from the north. It is assumed that water trucks would be coming from the well near Rincon, thus they would be coming from the south. Other deliveries were assumed to originate in equal proportions from the north and the south.

Roadway traffic is classified by the ability of drivers to maneuver, and the maintenance of the traffic flow. Movement on roads with a Level of Service (LOS) A is described as free-flowing at or above the posted speed limit. LOS B may limit lane changes, but does not reduce speed. LOS C and D are progressively more congested. LOS E provides marginal service, and usually occurs on roads servicing traffic beyond their design capacity. Traffic flow is irregular, speed varies rapidly, but the speed limit is rarely reached. The Highway Capacity Manual published by the American Association of State Highway and Transportation Officials indicates that a paved rural roadway at the C to D level of service would have a design capacity of 1,000 to 1,200 vehicles per lane per hour average (CADOT, 2001). This design capacity is not only for a paved road, it also would not account for other less optimum conditions such as narrow crossings. This design capacity indicates that the capacity of County Road A013 would be less, but not how much less. The peak hour traffic per lane would be approximately 134 vehicles or 13 percent of the lower range of design capacity of a paved road in good condition. NMDOT plans to complete paving the road and installing shoulders by the end of 2010.

The increased traffic would increase risk of accidents. NMDOT crash information was used to calculate crashes, injuries, and fatalities. The number of accidents that would be attributed to Spaceport America construction traffic was estimated for vehicle traffic of 3.17 million miles per year based on average traffic levels per phase of construction with the vehicles originating in Truth or Consequences or Las Cruces as discussed above for 260 working days per year. Using the accident rates and this mileage, the number of crashes, injuries, and fatalities were estimated and are presented in Exhibit H-3.

Exhibit H-3. Traffic Accident Rates and Estimated Increase in Traffic Accidents Based on Average Traffic Levels

Statistic	Rate per 100 Million Vehicle Miles[1]	Increase in Accident Statistics Per Year			
		Phase 1 Construction	Phase 2 Construction	Operations	X Prize Cup
Fatalities	2.04	0.06	0.02	0.041	0.008
Injured persons	101	3.18	1.06	2.00	0.414
Crashes	205	6.49	2.17	4.08	0.844

[1] Source: NMDOT, 2006

Hazardous materials would be transported to Spaceport America during construction. The materials include fuel for the construction equipment, compressed gases used in construction, and paints and epoxies. All hazardous materials transport would meet DOT Hazardous Materials Regulations, 49 CFR Parts 171-173. The shipments would be in DOT-approved packages and containers and meet the DOT requirements including packaging design, marking, labeling, and placarding for shipment over public roadways. As further detailed below in the operations discussion, the transportation of these materials poses a very small risk to the public and workers during transportation based on DOT statistic of accidents involving hazardous materials.

H.2.1.2 Operations

Section 4.10 indicates that peak direct operational employment at Spaceport America would be 100 workers in 2013. During operations, NMSA plans to encourage or require workers, passengers, and guests to access Spaceport America in vans or buses. Therefore, it was assumed that 25 percent of the workforce would commute in vehicles carrying only the driver and that the remainder would commute in 15-passenger vans. The estimated number of vehicles per hour is presented in Exhibit H-2. This yields a total of 51 vehicles per day traveling to and from Spaceport America. All of this traffic would use County Road A013, with 50 percent of the traffic coming from the north and 50 percent from the south. The traffic level for the south bound lane of County Road A013 during the peak morning hour is estimated at 8 vehicles and the same for the north bound lane during the peak afternoon hour.

The increased traffic could lead to increased traffic accidents and associated injuries and fatalities. Exhibit H-3 presents the estimated fatalities, injuries, and crashes based on the 2005 New Mexico traffic statistics and 1.99 million total miles driven by vehicles coming to and from Spaceport America.

X Prize Cup. It was assumed that by 2013 approximately 20,000 visitors per day would attend this event. The attendees would be bused to Spaceport America from a central parking location near the city of Hatch or the city of Truth or Consequences. The buses would access Spaceport America via County Road A013 from the north or south. The maximum number of roundtrips is estimated at 400 with an hourly maximum of 200 busses traveling to the spaceport (DMJM Aviation, 2007). For annual X Prize Cup events, a larger workforce would be required and is estimated to be 350 (Spalding and Gutman, 2008). It was assumed that approximately 60% of workers would commute in 50-passenger vehicles (4 buses), 30% in 15-passenger vehicles (7 vans), and the remainder in vehicles would carry only the driver (35 automobiles). The peak hour traffic on A013 would be 217 vehicles or 23 percent of the design capacity. (Design capacity is discussed in Section H.2.1.1).

The increased traffic on X Prize Cup days would increase the risk of accidents. The buses would either arrive at the site from the north or south originating in either the city of Hatch or the city of Truth or Consequences. The maximum one-way mileage is 66 miles (DMJM Aviation, 2007). Assuming a seven-day event with the maximum number of buses coming to the site using the route with the most miles along with the larger workforce and delivery vehicles originating half in Truth or Consequences and half in Las Cruces, the total estimated mileage would be 660,000 miles, which could potentially lead to 1 crash, 0.4 injuries, and 0.008 fatalities (Exhibit H-3).

Trucks would be needed during operation of Spaceport America to transport hazardous materials. During operations, these hazardous substances would include jet fuel, aviation gasoline, and various rocket propellants as discussed in Section 2.1.3.2. All hazardous materials transport would meet U.S. DOT Hazardous Materials Regulations, 49 CFR Parts 171-173. The shipments would be in DOT-approved packages and containers and meet the DOT requirements including packaging design, marking, labeling, and placarding for shipment over public roadways. Incompatible rocket propellants (i.e., an oxidizer and fuel) would not be shipped together in the same or nearby trucks traveling in the same caravan. Solid propellant and hybrid rocket fuel (HTPB or rubber) would be shipped pre-assembled in their rocket motor casings, which would provide additional shielding in case of fire.

Shipment of hazardous materials is very commonplace. The DOT estimates that there are more than 800,000 hazardous materials shipments (by all modes of transportation) per day in the U.S. (DOT, 1998). From 1997 through 2006, the number of accidents on the nation's roadways that involved hazardous materials ranged from 267 to 357 per year. (DOT, 2007) Based on DOT statistics, the risk of any one shipment of hazardous material being involved in a vehicular accident is about 1 out of 950,000.

H.2.1.3 Summary of Impacts from the Proposed Action

The congestion on County Road A013 is estimated to peak during Phase 1 construction with 134 vehicles per lane during the peak hour of commuting. This level of traffic on County Road A013 would lead to slow-downs and likely short-term backed-up traffic close to the Spaceport America entrance. As indicated in Section H.1, traffic counts are not available for County Road A013, but the number of vehicles is estimated to be 20 per day. The number of Spaceport American-related vehicles traveling the road during Phase 1 construction, when the road improvements would not be complete, is estimated at 309 vehicles. As described in Section H.1, County Road A013 is unpaved and narrow at several points. County Road A013 would be expected to experience some deterioration until it has been improved by the NMDOT. As stated in Section H.1, the NMDOT plans to pave the road from Engle on the north to Rincon on the south by the end of 2010. Traffic congestion would increase while NMDOT is working on the road. Traffic would be less during Phase 2 construction and during operations except during X Prize Cup. However, traffic congestion during the X Prize would be minimized by the improved road and the use of buses to transport attendees and the majority of the workers.

The primary and secondary roads on-site and the improved County Road A039 would allow the roads to support Spaceport America traffic and deterioration would be normal wear and tear.

A member of the general public driving the roads to and from Spaceport America, but for reasons other than going to or from the spaceport, would be exposed to a higher risk of a traffic accident because there would be more traffic than currently exists. However, the estimated number of accidents is low. The transportation of hazardous materials also carries risk; however, through the application of DOT requirements, the risk of accidents involving hazardous materials is very low.

H.2.2 Alternative 1 – Horizontal Launch Vehicles Only

Under this alternative the impacts to traffic and transportation would be less than the Proposed Action because the vertical launch area would not be constructed. The number of construction workers would decrease and there would be fewer staff during operations. The vehicles delivering supplies during construction and operations would also decrease. The quantity of hazardous materials shipped to Spaceport America would also decrease. Moreover, fewer attendees at the X Prize Cup would also likely be the result of this alternative.

H.2.3 Alternative 2 – Vertical Launch Vehicles Only

Under this alternative the impacts to traffic and transportation would be less than the Proposed Action because the airfield area and facilities would be smaller (less construction), operations staff would be fewer and there would be fewer operations activities requiring supplies including horizontal vehicle propellants. Also, fewer attendees at the X Prize Cup would be expected.

H.2.4 No Action Alternative

In this alternative, Spaceport America would not be constructed or operated and the existing traffic and transportation conditions would continue.

H.3 Cumulative Impacts

As discussed in above, Spaceport America would be accessed by Sierra County Road A013, which is currently a gravel-based road that is used on a daily basis by five families with residences along the road. The road is used occasionally by railroad and county employees. An estimated average 20 vehicles use County Road A013 on a daily basis (Dustin, 2007; Spalding, 2007). The estimated increase in the number of vehicles that would travel County Road A013 north of the Spaceport America entrance during peak construction and peak operations is 309 and 51, respectively. Peak hourly traffic would occur during commuting times and the number of vehicles on County Road A013 north of Spaceport America entrance is estimated at 134 during peak construction. The NMDOT has existing plans to pave and install shoulders on County Road A013 (see Section 2.1.2.5) and funding is available for this Project (NM, 2007). Spaceport America traffic would be a large increase over the existing traffic and the current users of the road would experience increased traffic and congestion during the peak hour. The road work would further lead to traffic congestion on a temporary basis.

H.4 Mitigation

The greatest measure to mitigate the increased traffic that would be a consequence of the construction and operation of Spaceport America would be completion of the NMDOT's plan to pave and install shoulders on Sierra County Road A013, the road that provides access to the site from Interstate 25 and the city of Truth of Consequences. To mitigate traffic congestion prior to completion of the roadwork, NMSA would implement mitigation measures such as staggered shifts and vanpools as needed.

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APPENDIX I
CALCULATIONS OF EMISSION LOAD FROM CONSTRUCTION AND OTHER NON-LAUNCH ACTIVITIES

This appendix presents the methods, assumptions, and inputs used to calculate emissions of substances into the atmosphere from construction and similar non-launch activities. These sources are combined because they are analyzed by common emission factor methods for both construction and operational activities. The non-launch activities include all roadway and non-road vehicle use, industrial engines, surface coatings, and propane combustion. All of these activities would occur during construction and operation. Fugitive dust from vehicles and construction activities are included in this section.

There are three types of emissions that affect the ambient air quality, which is regulated by the Environmental Protection Agency (EPA) in the air below 3,000 feet above ground level. These types are:

- Fugitive dust: particulate matter produced indirectly by disturbance of the ground
- Criteria pollutants: ambient air pollutants whose levels are regulated by EPA and State codes; these include SO2, CO, NO2, ozone precursors (NO2 and VOC), PM, and Pb.
- Air Toxics, or Hazardous Air Pollutants (HAPs), that may be injurious to human health above certain concentrations

This appendix explains the methodology used to estimate emissions of fugitive dust, other criteria pollutants, HAPs, and CO2 from Spaceport America construction and similar non-launch activities.

I.1 Emission Factor Methods Used

Emission factors are applied to estimate air emissions. An emission factor is defined in the introduction to the EPA AP-42 document (EPA, 1995) as follows.

> An emission factor is a representative value that attempts to relate the quantity of a pollutant released to the atmosphere with an activity associated with the release of that pollutant. These factors are usually expressed as the weight of pollutant divided by a unit weight, volume, distance, or duration of the activity emitting the pollutant (e.g., kilograms of particulate emitted per megagram of coal burned). Such factors facilitate estimation of emissions from various sources of air pollution. In most cases, these factors are simply averages of all available data of acceptable quality, and are generally assumed to be representative of long-term averages for all facilities in the source category (i.e., a population average).

Emission factors for a large number of activities are provided by the EPA through two methods. Non-fugitive dust emission factors for roadway vehicles (those that travel on paved or unpaved roads or surfaces) and non-road vehicles (including construction engines and equipment) are generated by software models due to the complexity of the inputs, the databases of vehicle inventories by State, and the huge number of emission factors possible. These factors include engine and exhaust emissions as well as other sources, such as release of fuel vapors during fueling and PM from brakes. All other emission factors are provided in the EPA document “AP-

42, Fifth Edition, Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources" (EPA, 1995), hereafter referred to simply as "AP-42".

Potential construction and related non-launch emission sources at the proposed Spaceport America were identified. These emission sources and the methods that provided the appropriate emission factors and equations are shown in Exhibit I-1.

Exhibit I-1. Construction and Similar Non-Launch Emission Sources and Emission Factor Methods Used

Emission Source	Emission Factor Method
Particulate Matter from Fugitive Dust	
Unpaved public roads	AP-42 13.2.2
Paved public roads	AP-42 13.2.1
Pile drop operations	AP-42 13.2.4
Heavy construction operations	AP-42 13.2.3, 11.9
Concrete batching	AP-42 11.12 (also includes Pb emissions)
Crushed stone processing and construction sand & gravel processing	AP-42 11.19.2
Other Criteria Pollutants	
Gasoline and diesel industrial engines	AP-42 3.3
Nonindustrial surface coatings	AP-42 4.2.1 and related document EIIP[1], Vol. 3, Chap. 3, Architectural Surface Coating (Nov. 1995)
Asphalt paving operations[2]	AP-42 4.5 and related document EIIP, Vol. 3, Chap. 17 Asphalt Paving (Jan. 2001)
Liquefied petroleum gas combustion (propane only)	AP-42 1.5
Roadway vehicles	Mobile 6.2 model
Non-road vehicles	NONROAD model; Core Model Ver. 2005a, Feb 2006; NONROAD Reporting Utility, Version 2005c

[1] Emission Inventory Improvement Program Document Series; available at the EPA web site.
[2] Asphalt paving emissions are not included in this analysis; see text below for discussion.

I.2 Use of NMIM and the NCD

The National Mobile Inventory Model (NMIM) was used in these analyses as a source of data and methodologies. The NMIM home page states the following about this model:

> The National Mobile Inventory Model (NMIM) is a free, desktop computer application developed by EPA to help you develop estimates of current and future emission inventories for on-road motor vehicles and nonroad equipment. NMIM uses current versions of MOBILE6 and NONROAD to calculate emission inventories, based on multiple input scenarios that you enter into the system. You can use NMIM to calculate national, individual State or county inventories.

NMIM is designed to produce county- and higher-level inventories, but is not appropriate for project-level emission estimates, such as Spaceport America. Certain methodologies related to estimating hazardous air pollutant (HAP) emissions, however, were used. Also, a number of new HAP-related inputs to MOBILE6.2 and the NONROAD model were obtained from the NMIM County Database (NCD), and are referenced below as NCD values.

The NCD provides values by month. Except where noted, mean annual values were used. In all cases, the NCD values for Sierra and Doña Ana Counties are identical and do not vary through the years 2009-2013.

I.3 Asphalt Paving Emissions

This analysis does not include asphalt plant or paving operations for County Road A013 between Engle and the Upham exit on I-25. New Mexico Department of Transportation (NMDOT) will prepare an EIS for these proposed road improvements. These road improvements are included in the analysis of cumulative impacts in this EIS in Chapter 5.

Hot mix asphalt (HMA) would be used to surface the entrance road, runway, taxiways, and apron. There are no significant emissions of pollutants during paving operations with HMA; AP-42 4.5 includes emission factors only for cutback and emulsified asphalts. The emissions associated with HMA are generated at the HMA plant. A temporary HMA plant would be constructed and used on-site, probably near the runway. Emissions from the temporary HMA plant are discussed here.

I.4 Method Assumptions and Options

Emissions under the Proposed Action were considered to be generated by five activities. These activities and their durations and dates are given in the list below. The level of vertical launch area and airfield area operational activities would be that in year 2013, the year of maximum levels of operations in the five-year period of this EIS. The X Prize Cup event additional activities would occur over seven days with the maximum number of visitors (20,000 per day) estimated for year 2013.

- Construction, Phase 1, 17 months, January 2009 through May 2010
- Construction, Phase 2, 12 months, June 2010 through May 2011
- Vertical launch area operations, one year (2013)
- Airfield area operations, one year (2013)
- X Prize Cup operations (only additional activities), seven days (2013)

I.4.1 Use of Default Values for Local Data

Some AP-42 emission factor equations incorporate local data. Examples include surface material silt and moisture content (for fugitive dust), material moisture content, and sulfur content of propane. Values for these data that were most representative of the proposed Spaceport America region were selected from data and tables in the AP-42 documents. In some cases, single default values are provided in AP-42, which were used. In general, these default values are conservative, i.e., result in higher levels of emissions. When a range of values was provided, a conservative value was selected. For example, for the sulfur content of propane the value of 15 grams per 100 standard cubic feet (scf) was used, which is the maximum value for commercial propane.

I.4.2 Roadway and Non-Road Vehicles

Emission factors for roadway vehicles were generated by the Mobile 6.2 model (EPA, 2004). Five Mobile "scenarios" were created, one for each calendar year between years 2009 and 2013. Emission factors for all criteria pollutants except Pb (no emissions) and PM2.5 were generated. PM2.5 was not specified because Mobile 6.2 does not output both PM10 and PM2.5 emissions factors in a scenario. PM10 emissions factors were used for PM2.5, which results in a conservative overestimate of PM2.5 emissions. The following inputs were used in each yearly scenario:

- Maximum Reid vapor pressure (RVP, a measure of gasoline volatility) for gasoline: 9 (maximum RVP in the CAA Amendments)
- Diesel sulfur content: 43 parts per million (ppm) for year 2009 through May, 2010, and 11 ppm after that date, per the guidance in Section 5.5.3 of EPA (2004);
- Altitude: Sierra County is designated as high altitude per 40 CFR 86.091-30 paragraphs (a)(5) (ii) and (iv));
- Roadway classification: all vehicle miles traveled (VMT) set to arterial/collector type roadway classification so that VMT was not distributed to freeways, ramps, and local urban roads; the arterial/collector Driving Cycles are most similar to Spaceport America roads according to guidance in Section 4.2 of EPA (2004);
- Average speed: 40 mph for 2009 and 2010, on the assumption that County Road A013 will be paved in 2010; thereafter 55 mph is used, assuming the speed limit (55) is the same as State Highway 51;
- Average daily minimum and maximum temperatures: 5.6/23.6 °C (42.0/74.5 °F)
- AIR TOXICS command so model outputs the "six primary air toxic pollutants" (the use of the AIR TOXICS command is discussed in Section I.5.1)

Emission factors from all five scenario years were not used. Construction Phase 1 used factors from the 2009 scenario and Phase 2 from the 2010 scenario. The operational activities used factors from the 2012 scenario. In general, emission factor values decrease for later years because of cleaner fuels and projected changes in technology to reduce emissions. Therefore, the use of 2012 is more conservative than using 2013.

Separate emissions for diesel transit buses and class 8a heavy duty diesel trucks (33,001-60,000 lbs gross weight) are used. Buses would be used for visitors and staff. The heavy duty truck category includes water hauling trucks, concrete trucks, aggregate hauling trucks, and diesel delivery trucks in this weight class. Separate emissions for these three vehicle categories (mixed, bus, and heavy truck) were calculated.

It was verified that "composite" hydrocarbon (HC) (i.e., VOC), CO, and NOx emission factors used in the MOBILE6.2 spreadsheet output are the sum of total exhaust plus evaporative emission factors, which is the desired result. Evaporative emission factors include emissions due to refueling, although refueling of roadway vehicles would not occur at the Spaceport. Refueling emission factors cannot be subtracted from the composite VOC emission factors, however, because that factor for “all vehicles” in the spreadsheet is “N/A” and for diesel busses and trucks is zero. Examination of the spreadsheet evaporative emission factors for “all vehicles” does indicate that there is a non-zero refueling emission factor being included. Thus, VOC emissions for “all vehicles” are slightly overestimated due to the inclusion of evaporative refueling emissions.

Emission factors for non-road vehicles were generated by the NONROAD model (EPA, 2007) for the years 2009 (used for Phase 1 construction) and 2010 (used for Phase 2 construction). Emission factors were generated for Sierra and Doña Ana Counties for all diesel and 4-stroke construction and mining equipment. The same max/min temperatures were used as in the Mobile 6.2 model. The following changes, which are based on NCD data, were inputs to the model. Default values for all other inputs were used.

- Reid vapor pressure of gasoline: 9.75 psi
- Gas sulfur: 0.003% (30 ppm)
- Diesel sulfur: 0.0043% (43 ppm) for 2009; 0.00243% (24.3 ppm) for 2009
- Oxygen Weight percent: 0.6136%

I.4.3 Hot Mix Asphalt Plant

Hot mix asphalt plant emissions were calculated by the methods in AP-42, Section 11.1. All emission sources were included. These sources are:

- Plant operations (primarily dryer and drum operations)
- Load-out and yard emissions (emissions from loading trucks with asphalt and from the trucks while they are in the plant yard)
- Silo filling and asphalt storage tank emissions (silo holds HMA produced but not directly loaded into trucks)

There are several variables that affect levels of emissions. The following values were used:

- Plant type: drum mix
- Dryer fuel: No. 2 fuel oil
- PM control process is fabric filter
- Asphalt volatility: -0.5
- HMA mix temperature: 325 °F

The appropriate methods from 11.1 were used for a drum mix HMA plant (EPA 1995). Plant emission factors were from AP-42 tables 11.1-4, 11.1-7, 11.1-8, 11.1-10, 11.1-12. Other emission factors were from tables 11.1-14, 11.1-15, 11.1-16.

I.4.4 Propane Combustion

Propane would be used in both the construction and operation of Spaceport America. During construction it would be used in portable heaters and asphalt laydown machines. Propane would be used during operations for space heating and hot water. The following assumptions and guidance were used in preparing the space heating requirements for propane:

- It was assumed that all heated areas, walls, and ceiling will be insulated to a value of R13.
- Floors are not considered in the Uniform Building Code unless they are positive heat sources (not assumed here).
- Although the Terminal and Hangar Facility may use Leadership in Energy and Environmental Design (LEED) technologies, such energy-saving measures were not assumed here. Geothermal technologies, such as circulating air or water heated in buried pipes, was not considered as values are hard to assign and this technology is not in the guidance documents.
- Heat from human bodies, electric lights, electronics, and electric motors were not considered as the number of sources is unknown.
- Earth banks were not considered because all outside walls are assumed to be insulated.

As a result of the above assumptions, the propane estimates for space heating are very conservative.

For the estimation of propane use for hot water it was assumed that heaters would run on a 30% duty cycle. There would be four water heaters in the Terminal and Hangar Facility, two in the vertical area Launch Control building, and one in each of the rest of the buildings.

I.4.5 Fugitive Dust

Construction site PM emissions can be reduced significantly by various control measures, as described in AP-42 section 13.2.3.4. These measures include:

- Wet suppression of disturbed ground and travel routes,
- Wind speed reduction,
- Chemical stabilization,
- Covering of truck dirt and debris loads, and
- Paving, including early paving of permanent roads.

There are five types of activities where percent effectiveness of fugitive dust suppression is input. These are shown Exhibit I-2, along with the values used in this analysis.

The justifications for these levels of dust-suppression effectiveness are as follows:

All activities except paved public road traffic: An efficiency value of 74% was used for these activities for the following reasons. The "WRAP Fugitive Dust Handbook" (Countess Environmental, 2006), by the Western Regional Air Partnership (WRAP), addresses the estimation of uncontrolled fugitive dust emissions and emission reductions achieved by demonstrated control techniques for eight major fugitive dust source categories. A table in the Executive Summary provides "Fugitive Dust Control Measures Applicable for the WRAP Region." Published PM_{10} control efficiencies for construction/demolition and unpaved roads only using water suppression are in the range of 10-74%. The high end of this range was used for the Spaceport America analysis because water suppression is expected to be used at a high level, and other measures, such as limiting vehicle speed, covering truckloads, limiting work in high wind conditions, and use of chemical suppressants would provide additional control.

Exhibit I-2. Values Used for Overall Percent Fugitive Dust Suppression Effectiveness

Type of Activity	Construction		Operations		
	Phase 1	Phase 2	Vertical	Horizontal	X Prize
Unpaved public roads: commute and on-site traffic	74%	74%	74%	74%	74%
Unpaved public roads: on-site construction traffic	74%	74%	N/A	N/A	N/A
Paved public road traffic[1]	0%	0%	0%	0%	0%
Storage pile drop operations	74%	74%	N/A	N/A	N/A
Heavy construction operations	74%	74%	N/A	N/A	N/A

[1]Percent suppression effectiveness on dry days

Paved public road traffic: There would be no active dust suppression on paved roads. An input to the AP-42 13.2.1 (Fugitive Dust, Paved Roads) emission factor calculations is "P", the number of "wet" days with at least 0.01 inches of precipitation during the averaging period, which in this case is 365 days. A value of 41 "wet" days per year was used based on the following weather data from http://www.wrcc.dri.edu/htmlfiles/nm/nm.01.html; these data are "Monthly average number of days precipitation greater than or equal to 0.01 inches."

- Jornada Exp Range 1925-2004: 43 days
- Truth Or Consequences 1951-2004: 42 days
- Aleman Ranch 1948-2000: 41 days
- Elephant Butte Dam 1917-2004: 43 days

Other fugitive dust assumptions: For fugitive dust from crushed stone processing, and construction sand and gravel processing, AP-42 emission factors for controlled processes were used if available.

Fugitive dust emissions from wind erosion of exposed soil were not estimated. AP-42 section 13.2.5 (Industrial Wind Erosion) includes emission factor equations for these cases. These emissions depend on a number of complex and sometimes uncertain variables, such as wind gust speed, the roughness and erosion potential of the surface, and the number of disturbances per year. Furthermore, there are differences between the erosion characteristics of flat surfaces vs. piles. Even if emissions were estimated here, they would not be correct because dust suppression measures would greatly reduce wind erosion. As with direct construction activities, measures would be employed to reduce fugitive dust emissions to the maximum extent reasonable. Potential reduction measures include wet suppression, chemical stabilization, and wind speed reduction. Spaceport America construction would be planned to minimize areas of potential wind erosion, and to suppress the erosion where it may occur.

I.5 Methods for Estimating Hazardous Air Pollutant Emissions

HAP emissions were estimated for all categories of construction and similar non-launch activities in which HAPs are produced. The HAPs and the methods by which they are calculated are presented in this section. At the end of each subsection, the methods used to calculate the emissions of the individual HAP species are given.

I.5.1 Roadway Vehicles

The AIR TOXICS command was added to the MOBILE6.2 model so that it would output the "six primary air toxic pollutants" The "six primary air toxic pollutants" output by the AIR TOXICS command are:

- Benzene
- 1,3-Butadiene
- Formaldehyde
- Acetaldehyde
- Acrolein
- MTBE

Although another command is available to compute additional HAPS, it requires a separate input file to specify the HAPs and the ratios to use to estimate them from other MOBILE6.2 outputs. There are about 40 possible additional HAPs. EPA (2002) (technical description of the toxics module for MOBILE6.2), however, states the following:

> "The above compounds [referring to the six above], except for MTBE, dominate risk from mobile sources, based on results of the recent National-Scale Air Toxics Assessment. Benzene and MTBE are found in both exhaust and evaporative emissions; the others are constituents of exhaust only."

For the reasons cited in the EPA document, additional HAPs were not calculated using MOBILE6.2 nor for the NONROAD model (discussed in the next section).

The use of the AIR TOXICS command requires six types of additional inputs to MOBILE6.2. These inputs are various chemical properties of gasoline. Values for these inputs were obtained from the NCD. The average annual value for each input was determined. The final inputs to MOBILE6.2 are shown in Exhibit I-3. The MOBILE6.2 User's Guide provides the definitions for these inputs.

Method of Calculating Emissions of Individual HAP Species: The MOBILE6.2 spreadsheet output gives separate emission factors for each HAP species for each type of vehicle. Three vehicle types were used: "all vehicles" (a standard fleet mix), diesel urban buses, and class 8a heavy duty diesel trucks. These emission factors are also a function of year; the MOBILE6.2 output for four years (2009-2012) was used. For all three vehicle types there are a total 28 different HAP emission factors (including gasoline engine evaporative as well as exhaust emissions), which in turn differ among the four years. Given that the differences in emission factors between years are generally small, average emission factors over the four-year period were calculated for each vehicle type, except buses, which would be used only in operations and therefore emission factors for 2012 were used. Each emission factor's "fraction" of the total of all emission factors for a vehicle type was multiplied by the total HAP emissions for that vehicle type to obtain the emission quantity for that HAP species for that vehicle type. This was done separately for each of the five activities (two construction phases and three operational activities).

Exhibit I-3. MOBILE6.2 Commands and Inputs Required for use of AIR TOXICS Command

Command Name	Description	Input Value(s)	
GAS AROMATIC%	Aromatic content (% volume)	27.6	
GAS OLEFIN%	Olefin content (% volume)	5.1	
GAS BENZENE%	Benzene content (% volume)	1.6	
E200	percentage of vapor produced at 200 °F	51.5	
E300	percentage of vapor produced at 300 °F	83.9	
OXYGENATE : MTBE	MTBE content (% volume) and market share	1.8	0.60
OXYGENATE : ETBE	ETBE content (% volume) and market share	0.0	0.00
OXYGENATE : ETOH	ETOH content (% volume) and market share	3.1	0.40
OXYGENATE : TAME	TAME content (% volume) and market share	0.0	0.00

I.5.2 Non-Road Vehicles and Industrial Engines

The NONROAD model calculated the same HAPs as output by MOBILE6.2 (except MTBE). Additional HAPs were not calculated from NONROAD output for the reasons cited in Section I.5.1. MTBE is one of the six primary HAPs, but MTBE emissions were not calculated for reasons given below.

The NMIM User's Guide (EPA, 2005) states the following with respect to which gas formulations it uses with NONROAD outputs.

> [For gaseous HAPS] NMIM uses the toxic to VOC ratios…. Separate ratios are used for evaporative and exhaust emissions for each of the following four categories of gasoline blends:
>
> - Baseline Gasoline. All cases that do not fall into categories 2-4 below. Ratios are in variables "ExhBaseGas" and "EvapBaseGas" in the SCCToxics table.
> - WO (Winter Oxygenate) Gasoline / Ethanol or ETBE - Used where the fuel contains ethanol which is greater than or equal to 5% by volume or ETBE greater than or equal to 5% by volume. Ratios are in variables "ExhEthGas" and "EvapEthGas" in the SCCToxics table.
> - WO (Winter Oxygenate) Gasoline / MTBE / TAME - Used where the fuel contains MTBE which is greater than or equal to 12% by volume or TAME greater than or equal to 13% by volume. Ratios are in variables "ExhMTBEGas" and "EvapMTBEGas" in the SCCToxics table.

- RFG/MTBE/TAME - Used where the fuel is RFG and where the fuel contains oxygenate greater than 5% by volume and where the fuel contains MTBE which is less than 12% by volume or TAME less than 13% by volume. Ratios are in variables "ExhRFGGas" and "EvapRFGGas" in the SCCToxics table.

Only baseline and ethanol gasoline blends were used in the new NONROAD analysis for the following reasons:

- The MTBE % volume does not exceed 12% in any month (highest value is 3% for 4 months, May-August). Therefore, gasoline category 3 above does not apply.
- The gasoline blends in category 4 in the counties in this study do not meet the criteria for this category. Also, the average annual oxygenate is not greater than 5%. Therefore, gasoline category 4 above does not apply.
- The ETOH % volume exceeds 5% for three months a year (7%). Therefore, gasoline category 2 toxic to VOC ratios were used for ¼ of a year and baseline category 1 gasoline ratios for ¾ of a year.

The use of baseline and ethanol gasoline blends results in no MTBE emissions from construction equipment. Of the 16 categories of construction equipment modeled, however, only three use gasoline (4-stroke) engines. These three categories (tampers/rammers, plate compactors, and concrete/industrial saws) would use extremely little fuel relative to the diesel heavy equipment; diesel fuel does not have MTBE added. Also, construction equipment gasoline usage would be insignificant compared to roadway vehicles, for which MTBE emissions are output by the MOBILE6.2 model. Therefore, this approach underestimates MTBE emissions very slightly.

The methodology used to estimate HAPs is that used in NMIM, i.e., emissions for the five HAPs (the six primary HAPs, not including MTBE) are calculated as ratios of the VOC emissions. These "toxic to VOC" ratios were extracted from the NCD for the 16 categories of construction equipment. The ratios for the 13 diesel equipment categories were the same, as were those for the three gasoline equipment categories. These ratios are shown in Exhibit I-4 for the three types of fuel (baseline gasoline, ETOH gasoline, and diesel). Gasoline emissions include both exhaust and evaporative. The ratios used for each fuel type are shown in the last row of the table; the gasoline ratios used are the sum of the exhaust and evaporative ratios.

Exhibit I-4. Toxic to VOC Ratios Used for HAP Emissions in Non-Road Vehicles

	Toxic to VOC Ratios				
HAP	**Base Gas Exhaust**	**Base Gas Evaporative**	**ETOH Gas Exhaust**	**ETOH Gas Evaporative**	**Diesel Exhaust**
1,3-Butadiene	0.0095212		0.0095212		0.0018616
Acrolein	0.0007		0.000693		0.00303165
Formaldehyde	0.011715		0.015933		0.118155
Benzene	0.052466	0.022	0.047219	0.01254	0.020344
Acetaldehyde	0.0041006		0.0082012		0.05308
Ratio Totals	0.0785	0.0220	0.0816	0.0125	0.1965
Ratios used	0.1005		0.0941		0.1965

Total HAP emissions for diesel equipment were estimated by the equation:

$$\textit{HAP emissions} = \textit{VOC emissions} \times 0.1965$$

As discussed above, gasoline category 2 (ethanol blend) toxic to VOC ratios were used for ¼ of a year and baseline gasoline ratios for ¾ of a year. Total HAP emissions for gasoline equipment were estimated by the equation:

$$\textit{HAP emissions} = (0.75 \times \textit{VOC emissions} \times 0.1005) + (0.25 \times \textit{VOC emissions} \times 0.0941)$$

Method of Calculating Emissions of Individual HAP Species: Total HAP emissions were calculated by using the toxic to VOC ratios as discussed above. Although there are both diesel and gasoline vehicles in the construction estimates, HAP emissions from gasoline vehicles represent only 0.2% of the total for construction Phase 1 and 0.6% of the total for Phase 2. Given these very small proportions of HAPs from gasoline vehicles, the total HAP emissions were considered to all be from diesel vehicles. The total HAP emissions were multiplied by the fraction each HAP species represented of this total (HAP ratio / total ratio) to obtain the emission quantities for each of the five HAP species. This was done separately for each construction phase.

Emissions of each of the five HAP species were calculated in the same manner as those for Non-Road vehicles with the following differences. As all industrial engines in the construction estimates were gasoline-powered, the toxic to VOC ratios for base and ETOH gasolines were used to determine the fraction that each HAP represented of the total HAP emissions. These ratios were apportioned as discussed in the previous section, i.e., assuming base gasoline is used 75% of the time and ETOH gasoline 25%. The resulting fraction of emissions for each HAP was multiplied by the total HAP emissions to obtain the emissions for each HAP. As with gasoline roadway vehicles, both exhaust and evaporative emissions were included. This was done separately for each construction phase.

I.5.3 Non-Industrial Surface Coatings

HAP emissions for Non-Industrial Surface Coatings were calculated by methods provided in AP-42, Section 4.2.1, Related document Architectural Surface Coating (Nov. 1995), pages 5-6 through 5-9. Total HAP emissions are calculated by multiplying total VOC emissions by the total weight fraction for all HAP species.

Exhibit I-5 and Exhibit I-6 show the weight fractions for water- and solvent-based coatings. These values were taken from Tables 5-3 and 5-4 of the above document. Species include only hazardous air pollutants listed in CAA Amendments of 1990, which are indicated in the weight fraction tables of the above document. VOC emissions are multiplied by the total weight fraction for each coating type.

Method of Calculating Emissions of Individual HAP Species: The VOC weight fractions of each HAP species are given in the above two tables. To obtain the emissions of each HAP for a type of coating (water- or solvent-based), the total emissions were multiplied by the fraction that each HAP represented of the total weight fraction for that type of coating. This was done separately for each construction phase.

Exhibit I-5. VOC HAP Species Profile for Water-Based Architectural Surface Coating

HAP	Weight Fraction
Benzene	0.0030
Dichloromethane (methylene chloride)	0.0550
Ethyl chloride	0.0060
Ethylene glycol	0.0050
TOTAL	0.0690

Exhibit I-6. VOC HAP Species Profile for Solvent-Based Architectural Surface Coating

HAP	Weight Fraction
Dimethyl formamide	0.0050
Ethylbenzene	0.0430
Ethylene glycol	0.0060
Isomers of xylene	0.0260
Methyl ethyl ketone	0.0560
Methyl isobutyl ketone	0.0060
Toluene	0.0520
TOTAL	0.1940

I.5.4 Hot Mix Asphalt Plant

In AP-42, Section 11.1, HAP emissions are estimated by the use of numerous emission factors and speciation profiles (amount of a HAP species as a percentage of organic PM or TOC) based on the tons of HMA produced by the plant. All of the HAP species in AP-42 11.1 are included in the HMA plant emissions in this analysis. The number of these HAPs is large and depends on the type of plant operation being analyzed. The information in Exhibit I-7 shows which tables in AP-42, Section 11.1were used for each type of HAP species estimated in this analysis. The relevant parts of these tables for plant emissions are those for drum mix HMA plants using No. 2 fuel oil-fired dryer with fabric filter.

Method of Calculating Emissions of Individual HAP Species: There are 74 HAP species included in AP-42, Section 11.1 for HMA plants of the type analyzed here. The relative amounts of each species are given in the AP-42 Tables listed in Exhibit I-7 (except Table 11.1-14) either as emission factors or percentages of PM or TOC. These amounts were converted to fractions that were multiplied by total HAPs emissions to yield emissions for each species. This was done separately for the three emission sources (column 1 in Exhibit I-7) and for the types of HAPs emitted by each source. For example, for the source “Plant Load-Out and Yard Emissions” both organic PM-based HAPs and volatile organic-based HAPs were calculated. This was done only for construction Phase 1, as the HMA plant would not be operated after that Phase. For more information on the HAP species included here see AP-42, Section 11.1.

Exhibit I-7. Sources of Data for Hot Mix Asphalt Plant HAP Emissions

Source of Emissions	Tables Used	Information in Tables
Plant Emissions (not including next two sources)	11.1-10	All Non-PAH[1] and PAH HAP emission factors
	11.1-12	All metal HAPs[2] emission factors
Plant Load-Out and Yard Emissions	11.1-14	Organic PM and TOC emission factors
	11.1-15	All HAPs as percentages of organic PM
	11.1-16	All volatile organic HAPs as percentages of TOC
Silo Filling and Asphalt Storage Tank Emissions	11.1-14	Organic PM and TOC emission factors
	11.1-15	All HAPs as percentages of organic PM
	11.1-16	All volatile organic HAPs as percentages of TOC

1Polynuclear aromatic hydrocarbon (PAH)
2Metals in Table 11.1-12 identified as HAPs as defined in the 1990 CAAA

I.6 Emission Factor Equation Inputs

The AP-42 emission factor documents in Exhibit I-1 were studied and all relevant emission factor equations, constants, and other computational elements were coded into an Excel spreadsheet to calculate emissions. These methods incorporated a total of 56 inputs. A worksheet was created in which these inputs could be entered. There were six identical worksheets, one for each of the three phases of construction and three for operations (vertical launch area, airfield area, and X Prize Cup event) at the proposed Spaceport America. A blank worksheet is shown in Exhibit I-8. The types of inputs are shown in the right column, with the value to be entered in the left column.

The values of all these inputs are not included here. They were determined by careful evaluation of the Proposed Action. The most important inputs (those that resulted in higher emission estimates for fugitive dust, the other criteria pollutants, and CO2) are shown in Exhibit I-9. The values of these inputs for each of the five construction and operational activities at the proposed Spaceport America are shown in this Exhibit.

Exhibit I-8. Worksheet to Specify Inputs to Emission Factor Calculations

	Input
Fugitive Dust Particulate Matter - Unpaved Public Roads	
3.90	surface material silt content (%) - DEFAULT
0.50	surface material moisture content (%) - DEFAULT
	mean vehicle weight (tons)
	mean vehicle speed (mph)
	vehicle miles traveled on UNPAVED roads
	overall percent suppression effectiveness
Fugitive Dust Particulate Matter - Paved Public Roads	
	mean vehicle weight (tons)
	total miles of PAVED road
0.60	road surface silt loading (g/m2) - DEFAULT: if ADT < 500=0.6; ADT 500-5000=0.2
	Average daily traffic on PAVED roads
	number of trackout points
	percent suppression effectiveness on dry days
Fugitive Dust Particulate Matter - Storage Pile Drop Operations (includes scrapers unloading)	
10	mean wind speed (mph) - DEFAULT (from historical climate data)
0.05	material moisture content (%) - DEFAULT
	mass of material dropped (tons)
	overall percent suppression effectiveness
Fugitive Dust Particulate Matter - Heavy Construction Operations	
	overall percent suppression effectiveness for these operations
Bulldozing (includes compacting and general land clearing)	
	number of hours of operations
Grading (includes scrapers in travel)	
	mean vehicle speed (mph)
	vehicle miles traveled
Scrapers removing topsoil	
	vehicle miles traveled
General construction activity	
	Use only for activities that are not defined elsewhere.
	months of activity
	total area of activity (acres)
Fugitive Dust Particulate Matter - Concrete and Borrow Pit Operations	
Concrete Batching	
	Yards of concrete
Crush Stone Processing	
	Tons of material

Exhibit I-8. Worksheet to Specify Inputs to Emission Factor Calculations (continued)

	Input
Sand and Gravel Processing	
	Tons of material
Pollutants - Gasoline and Diesel Industrial Engines	
	mean hp, gasoline engines
	hrs usage, gasoline engines
	mean hp, diesel engines
	hrs usage, diesel engines
Pollutants - Nonindustrial Surface Coating	
	gallons (water-based)
	gallons (solvent-based)
Pollutants - Asphalt Paving Operations	
	rapid cure cutback (tons) AND % diluent
	medium cure cutback (tons) AND % diluent
	slow cure cutback (tons) AND % diluent
	emulsified (tons) AND diluent fraction (%)
Pollutants - Liquefied Petroleum Gas Combustion (Propane only)	
15	sulfur content (gr/100 scf) - DEFAULT
	gallons (1000's)
Pollutants - Roadway Vehicles	
	year (2009-2013)
	vehicle miles traveled
Pollutants - Non-road Vehicles	Data are days operated
	Rollers, diesel
	Scrapers, diesel
	Trenchers, diesel
	Bore/Drill Rigs, diesel
	Excavators, diesel
	Cranes, diesel
	Graders, diesel
	Off-highway Trucks, diesel
	Crushing/Proc. Equipment, diesel
	Rough Terrain Forklifts, diesel
	Rubber Tire Loaders, diesel
	Tractors/Loaders/Backhoes, diesel
	Crawler Tractor/Dozers, diesel
	Tampers/Rammers, 4-stroke
	Plate Compactors, 4-stroke
	Concrete/Industrial Saws, 4-stroke

Exhibit I-9. Key Inputs to Emission Factor Methods to Calculate Air Quality Emissions

Input	Input Values for Each Activity (Duration of Activity)				
	Construction		Operations		
	Phase 1 (17 Months)	Phase 2 (12 Months)	Vertical Area (Year 2013)	Horizontal Area (Year 2013)	X Prize Event (7 Days)
Used for Fugitive Dust Emissions					
VMT1, unpaved road commute traffic (miles)	2,289,113	599,447	55,891	6,570	126
VMT, unpaved road on-site construction traffic (miles)	128,529	4,913	0	0	0
VMT, paved road commute and construction traffic (miles)2,3,4, Scenario 1	4,868,732	1,398,020	533,995	1,489,565	288,904
VMT, paved road commute and construction traffic (miles)2,3,4, Scenario 3	4,868,732	1,398,020	590,205	1,770,615	301,840
Mean vehicle weight (tons), paved road traffic	11.37	16.55	6.85	11.70	19.60
Pile drop operations (tons)	1,066,593	130,710	0	0	0
Concrete used (cubic yards)	14,179	6,875	0	0	0
Crushed Stone Processed (tons)	131,554	0	0	0	0
Sand and Gravel Processed (tons)	53,826	46,109	0	0	0
Used for Non-Fugitive Dust Criteria Pollutants, CO^2, and HAP Emissions					
Hot Mix Asphalt (tons)	110,880	0	0	0	0
VMT, "all vehicles" (miles)3,5	3,517,950	541,739	532,991	1,050,707	64,178
VMT, buses (miles) 5	0	0	275,593	676,509	217,295
VMT, heavy duty trucks (miles)5, Scenario 1	1,396,928	564,590	68,985	56,210	10,780
VMT, heavy duty trucks (miles)5, Scenario 3	1,396,928	564,590	111,690	269,735	20,608
Non-Road Construction Vehicles (Values Are Days Operated)					
Rollers, diesel	1,654	184	0	0	0
Scrapers, diesel	970	0	0	0	0
Trenchers, diesel	344	0	0	0	0

Input	Input Values for Each Activity (Duration of Activity)				
	Construction		Operations		
	Phase 1 (17 Months)	Phase 2 (12 Months)	Vertical Area (Year 2013)	Horizontal Area (Year 2013)	X Prize Event (7 Days)
Bore/Drill Rigs, diesel	19	0	0	0	0
Excavators, diesel	93	4	0	0	0
Cranes, diesel	1,281	359	0	0	0
Graders, diesel	1,309	273	0	0	0
Off-highway trucks, diesel	3,456	936	0	0	0
Rubber tire loaders, diesel	2,240	756	0	0	0
Tractors/Loaders/Backhoes, diesel	158	251	0	0	0
Crawler Tractor/Dozers, diesel	1,866	0	0	0	0
Tampers/Rammers, 4-stroke	510	0	0	0	0
Plate Compactors, 4-stroke	4	316	0	0	0
Non-road vehicles total days operated	13,903	3,079	0	0	0

[1] VMT=Vehicle miles traveled

[2] VMT for paved roads is not a direct input. Inputs that determine VMT are average daily traffic, miles of road, and number of trackout points (intersections where vehicles track dirt onto a paved road while leaving a construction site or dirt area). The VMT values listed here were computed from these inputs as part of the AP-42 13.1.1 emission calculations.

[3] VMT values for paved road fugitive dust are greater than VMT for roadway vehicles for non-fugitive dust pollutants because the former VMT contains road miles added to include the emission effects of trackout points, per AP-42 13.2.1.

[4] VMT is that for calculating PM10 emissions; VMT for PM2.5 emissions are less due to fewer miles added for trackout points.

[5] Roadway vehicles only; ”all vehicles” is a standard mixed fleet; buses are diesel urban buses; heavy duty trucks are diesel and haul construction material and water.

I.7 Method to Total Emissions for Each Year

Emission totals for each pollutant were calculated for each year of the five-year period covered by this EIS (2009-2013) by the following method. The emissions for a calendar year were calculated by summing the proportion of the emissions from each of the six activities that occurred in that year. These proportions are shown in Exhibit I-10 and are explained as follows. Note that emissions for a construction phase are the total emissions for the entire phase independent of the length of time it would take to complete the phase. Emissions for the three operational activities are the totals estimated for year 2013, the year with the highest level of operations.

Exhibit I-10. Proportions Used to Sum Emissions from Activities for Each Calendar Year

Activity	2009	2010	2011	2012	2013
Construction Phase 1	70.6%	29.4%			
Construction Phase 2		58.3%	41.7%		
Vertical Launch Area Operations	20.0%	49.6%	76.09%	92.0%	100%
Airfield Area Operations		6.6%	33.9%	67.0%	100%
X Prize Cup Event Operations		50.0%	70.0%	90.0%	100%

The following example explains how this methodology was applied for calendar year 2011. Since construction Phase 1 would be completed, it would contribute no emissions to that year. The 58.3 percent of construction Phase 2 would be completed before that year, so 41.7 percent of the total emissions produced by that phase are added for 2011. For operational activities, it was estimated that vertical launch support operations would be at 76.09 percent of the year 2013 levels, horizontal launch support operations would be at 33.9% of year 2013 levels, and X Prize Cup activities would be at 70.0 percent of year 2013 levels.

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APPENDIX J
CALCULATIONS OF EMISSION LOAD FROM VERTICAL LAUNCHES

This appendix presents the methodology to calculate emission loads to the atmosphere from vertical launches at the proposed Spaceport America, and the results of the calculations performed. "Emission load" is the term used for the mass of emissions exhausted into the atmosphere by rocket engines. The methods are based in part on those used in the PEIS LL, which are presented in Appendix A of that document (FAA, 2001). The purpose of these methods is to estimate the amounts of various exhaust products of environmental concern from rocket propellants that would be emitted in different layers of the atmosphere per year.

J.1 General Method to Calculate Emission Loads

Both the PEIS HL and PEIS LL define the altitude ranges of layers of the atmosphere as shown in Exhibit J-1.

Exhibit J-1. Altitude Range for Various Atmospheric Layers

	Troposphere	Stratosphere	Mesosphere	Ionosphere
Altitude Range	Surface to 10 km	10 to 50 km	50 to 80 km	80 to 1,000 km

Note: 1 km = 0.62 miles
Source: FAA, 2001; FAA, 2005

The general formula to calculate the load for a particular exhaust product in a layer of the atmosphere per year for a single type of rocket launch is as follows:

Load of exhaust product per layer per year = number of launches per year ×
total mass of propellant per LV ×
proportion of propellant burned in layer ×
weight fraction of product in exhaust

The total load for an exhaust product in a year would be the sum of the loads for all launches of each type of rocket launch. The values used in this formula, and the assumptions underlying them, are given in the next section.

J.2 Data Used to Calculate Emission Loads

The estimated number of vertical LV launches and landings per year, propellant types, and typical propellant masses for concept LVs are shown in Exhibit J-2. The launches for years 2009 through 2013 are listed by propellant type, with each concept/propellant type LV having a typical propellant mass, as explained further below. Landings of vertical concept LVs are also included as they would emit exhaust products into the atmosphere. These estimates of proposed

Exhibit J-2. Estimated Number of Vertical LV Launches and Powered Landings Per Year, Propellant Types, and Typical Propellant Masses for Concept LVs at the Proposed Spaceport America

Vertical LV Concept	Propellant Type	Typical Propellant Mass (tons)	Estimated Number of Vertical Launches or Powered Landings				
			2009	2010	2011	2012	2013
Concept V1 Launch[1]	All launches		25	60	80	90	100
	Solid	1	10	40	50	60	70
	Hydro/Hybrid[2]	20	5	20	30	30	30
Concept V2 Launch	All launches		0	0	5	5	5
	Hydro/Hybrid	20	0	0	3	3	3
	Cryogenic	20	0	0	2	2	2
Concept V2 Powered Horizontal Landing	All landings		0	0	5	5	5
	Hydrocarbon	2	0	0	3	3	3
	Cryogenic	2	0	0	2	2	2
Concept V3 Launch	All launches		0	2	10	20	20
	Hydrocarbon	20	0	1	5	10	10
	Cryogenic	20	0	1	5	10	10
Concept V3 Powered Vertical Landing	All landings		0	2	10	20	20
	Hydrocarbon	2	0	1	5	10	10
	Cryogenic	2	0	1	5	10	10
Total (all launches)			25	62	95	115	125
Total (all powered landings)			0	2	15	25	25

[1] Hydrogen peroxide used as a monopropellant is not considered because the number of LVs that would use it is difficult to estimate and its exhaust contains no compounds that would adversely affect any atmospheric layer. If used as an oxidizer with a hydrocarbon fuel, the exhaust components would be similar to those using LOX with hydrocarbon fuels.

[2] Hydro/Hybrid = hydrocarbon or hybrid propellants; hybrid propellants would use LOX as the oxidizer and a hydrocarbon fuel such as hydroxy-terminated polybutadiene (HTPB), which the PEIS LL (FAA, 2001) assumed has emission-weighted fractions similar to the weighted fractions for the LOX/RP1 (hydrocarbon) propellants.

Spaceport America launch data cannot be known with certainty because they depend on future commercial space customers and LVs that are under development or in planning stages. For reasons given below, however, these data are considered conservative over-estimates.

The LVs of each concept are assumed to be divided by propellant type. Each LV would have a typical propellant mass. SRMs would be used in Concept V1 vehicles only. These would be small sounding rocket class vehicles with a typical propellant mass of one ton. The first proposed Spaceport America customer (UP Aerospace) has launched an LV of this type (under an amateur waiver from the FAA) with a propellant mass of 415 lb (0.2 ton). The proposed LV in the Launch Site Operator License Application for the Spaceport is the Improved Orion, which is a Concept V1 LV with an SRM propellant mass of 650 lb (0.325 tons). It is not expected that any LV of this type would have a propellant mass of 2,000 lb within the five-year period of this EIS. Even if such an LV were launched in this period, the average propellant mass is expected to be far below one ton. Therefore, the estimate of one ton as a typical mass is considered a conservative overestimate

All other LVs are assumed to carry people or payloads on the order of 0.9 metric tons (1 ton). All LVs of this larger class would use hydrocarbon, hybrid, or cryogenic propellant systems. The numbers of launches of LVs with hydrocarbon or hybrid propellants are combined because their exhaust product weight fractions are similar (see note 2 in Exhibit J-2). The maximum possible weight of propellant in the largest vertical LV is 30 metric tons (33 tons); however, a typical mass of 18 metric tons (20 tons) is expected to be a conservative overestimate, especially within the five-year period of this EIS. As an example, the Michelle-B LV under development by TGV-Rockets is a Concept V3 type with gross weight of nearly 28 metric tons (31 tons) and a propellant weight of 19.8 metric tons (21.8 tons) (Martin and Law, 2002). Some of this propellant would be used for its powered vertical landing. Although larger propellant masses would be possible in vertical LVs, some LVs would have less propellant. For example, the Thunderstar vehicle being developed by Starchaser Industries would have nine tons of propellant and is designed to carry a payload of one ton or three passengers to an altitude of 158 km (98 miles) (Starchaser, 2008).

A propellant mass of 1.8 metric tons (2 tons) is estimated for Concept V2 and V3 powered landings. V2 vehicles would fire rockets only for maneuvering near the airfield in preparation for horizontal landing. V3 vehicles would have a powered vertical landing. These vehicles would employ parachutes or aero-braking of some type to slow the descent velocity and would not fire rockets at high thrust until near the ground. For example, the Michelle-B terminal velocity is estimated to be below 50 m/s (112 mph; Martin and Law, 2002). An estimate of two tons of propellant for the powered landing of vertical LVs is considered a conservative overestimate.

The next element in the formula for calculating emission loads is the proportion of propellant burned in each layer of the atmosphere, which depends on the type of vehicle and whether it is launching or landing. Assuming a constant thrust, estimates for the amount of time a rocket spends in a given range of altitude can be calculated from the kinematics equations for rocket flight. These equations were solved for the two types of rocket assumed in Exhibit J-2 (small solid and larger hydrocarbon/hybrid/cryogenic) based on the parameters shown in Exhibit J-3. These parameter values were provided by Up Aerospace for the small solid propellant rocket and by Starchaser Industries for the larger, non-solid propellant rocket. It is recognized that using only two types of rockets for this purpose is a simplification, but one that seems reasonable given the lack of information on vertical LVs that would launch from Spaceport America.

The proportion of propellant burned in each layer of the atmosphere is also estimated for the powered landing phases of vertical Concept V2 and V3 vehicles. As described above, V2 powered landings would probably be used only to maneuver near the airfield and V3 vehicles would be slowed by some form of aero-braking prior to firing rockets at high thrust for landing. The most conservative assumption is to assume that all propellant 1.8 metric tons (2 tons) used for landing these vehicles is burned below 914 m (3,000 feet) above the ground, which is the portion of the atmosphere to which the ambient air quality regulations apply.

Exhibit J-3. Parameters Used to Solve the Kinematic Equations for Vertical Rocket Flights at the Proposed Spaceport America

Vertical Launch Vehicle Type	Gross Liftoff Weight of Vehicle (kg)	Thrust (newtons)	Engine Burn Time (seconds)
Solid propellant, small sounding rocket	367	49×104	13.5
Hydrocarbon, hybrid, or cryogenic propellants, one ton payload	15,000	1.92×105	70

The proportion of propellant burned in each layer of the atmosphere that was determined from the above analyses is shown in Exhibit J-4. The portion of the atmosphere below 914 m (3,000 feet) is included because the EPA uses that altitude to assess contributions of emissions to the ambient air quality under the Clean Air Act (CAA) (EPA, 1992). The troposphere layer includes the layer below 914 m (3,000 feet). Both types of LVs analyzed terminate rocket firing in ascent before they would reach the mesosphere.

Exhibit J-4. Proportions of Total Propellant Mass Burned in Atmospheric Layers

	Proportion of Propellant Burned in Atmospheric Layer			
Type of Launch	Below 3,000 feet	Troposphere	Stratosphere	Mesosphere
Launch, solid propellant	27%	91%	9%	0%
Launch, hydro/hybrid propellant	14%	47%	53%	0%
Landing, hydrocarbon propellant	100%	100%	0%	0%

The final element in the formula to calculate emission loads is the weight fraction of each exhaust product (e.g., CO_2). This is the proportion of that product in the total exhaust mass and is a function of propellant type and atmospheric layer. The weight fractions used here were those provided in the PEIS LL (FAA, 2001) and are shown in Exhibit J-5. Data are not provided for cryogenic propellants (LOX and liquid H_2) because the exhaust emissions consist of H_2O and H_2. The PEIS LL states the following assumptions concerning exhaust products, which results in different weight fractions for some products in the troposphere and stratosphere vs. the mesosphere:

> In most studies, the weight fraction information for CO, CO_2, and H_2 pertains to the exhaust directly from the nozzle and not after the exhaust could react with the air. However, most studies acknowledge that in the troposphere and stratosphere, the CO will almost completely react to CO_2 in the high temperatures of the exhaust plume. Likewise, H_2 and N_2 in the exhaust plume will almost completely react to form H_2O and NO_X. (FAA, 2001)

Exhibit J-5. Weight Fractions of Solid, Hydrocarbon, and Hybrid Propellant Exhaust Emissions

Propellant Type	Layer of Atmosphere	Weight Fraction of Exhaust Product							
		HCl	Al_2O_3	Cl	CO_2	CO	NO_2	H_2O	OH
Solid	Trop/Strat[1]	0.2100	0.3800	0.0028	0.4600	-	0.2700	0.2700	-
	Mesosphere	0.2100	0.3800	0.0028	0.0300	0.2300	-	0.0630	-
Hydro/ Hybrid	Trop/Strat	-	-	-	0.9310	-	-	0.3400	0.0350
	Mesosphere	-	-	-	0.1800	0.0300	0.0190	-	-

[1]Weight fractions for exhaust in the troposphere and stratosphere are the same

J.3 Emission Loads

The data in the previous section were used to calculate total emission loads to each atmospheric layer for the years 2009-2013. These data and equations were used in a spreadsheet to perform the calculations. These emission loads for all vertical launches in year 2011 are presented in the spreadsheet output format in Exhibit J-6a through J-6e.

Exhibit J-6a. Rocket Emission Loads to Atmospheric Layers for All Vertical Launches in Year 2009

	No. Ops[1]	Propellant (tons)[3]	HCl	Al_2O_3	Cl	CO_2	CO	NO_2	H_2O	OH
Bottom 3000 ft										
V1 Launch, Solid	25	1	1.42	2.57	0.02	3.11	0.00	1.82	1.82	0.00
V1 Launch, Hydro/Hybrid[2]	0	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V2 Launch, Hydro/Hybrid	0	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V2 Landing, Hydrocarbon	0	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V3 Launch, Hydrocarbon	0	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V3 Landing, Hydrocarbon	0	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	**25**		**1.42**	**2.57**	**0.02**	**3.11**	**0.00**	**1.82**	**1.82**	**0.00**
Troposphere										
V1 Launch, Solid	25	1	4.78	8.65	0.06	10.47	0.00	6.14	6.14	0.00
V1 Launch, Hydro/Hybrid	0	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V2 Launch, Hydro/Hybrid	0	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V2 Landing, Hydrocarbon	0	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V3 Launch, Hydrocarbon	0	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V3 Landing, Hydrocarbon	0	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	**25**		**4.78**	**8.65**	**0.06**	**10.47**	**0.00**	**6.14**	**6.14**	**0.00**
Stratosphere										
V1 Launch, Solid	25	1	0.47	0.86	0.01	1.04	0.00	0.61	0.61	0.00
V1 Launch, Hydro/Hybrid	0	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V2 Launch, Hydro/Hybrid	0	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V2 Landing, Hydrocarbon	0	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V3 Launch, Hydrocarbon	0	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V3 Landing, Hydrocarbon	0	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	**25**		**0.47**	**0.86**	**0.01**	**1.04**	**0.00**	**0.61**	**0.61**	**0.00**

1 Number of launch and landing operations.
2 Hydro/Hybrid=Hydrocarbon or hybrid propellant system.
3 1 metric ton = 1.1 ton

Exhibit J-6b. Rocket Emission Loads to Atmospheric Layers for All Vertical Launches in Year 2010

	No. Ops[1]	Propellant (tons)[3]	HCl	Al_2O_3	Cl	CO_2	CO	NO_2	H_2O	OH
Bottom 3000 ft										
V1 Launch, Solid	40	1	2.27	4.10	0.03	4.97	0.00	2.92	2.92	0.00
V1 Launch, Hydro/Hybrid[2]	20	20	0.00	0.00	0.00	52.14	0.00	0.00	19.04	1.96
V2 Launch, Hydro/Hybrid	0	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V2 Landing, Hydrocarbon	0	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V3 Launch, Hydrocarbon	1	20	0.00	0.00	0.00	2.61	0.00	0.00	0.95	0.10
V3 Landing, Hydrocarbon	1	2	0.00	0.00	0.00	1.86	0.00	0.00	0.68	0.07
TOTAL	**62**		**2.27**	**4.10**	**0.03**	**61.57**	**0.00**	**2.92**	**23.59**	**2.13**
Troposphere										
V1 Launch, Solid	40	1	7.64	13.83	0.10	16.74	0.00	9.83	9.83	0.00
V1 Launch, Hydro/Hybrid	20	20	0.00	0.00	0.00	175.03	0.00	0.00	63.92	6.58
V2 Launch, Hydro/Hybrid	0	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V2 Landing, Hydrocarbon	0	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V3 Launch, Hydrocarbon	1	20	0.00	0.00	0.00	8.75	0.00	0.00	3.20	0.33
V3 Landing, Hydrocarbon	1	2	0.00	0.00	0.00	1.86	0.00	0.00	0.68	0.07
TOTAL	**62**		**7.64**	**13.83**	**0.10**	**202.39**	**0.00**	**9.83**	**77.62**	**6.98**
Stratosphere										
V1 Launch, Solid	40	1	0.76	1.37	0.01	1.66	0.00	0.97	0.97	0.00
V1 Launch, Hydro/Hybrid	20	20	0.00	0.00	0.00	197.37	0.00	0.00	72.08	7.42
V2 Launch, Hydro/Hybrid	0	20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V2 Landing, Hydrocarbon	0	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V3 Launch, Hydrocarbon	1	20	0.00	0.00	0.00	9.87	0.00	0.00	3.60	0.37
V3 Landing, Hydrocarbon	1	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	**62**		**0.76**	**1.37**	**0.01**	**208.90**	**0.00**	**0.97**	**76.66**	**7.79**

1 Number of launch and landing operations.
2 Hydro/Hybrid=Hydrocarbon or hybrid propellant system.
3 1 metric ton = 1.1 ton

Exhibit J-6c. Rocket Emission Loads to Atmospheric Layers for All Vertical Launches in Year 2011

	No. Ops[1]	Propellant (tons)[3]	HCl	Al_2O_3	Cl	CO_2	CO	NO_2	H_2O	OH
Bottom 3000 ft										
V1 Launch, Solid	50	1	2.84	5.13	0.04	6.21	0.00	3.65	3.65	0.00
V1 Launch, Hydro/Hybrid[2]	30	20	0.00	0.00	0.00	78.20	0.00	0.00	28.56	2.94
V2 Launch, Hydro/Hybrid	3	20	0.00	0.00	0.00	7.82	0.00	0.00	2.86	0.29
V2 Landing, Hydrocarbon	3	2	0.00	0.00	0.00	5.59	0.00	0.00	2.04	0.21
V3 Launch, Hydrocarbon	5	20	0.00	0.00	0.00	13.03	0.00	0.00	4.76	0.49
V3 Landing, Hydrocarbon	5	2	0.00	0.00	0.00	9.31	0.00	0.00	3.40	0.35
TOTAL	**96**		**2.84**	**5.13**	**0.04**	**120.16**	**0.00**	**3.65**	**45.26**	**4.28**
Troposphere										
V1 Launch, Solid	50	1	9.56	17.29	0.13	20.93	0.00	12.29	12.29	0.00
V1 Launch, Hydro/Hybrid	30	20	0.00	0.00	0.00	262.54	0.00	0.00	95.88	9.87
V2 Launch, Hydro/Hybrid	3	20	0.00	0.00	0.00	26.25	0.00	0.00	9.59	0.99
V2 Landing, Hydrocarbon	3	2	0.00	0.00	0.00	5.59	0.00	0.00	2.04	0.21
V3 Launch, Hydrocarbon	5	20	0.00	0.00	0.00	43.76	0.00	0.00	15.98	1.65
V3 Landing, Hydrocarbon	5	2	0.00	0.00	0.00	9.31	0.00	0.00	3.40	0.35
TOTAL	**96**		**9.56**	**17.29**	**0.13**	**368.38**	**0.00**	**12.29**	**139.17**	**13.06**
Stratosphere										
V1 Launch, Solid	50	1	0.95	1.71	0.01	2.07	0.00	1.22	1.22	0.00
V1 Launch, Hydro/Hybrid	30	20	0.00	0.00	0.00	296.06	0.00	0.00	108.12	11.13
V2 Launch, Hydro/Hybrid	3	20	0.00	0.00	0.00	29.61	0.00	0.00	10.81	1.11
V2 Landing, Hydrocarbon	3	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V3 Launch, Hydrocarbon	5	20	0.00	0.00	0.00	49.34	0.00	0.00	18.02	1.86
V3 Landing, Hydrocarbon	5	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	**96**		**0.95**	**1.71**	**0.01**	**377.08**	**0.00**	**1.22**	**138.17**	**14.10**

1 Number of launch and landing operations.
2 Hydro/Hybrid=Hydrocarbon or hybrid propellant system.
3 1 metric ton = 1.1 ton

Exhibit J-6d. Rocket Emission Loads to Atmospheric Layers for All Vertical Launches in Year 2012

	No. Ops[1]	Propellant (tons)[3]	HCl	Al_2O_3	Cl	CO_2	CO	NO_2	H_2O	OH
Bottom 3000 ft										
V1 Launch, Solid	60	1	3.40	6.16	0.05	7.45	0.00	4.37	4.37	0.00
V1 Launch, Hydro/Hybrid[2]	30	20	0.00	0.00	0.00	78.20	0.00	0.00	28.56	2.94
V2 Launch, Hydro/Hybrid	3	20	0.00	0.00	0.00	7.82	0.00	0.00	2.86	0.29
V2 Landing, Hydrocarbon	3	2	0.00	0.00	0.00	5.59	0.00	0.00	2.04	0.21
V3 Launch, Hydrocarbon	10	20	0.00	0.00	0.00	26.07	0.00	0.00	9.52	0.98
V3 Landing, Hydrocarbon	10	2	0.00	0.00	0.00	18.62	0.00	0.00	6.80	0.70
TOTAL	**116**		**3.40**	**6.16**	**0.05**	**143.75**	**0.00**	**4.37**	**54.15**	**5.12**
Troposphere										
V1 Launch, Solid	60	1	11.47	20.75	0.15	25.12	0.00	14.74	14.74	0.00
V1 Launch, Hydro/Hybrid	30	20	0.00	0.00	0.00	262.54	0.00	0.00	95.88	9.87
V2 Launch, Hydro/Hybrid	3	20	0.00	0.00	0.00	26.25	0.00	0.00	9.59	0.99
V2 Landing, Hydrocarbon	3	2	0.00	0.00	0.00	5.59	0.00	0.00	2.04	0.21
V3 Launch, Hydrocarbon	10	20	0.00	0.00	0.00	87.51	0.00	0.00	31.96	3.29
V3 Landing, Hydrocarbon	10	2	0.00	0.00	0.00	18.62	0.00	0.00	6.80	0.70
TOTAL	**116**		**11.47**	**20.75**	**0.15**	**425.63**	**0.00**	**14.74**	**161.01**	**15.06**
Stratosphere										
V1 Launch, Solid	60	1	1.13	2.05	0.02	2.48	0.00	1.46	1.46	0.00
V1 Launch, Hydro/Hybrid	30	20	0.00	0.00	0.00	296.06	0.00	0.00	108.12	11.13
V2 Launch, Hydro/Hybrid	3	20	0.00	0.00	0.00	29.61	0.00	0.00	10.81	1.11
V2 Landing, Hydrocarbon	3	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V3 Launch, Hydrocarbon	10	20	0.00	0.00	0.00	98.69	0.00	0.00	36.04	3.71
V3 Landing, Hydrocarbon	10	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	**116**		**1.13**	**2.05**	**0.02**	**426.83**	**0.00**	**1.46**	**156.43**	**15.95**

1 Number of launch and landing operations.
2 Hydro/Hybrid=Hydrocarbon or hybrid propellant system.
3 1 metric ton = 1.1 ton

Exhibit J-6e. Rocket Emission Loads to Atmospheric Layers for All Vertical Launches in Year 2013

	No. Ops[1]	Propellant (tons)[3]	HCl	Al_2O_3	Cl	CO_2	CO	NO_2	H_2O	OH
Bottom 3000 ft										
V1 Launch, Solid	70	1	3.97	7.18	0.05	8.69	0.00	5.10	5.10	0.00
V1 Launch, Hydro/Hybrid[2]	30	20	0.00	0.00	0.00	78.20	0.00	0.00	28.56	2.94
V2 Launch, Hydro/Hybrid	3	20	0.00	0.00	0.00	7.82	0.00	0.00	2.86	0.29
V2 Landing, Hydrocarbon	3	2	0.00	0.00	0.00	5.59	0.00	0.00	2.04	0.21
V3 Launch, Hydrocarbon	10	20	0.00	0.00	0.00	26.07	0.00	0.00	9.52	0.98
V3 Landing, Hydrocarbon	10	2	0.00	0.00	0.00	18.62	0.00	0.00	6.80	0.70
TOTAL	**126**		**3.97**	**7.18**	**0.05**	**144.99**	**0.00**	**5.10**	**54.88**	**5.12**
Troposphere										
V1 Launch, Solid	70	1	13.38	24.21	0.18	29.30	0.00	17.20	17.20	0.00
V1 Launch, Hydro/Hybrid	30	20	0.00	0.00	0.00	262.54	0.00	0.00	95.88	9.87
V2 Launch, Hydro/Hybrid	3	20	0.00	0.00	0.00	26.25	0.00	0.00	9.59	0.99
V2 Landing, Hydrocarbon	3	2	0.00	0.00	0.00	5.59	0.00	0.00	2.04	0.21
V3 Launch, Hydrocarbon	10	20	0.00	0.00	0.00	87.51	0.00	0.00	31.96	3.29
V3 Landing, Hydrocarbon	10	2	0.00	0.00	0.00	18.62	0.00	0.00	6.80	0.70
TOTAL	**126**		**13.38**	**24.21**	**0.18**	**429.82**	**0.00**	**17.20**	**163.47**	**15.06**
Stratosphere										
V1 Launch, Solid	70	1	1.32	2.39	0.02	2.90	0.00	1.70	1.70	0.00
V1 Launch, Hydro/Hybrid	30	20	0.00	0.00	0.00	296.06	0.00	0.00	108.12	11.13
V2 Launch, Hydro/Hybrid	3	20	0.00	0.00	0.00	29.61	0.00	0.00	10.81	1.11
V2 Landing, Hydrocarbon	3	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
V3 Launch, Hydrocarbon	10	20	0.00	0.00	0.00	98.69	0.00	0.00	36.04	3.71
V3 Landing, Hydrocarbon	10	2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL	**126**		**1.32**	**2.39**	**0.02**	**427.25**	**0.00**	**1.70**	**156.67**	**15.95**

1 Number of launch and landing operations.
2 Hydro/Hybrid=Hydrocarbon or hybrid propellant system.
3 1 metric ton = 1.1 ton

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APPENDIX K
AQUIFER DRAWDOWN CALCULATIONS

To determine the effects of proposed Spaceport America ground water use on the alluvial aquifer beneath the proposed site and vicinity, aquifer drawdown calculations were performed. Those calculations evaluate the impacts of the construction and operations pumping scenarios from a theoretical well with withdrawal (pumping rate) equivalent to the three wells of the Proposed Action. Ground water drawdowns at locations from one-half to three miles from the proposed withdrawals are presented in Chapter 4; the details of the drawdown calculation at two miles after one-and-a-half years of construction Phase 1 pumping are amplified in this appendix.

The aquifer drawdown was calculated using the Theis equation, which is a long-established method for estimating drawdown at a fully penetrating pumping well in a homogeneous, isotropic, uniformly thick aquifer.

$$h_0 - h(r,t) = \frac{Q}{4\pi T}\int_u^\infty \frac{e^{-u}\,du}{u}$$

$$= \frac{Q}{4\pi T} W(u)$$

where h_0 = initial elevation of aquifer pressure head (meters)
r = distance from pumping well (meters)
t = time since pumping began (days)
h(r, t) = elevation of aquifer pressure head at distance r and time t (meters)
Q = pumping rate (cubic meters/day)
T = aquifer transmissivity (square meters/day)
S = aquifer storativity (unitless)
u = $r^2S/(4Tt)$
W(u) = well function = $-0.5772 - \ln(u) + u - u^2/(2*2!) + u^3/(3*3!) - u^4/(4*4!) + \ldots$

Parameters used in the proposed Spaceport America water impacts drawdown analysis were:

Q = 199.12 cubic meters/day (58.9 acre-feet/year) for 1 ½ years of construction Phase 1
36.947 cubic meters/day (10.9 acre-feet/year) for 1 year of construction Phase 2
56.522 cubic meters/day (16.7 acre-feet/year) for operations
(Thomas and Gutman, 2007)

T = 46.5 square meters/day (500 square feet/day), rounded down from the smallest value for producing wells measured on-site by Shomaker (2008). The Theis equation, above, shows that larger transmissivity results in smaller drawdown.

S = 0.0001 the lowest end of the range for the alluvial sediments (Shomaker, 2006). A lower value of S results in a lower value of u and a larger value of the well function. The larger the well function, the greater the drawdown.

The calculation of the drawdown one-mile from the equivalent Spaceport America well after one-and-a-half years of construction is calculated below:

$r = 3218.68$ meters
$t = 547.5$ days
$Q = 199.12$ cubic meters/day
$T = 46.45$ square meters/day
$S = .0001$
$u = 3218.68 * 3218.68 * .0001/(4 * 46.45 * 547.5) = .01018$
$W(u) = -0.5772 - \ln(.01018) + .01018 - 2.593E\text{-}5 + 5.868E\text{-}8 - \ldots. = 4.020$

$h_0 - h(2 \text{ miles}, 2 \text{ years}) = 199.12 * 4.020/ (4 * \pi * 46.45) = 1.371$ meters (4.5 feet)

Drawdown during construction Phase 2, which is assumed to begin at the conclusion of the 1 ½ year duration of Phase 1, was calculated by superposition of the Phase 2 withdrawal solution to the Theis equation on the Phase 1 solution.

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APPENDIX L
SCHEMATICS OF MAJOR PROPOSED FACILITIES

Exhibit L-1. Aerial View of Proposed Terminal and Hangar Facility

Exhibit L-2. East Elevation (facing toward Runway) of Proposed Terminal and Hangar Facility

Exhibit L-3. West Elevation (facing toward Spaceport America Entrance) of Proposed Terminal and Hangar Facility

Exhibit L-4. Aerial View of North Elevation of Proposed Terminal and Hangar Facility

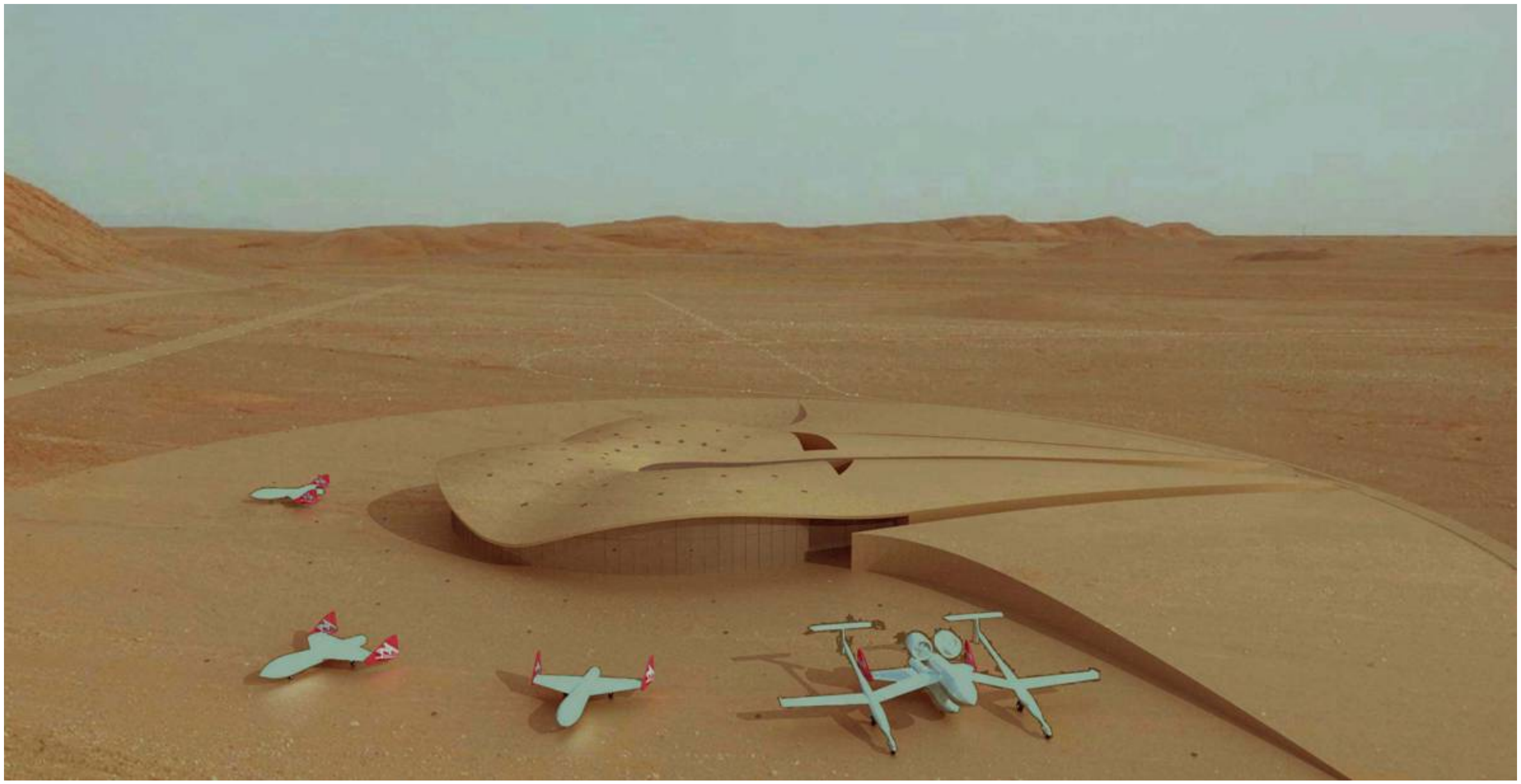


Exhibit L-5. North and South (facing toward Terminal and Hangar Facility) Elevations of Proposed Aircraft Rescue and Fire-Fighting Facility

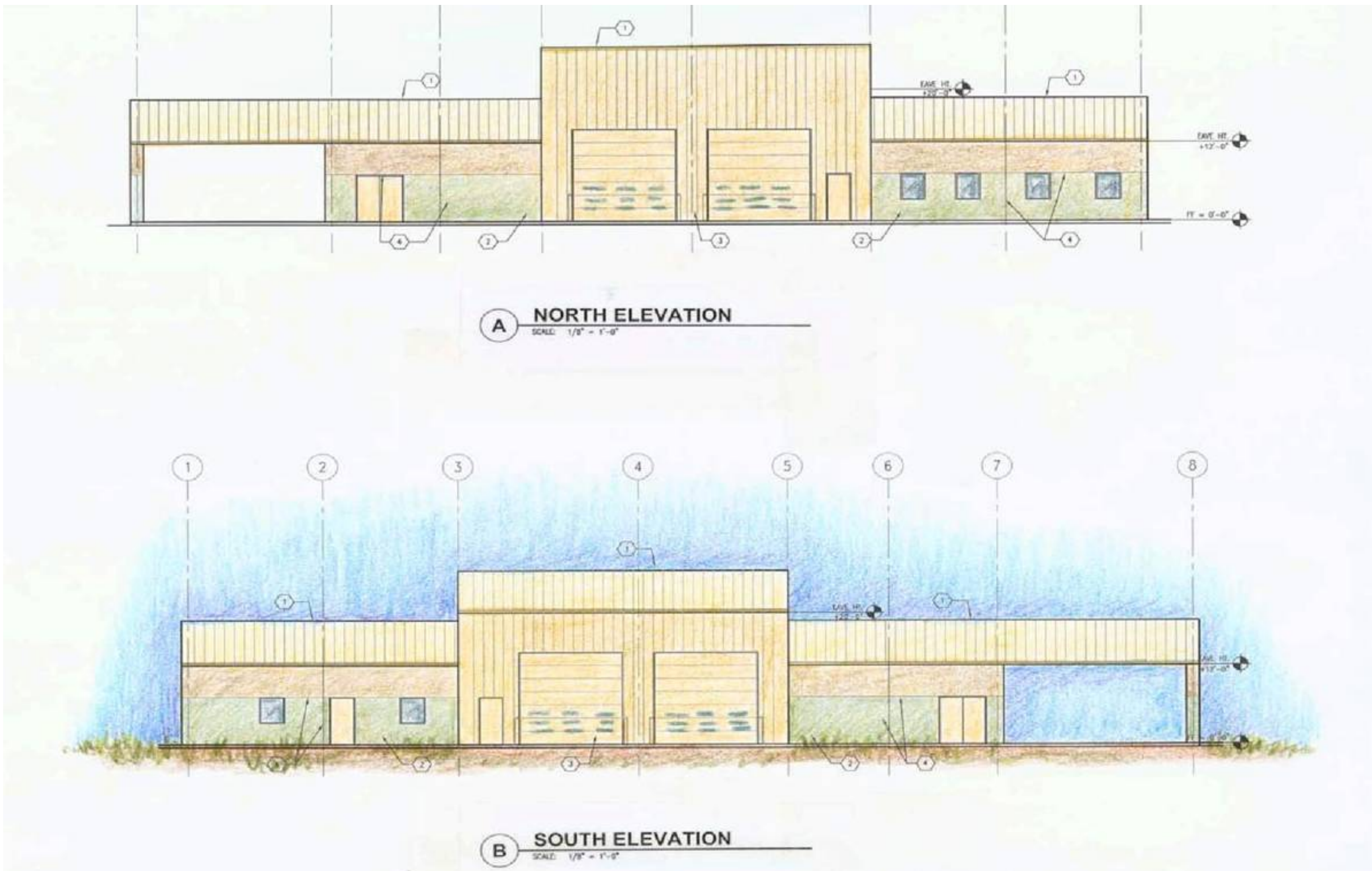
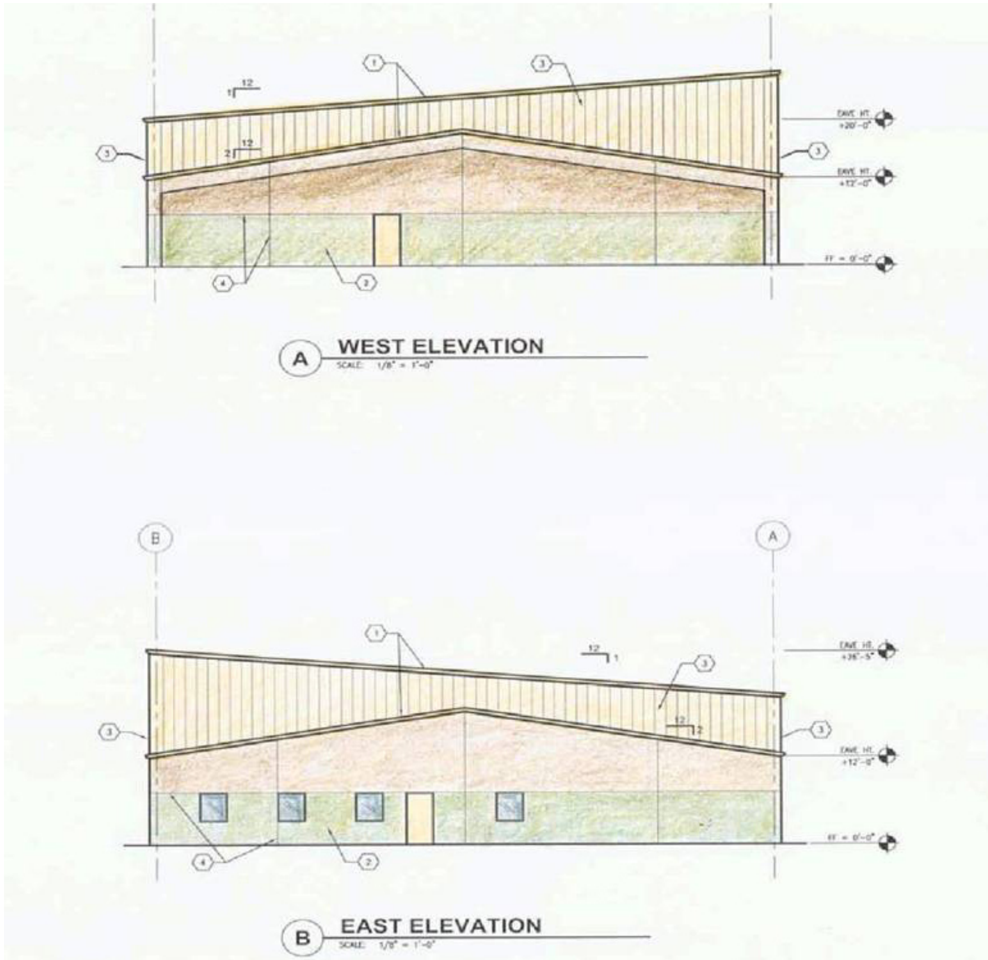


Exhibit L-6. West and East (facing toward Runway) Elevations of Proposed Aircraft Rescue and Fire-Fighting Facility



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APPENDIX M
CALCULATIONS OF EMISSION LOAD FROM AIRFIELD OPERATIONS

This appendix presents the methodology to calculate air emissions due to aircraft operations at the proposed Spaceport America, and the results of the calculations performed.

M.1 General Method to Calculate Emission Loads

The air emissions due to aircraft operations at the proposed Spaceport America were calculated using the Emissions and Dispersion Modeling System (EDMS) program (version 5.0.2) produced by the Federal Aviation Administration (FAA, 2007). By specifying aircraft type, engine type, and the number of landing and takeoff (LTO) cycles, EDMS determines the amount of the following air emissions.

- Carbon Monoxide (CO)
- Total Hydrocarbons (THC)
- Non-Methane Hydrocarbons (NMHC)
- Volatile Organic Compounds (VOC)
- Oxides of Nitrogen (NOx)
- Oxides of Sulfur (SOx)
- Particulate Matter 10 microns and smaller (PM-10)
- Particulate Matter 2.5 microns and smaller (PM-2.5)

EDMS also calculates the air emissions from the typical auxiliary power units (APU) and ground support equipment (GSE) associated with the specified aircraft activity. These calculations are made using the International Civil Aviation Organization (ICAO) and United States Environmental Protection Agency (USEPA) defaults within EDMS. Air emissions were calculated for both normal aircraft operations and the seven days of X Prize Cup activities.

M.2 Data Used to Calculate Emission Loads

EDMS requires several types of inputs, including the numbers and types of aircraft using the airfield (fleet mix), the airfield location, and the number of Landing & Takeoff Operations (LTOs) per aircraft and engine type (an LTO is the combination of one arrival and one departure while an "operation" is an arrival or departure; therefore one LTO equals two operations). The fleet mix for normal operations is shown in Exhibit M-1, and Exhibit M-2 shows the fleet mix for additional aircraft operations during X Prize Cup operations. Exhibit M-3 shows the maximum annual number of LTOs per aircraft and engine type. The airfield location was estimated at latitude of 33.00356 North and longitude of 106.97276 West and an elevation of 4601 feet above sea level. Exhibit M-3 shows the number of LTOs for each combination of aircraft type and engine type (Spalding and Gutman, 2008). The amount of time it takes for aircraft to taxi to and from the runway was assumed to be 16.5 and 7 minutes, respectively (NYCC, 2007). Default values were used for all other inputs.

Exhibit M-1. Aircraft Fleet Mix for Normal Operations

		MTOW	Annual	Aircraft	Substitution	MTOW	Departures		
User	**Aircraft**	**(lbs)**	**Departures**	**In INM?**	**Aircraft**	**(lbs)**	**Annual**	**Daily**	**INM Aircraft Used**
Tenant 1	Boeing 757	240,000	1,200	Yes			750.0	2	Boeing 757-200/pw2037
Tenant 2	150,000 DWG	150,000	600	No	Boeing 737-400	150,000	5.0	0.014	Not modeled because the small number of flights annually (7) would make no significant contribution to DNL average sound; included in X Prize Ops
Tenant 3	150,000 DWG	150,000	300	No	Boeing 737-400	150,000	2.0	0.005	
Global Express	100,000 DWG	100,000	500	No	Boeing 737-100	108,000	180.2	0.5	Boeing 737/JT8D-9QN [substitution]
Gulfstream V	90,500 DWG	90,500	500	Yes			180.2	0.5	Gulfstream GV/BR 710
Gulfstream IV	73,200 DWG	73,200	500	Yes			180.2	0.5	Gulfstream GIV-SP/TAY 611-8
Gulfstream III	68,700 DWG	68,700	500	Yes			180.2	0.5	Gulfstream GIIB/GIII-SPEY 511-8
Eclipse 500	7,000 SWG	7,000	1,000	No	550 Citation II	15,000	360.5	1.0	MU3001 [substitution]
Citation X	35,700 DWG	35,700	500	Yes			180.2	0.5	Citation X/RR Allison AE 3007C
Other	30,000 SWG	30,000	1,000	No	Learjet 60	23,500	360.5	1.0	Learjet 60 [LEAR 35 substitution]
Source: Spalding and Gutman, 2008.									

Exhibit M-2. Aircraft Fleet Mix for Additional X Prize Cup Operations

		Departures	INM Aircraft Used	
Aircraft	**Purpose**	**Daily**	**ID**	**Description**
550 Citation II	Carry passengers or chase plane	4	CNA550	MU3001 [substitution aircraft]
Boeing 737-400	Horizontal LV flights	2	737400	Boeing 737-400/CFM56-3C-1
Boeing 727-200	Zero-gravity flights	3	727D17	Boeing 727-200/JT8D-17
Learjet 25	Rocket Racers	96	LEAR25	LEAR 25/CJ610-8
Source: Spalding and Gutman, 2008				

Exhibit M-3. Maximum Annual LTOs per Aircraft and Engine Type

Aircraft type	Engine type	LTO
Normal Operations		
Boeing 737-100 Series	JT8D-9 series	181
Boeing 757-200 Series	PW2037	750
Boeing 737-400 Series	CFM56-3C-1	7
Bombardier Learjet 60	TFE731-2/2A	361
Cessna 550 Citation II	JT15D-4 series	361
Cessna 750 Citation X	AE3007C Type 2	181
Gulfstream G550	BR700-710A1-10	181
Gulfstream II-B	SPEY Mk511 Transply IIH	181
Gulfstream IV-SP	TAY 611-8C Transply IIJ	181
X Prize Cup Activities		
Boeing 737-400 Series	CFM56-3C-1	14
Boeing 757-200 Series	PW2037	21
Bombardier Learjet 60	TFE731-2/2A	672
Cessna 550 Citation II	JT15D-4 series	28

M.3 Results

The following exhibits give the results of the EDMS calculations. Exhibit M-4 and Exhibit M-5 show aircraft, GSE, and APU emissions per type of aircraft from normal operations and X Prize Cup activities, respectively. Exhibit M-6 and Exhibit M-7 show the maximum annual emissions for normal operations and the seven days of X Prize Cup activities, respectively. The estimated maximum annual pollutant emissions due to airfield operations are presented in Exhibit M-8.

Exhibit M-4. Emissions from Airfield Activities during Normal Spaceport Operations (tons)

Aircraft	Engine	Mode	CO	THC	NMHC	VOC	NOx	SOx	PM-10	PM-2.5	Fuel Con
Boeing 737-100 #1	JT8D0-9 Series Reduced	Airport	1,287	0.594	0.594	0.562	1.406	0.236	0.042	0.042	173.662
		APU	0.166	0.010	0.010	0.010	0.044	0.009	0.000	0.000	N/A
		GSE	2.526	0.090	0.082	0.085	0.264	0.007	0.007	0.007	N/A
Boeing 737-400 #1	CPM56-3C-1	Airport	0.086	0.009	0.009	0.009	0.075	0.009	0.002	0.002	6.961
		APU	0.006	0.000	0.000	0.000	0.000	0.000	0.000	0.000	N/A
		GSE	0.098	0.003	0.003	0.003	0.010	0.000	0.000	0.000	N/A
Boeing 757-200 #1	PW2037	Airport	9.211	1.633	1.633	1.547	13.572	1.325	0.331	0.331	974.312
		APU	0.180	0.019	0.019	0.019	0.414	0.044	0.000	0.000	N/A
		GSE	10.481	0.377	0.343	0.357	1.142	0.0.32	0.032	0.031	N/A
Bombardier Learj #1	TFE731-2/2A	Airport	1.662	0.443	0.443	0.407	0.306	0.063	0.012	0.012	46.535
		APU	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		GSE	1.937	0.070	0.063	0.065	0.165	0.004	0.002	0.002	N/A
Cessna 550 Citat	JT15D-4 series	Airport	3.324	2.051	2.051	1.886	0.169	0.059	0.041	0.041	43.546
		APU	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		GSE	1.942	0.071	0.064	0.066	0.177	0.004	0.003	0.003	N/A
Cessna 750 Citat #1	AE3007C Type 2	Airport	0.826	0.210	0.210	0.193	0.208	0.045	0.006	0.006	32.992
		APU	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		GSE	0.974	0.036	0.032	0.033	0.089	0.002	0.001	0.001	N/A
Gulfstream G550 #1	BR700-710A1-10	Airport	1.482	0.171	0.171	0.157	0.507	0.106	0.014	0.014	77.645
		APU	0.018	0.001	0.001	0.001	0.088	0.009	0.000	0.000	N/A
		GSE	1.272	0.043	0.039	0.041	0.102	0.003	0.002	0.002	N/A
Gulfstream II-B #1	SPEY Mk511 Transply IIH	Airport	2.589	0.632	0.632	0.599	1.491	0.217	0.046	0.046	159.570
		APU	0.178	0.003	0.003	0.003	0.031	0.006	0.000	0.000	N/A
		GSE	0.453	0.017	0.015	0.016	0.052	0.001	0.002	0.002	N/A
Gulfstream IV-SP #1	TAY611-8C Transply IIJ	Airport	2.027	0.153	0.153	0.145	1.032	0.182	0.018	0.018	133.719
		APU	0.178	0.003	0.003	0.003	0.031	0.006	0.000	0.000	N/A
		GSE	0.650	0.023	0.021	0.021	0.058	0.002	0.001	0.001	N/A

Exhibit M-5. Emissions from Airfield Activities during X Prize Cup Operations (tons)

Aircraft	Engine	Mode	CO	THC	NMHC	VOC	NOx	SOx	PM-10	PM-2.5	Fuel Con
Boeing 737-400 #1	CPM56-3C-1	Airport	0.172	0.018	0.018	0.018	0.150	0.019	0.003	0.003	13.923
		APU	0.013	0.001	0.001	0.001	0.003	0.001	0.000	0.000	N/A
		GSE	0.195	0.007	0.006	0.007	0.020	0.001	0.001	0.001	N/A
Boeing 757-200 #1	PW2037	Airport	0.258	0.046	0.046	0.043	0.380	0.037	0.009	0.009	27.282
		APU	0.005	0.001	0.001	0.001	0.012	0.001	0.000	0.000	N/A
		GSE	0.293	0.011	0.010	0.010	0.032	0.001	0.001	0.001	N/A
Bombardier Learjet #1	TFE731-2/2A	Airport	3.093	0.824	0.824	0.758	0.570	0.118	0.023	0.023	86.628
		APU	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		GSE	3.607	0.130	0.117	0.122	0.307	0.008	0.004	0.083	N/A
Cessna 550 Citatio	JT15D-4 series	Airport	0.258	0.159	0.159	0.146	0.013	0.005	0.003	0.003	3.378
		APU	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
		GSE	0.151	0.005	0.005	0.005	0.014	0.000	0.000	0.000	N/A

Exhibit M-6. Maximum Annual Pollutant Emissions from Normal Operations (tons per year)

Category	CO	THC	NMHC	VOC	NOx	SOx	PM-10	PM-2.5
Aircraft	22.461	5.895	5.895	5.504	18.765	2.243	0.511	0.511
GSE	20.333	0.730	0.662	0.689	2.059	0.056	0.050	0.048
APUs	0.726	0.036	0.036	0.036	0.608	0.073	0.000	0.000
Parking Facilities	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Roadways	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Stationary Sources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Training Fires	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Grand Total	43.553	6.661	6.594	8.229	21.432	2.372	0.562	0.559

Exhibit M-7. Maximum Annual Pollutant Emissions from X Prize Cup Operations (tons per year)

Category	CO	THC	NMHC	VOC	NOx	SOx	PM-10	PM-2.5
Aircraft	3.781	1.047	1.047	0.965	1.114	0.178	0.039	0.039
GSE	4.246	0.153	0.138	0.144	0.373	0.009	0.005	0.005
APUs	0.018	0.001	0.001	0.001	0.015	0.002	0.000	0.000
Parking Facilities	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Roadways	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Stationary Sources	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Training Fires	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Grand Total	8.045	1.202	1.187	1.110	1.502	0.190	0.044	0.044

Exhibit M-8. Maximum Annual Pollutant Emissions from All Airfield Operations (tons per year)

	CO	THC	NMHC	VOC	NOX	SOX	PM-10	PM-2.5
Total	51.60	7.86	7.78	7.34	22.93	2.56	0.61	0.60

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