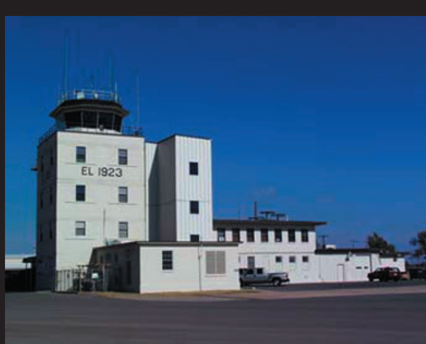
Federal Aviation Administration



Department of Transportation
Federal Aviation Administration
Office of Commercial Space Transportation

Final Environmental Assessment for the Oklahoma Spaceport

May 2006

Final Environmental Assessment for the Oklahoma Spaceport

AGENCY: Federal Aviation Administration (FAA), lead agency and United States Air Force, cooperating agency

PUBLIC REVIEW PROCESS: In accordance with the National Environmental Policy Act (NEPA), the FAA initiated a public comment period for the Draft Environmental Assessment (EA) for the Oklahoma Spaceport. The Notice of Availability of the Draft EA was announced in the Federal Register on February 3, 2006 (71 FR 5901). This notice initiated the beginning of the Draft EA public comment period, which ended on March 13, 2006. A public hearing on the Draft EA was held in Burns Flat, Oklahoma on March 9, 2006 to receive comments from the public. Comments received on the Draft EA are addressed in Appendix C and incorporated into this Final EA as appropriate.

ABSTRACT: The Final EA for the Oklahoma Spaceport addresses the potential environmental impacts of the proposed action, where the FAA would issue a launch site operator license to the Oklahoma Space Industry Development Authority (OSIDA) to operate a launch facility at the Clinton-Sherman Industrial Airpark (CSIA). The CSIA is located in Washita County, adjacent to the town of Burns Flat, Oklahoma. This EA evaluates the impacts of launching three types of launch vehicles from the CSIA.

Potential impacts of the proposed action and alternatives were analyzed in the Final EA. Potential environmental impacts of successful launches include impacts to the atmosphere, airspace, biological resources, cultural resources, hazardous materials and hazardous waste, health and safety, geology and soils, land use and Section 4(f) resources, noise, socioeconomics and environmental justice, transportation, visual resources, and water resources. Potential cumulative impacts of the proposed action are also addressed in the Final EA.

CONTACT INFORMATION: Questions regarding the proposed action and Final EA for the Oklahoma Spaceport can be addressed to Mr. Doug Graham, FAA Environmental Specialist, FAA Oklahoma Spaceport EA, c/o ICF Consulting, 9300 Lee Highway, Fairfax, VA 22031; e-mail FAAOklahomaSpaceportEA@icfconsulting.com; or fax (703) 934-3951.

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

Responsible FAA Official:

Patricia Grace Smith
Associate Administrator for
Commercial Space Transportation

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EXECUTIVE SUMMARY

Introduction

Under the proposed action, the Federal Aviation Administration (FAA) would issue a launch site operator license to the Oklahoma Space Industry Development Authority (OSIDA). In addition, as part of the proposed action, the FAA would approve the transfer of ownership of the Clinton-Sherman Industrial Airpark (CSIA) from the City of Clinton, Oklahoma to OSIDA. OSIDA proposes to operate a launch facility at the CSIA located adjacent to the town of Burns Flat, Oklahoma. The CSIA is a public use airport currently used by both military and civilian aircraft primarily as a training facility. To operate a commercial launch facility, OSIDA must obtain a license from the FAA, Office of Commercial Space Transportation (AST). Individual launch operators proposing to conduct launches at the CSIA must also obtain a license or permit, as appropriate from the FAA.

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 Code of Federal Regulations [CFR] 420.43) A license to operate a launch site authorizes a licensee to offer its launch site to a launch operator for each launch point that can accommodate 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 the 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)

The decision to license or permit a commercial launch or the operation of a commercial launch site by the FAA is considered a major Federal action; consequently, the FAA is responsible for analyzing the environmental impacts associated with licensing or permitting proposed commercial launches or proposed commercial launch sites as required by the National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190), as amended, 42 United States Code (U.S.C.) § 4321, et seq. The land transfer of ownership from the City of Clinton to the CSIA is of a type of action that the FAA has found, based on past experience with similar actions, does not normally require an Environmental Assessment (EA) or Environmental Impact Statement (EIS) because it does not individually or cumulatively have a significant effect on the human environment. Accordingly, this type of action is normally categorically excluded. However, because the land transfer is interrelated with the decision to license the operation of a commercial launch site, this EA addresses both requirements.

The FAA is the lead Federal Agency for the NEPA process and the United States (U.S.) Air Force (USAF) is a cooperating agency on this proposed action. The CSIA is an auxiliary training location for Altus Air Force Base (AFB) and Vance AFB. The USAF is the primary user of the CSIA for aircrew training including landing and departures. In addition, the USAF's current and yet undefined future activities could be impacted by the use of the CSIA as a launch site. Therefore, the FAA requested and the USAF agreed to participate as a cooperating agency in the preparation of this EA.[1]

Purpose and Need

The CSIA would serve as an alternative location to Federal facilities or other commercial sites for launching horizontally-launched, suborbital vehicles. The proposed action would allow OSIDA to offer the CSIA to customers wishing to conduct launch operations. Customers operating under a launch license may use the facility to provide for-profit launch services including tourism activities. Customers operating under an experimental permit may use the facility to conduct research, development, and testing of reusable launch vehicles (RLVs). These activities are consistent with the objectives of the Commercial Space Launch Amendments Act of 2004[2] (CSLAA) and AST's mission to encourage, facilitate, and promote commercial launch and reentry activities by the private sector. Given the increasing demand for lower cost access to space, commercial launch site operators have begun to develop proposals to offer launch sites not collocated with Federal facilities or operated by the Department of Defense (DoD) or the National Aeronautics and Space Administration (NASA). The proposed action is needed to meet this demand.

The purpose of the FAA action in connection with OSIDA's request for licensure is to ensure compliance with international obligations of the United States (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 CSLAA, the Commercial Space Transportation Competitiveness Act, Executive Order 12465, 14 CFR Parts 400-450, the National Space Transportation Policy, and the National Space Policy. The purpose of the FAA action in connection with the proposed transfer of property from the City of Clinton to OSIDA is to ensure that the transfer of the CSIA property is conducted in accordance with Federal laws and regulations, including, without limitation, applicable provisions of 49 U.S.C. Ch. 471 (§§ 47101-47153) and 14 CFR Parts 152 and 155.

Public Involvement

On October 23, 2002, the FAA issued a Notice of Intent in the FR (67 FR 65169) announcing the intent to prepare an EIS and conduct public scoping meetings. Two scoping meetings were held in November 2002 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

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[1] The FAA published a Notice of Intent to prepare an Environmental Impact Statement for this proposed project in the Federal Register (FR) (67 FR 65169) on October 23, 2002. However, OSIDA has since determined that their proposed action consists of only a subset of the activities that were originally proposed in the Notice of Intent. Therefore, the FAA reconsidered the scope of the analysis required to support the proposed action and alternatives and determined that an EA would more appropriately address the environmental consequences of the proposed action and alternatives. On October 7, 2005, the FAA issued a notice in the FR announcing that the proposed action would be addressed in an EA.

[2] Formerly the Commercial Space Launch Act, see 49 U.S.C. Subtitle IX, Chapter 701

impacts associated with the proposed action. The scoping meetings were held at the Western Technology Center, Burns Flat, Oklahoma on November 13, 2002 and at the Metro Technology Center, Springlake Campus, Oklahoma City, Oklahoma on November 14, 2002. The comments and concerns raised by the public have been incorporated into this document, as appropriate.

The FAA reconsidered the scope of the analysis required to support the proposed action and alternatives and determined that an EA would more appropriately address the environmental consequences of the proposed action and alternatives. On October 7, 2005, the FAA issued a notice in the FR announcing that the proposed action would be addressed in an EA.

The Notice of Availability of the Draft EA was announced in the Federal Register on February 3, 2006 (71 FR 5901). This notice initiated the beginning of the Draft EA public comment period, which ended on March 13, 2006.

The FAA held a public hearing to request comments on the Draft EA on March 9, 2006 at the Western Technology Center in Burns Flat, Oklahoma. Five persons provided oral comments, and one person submitted a written comment. In addition, comments on the Draft EA were accepted via fax, mail, and e-mail. All comments on the Draft EA were taken into consideration when preparing this Final EA. Specific responses to comments are provided in Appendix C of this document.

Description of the Proposed Action/Preferred Alternative

OSIDA has identified three types of launch vehicles, identified in this EA as Concept X, Y, and Z, which are typical of the vehicles that would operate from the CSIA. The proposed action includes launches and landings of all three Concept launch vehicles. The potential users of the site would be responsible for obtaining any necessary permits or approvals including a launch license from the FAA for specific missions. The FAA may use the analysis in this document as the basis for making a determination on whether to prepare an EIS or a Finding of No Significant Impact regarding the issuance of a launch site operator license and the licensing or permitting of the launch of certain types of launch vehicles and the transfer of ownership of the CSIA.

The activities included in this analysis are those associated with launches and landings of Concept X, Y, and Z launch vehicles at the CSIA. The FAA does not license vehicles, only the operation of vehicles, launch sites, and reentry sites.

The CSIA has been proposed as a location to support static rocket engine testing. In addition to becoming a launch site, OSIDA may offer the CSIA as a location to test these types of rocket engines. Rocket engines would be tested using a mobile trailer tied down to the test area. Rocket engines that are tested at the CSIA would consist of Rocketdyne 88 or similar engines and would either be incorporated into vehicles that are launched at the CSIA or at other facilities.

No construction activities are proposed as part of the proposed action. Existing infrastructure including buildings, hangars, and runways would be used to support proposed launch and landing operations at the site.

The scope of this analysis is limited to the five-year period supporting the launch site operator license that would be issued by the FAA and considers the use of the CSIA for launching and landing horizontally-launched Concept X, Y, and Z vehicles into suborbital trajectories. Under the proposed action, the CSIA would continue to operate as a general aviation airport.

Description of Alternatives and No Action

The FAA identified two alternatives to the proposed action, which are considered in this EA. The first alternative would involve the issuance of a launch site operator license to OSIDA for the CSIA that would allow only Concept X and Y vehicles to be launched from the CSIA. The FAA has proposed this alternative because OSIDA holds Memoranda of Understanding (MOUs) with companies proposing to launch Concept X and Y vehicles, but not with companies proposing to launch Concept Z vehicles.

The second alternative would involve the issuance of a launch site operator license to OSIDA for the CSIA that would allow only Concept X and Z vehicles to be launched from the CSIA. The FAA has proposed this alternative because the issuance of a license to OSIDA to operate a launch facility to launch Concept X and Z vehicles may reduce the amount of rocket emissions that reach the ground and reduce the amount of noise experienced on the ground during launches.

Under the no action alternative, the FAA would not issue a launch site operator license to OSIDA and there would be no commercial launches from the CSIA. In addition, the FAA would not issue launch licenses or permits to any operators for launches from the CSIA. The CSIA would continue to be available for existing aviation and training related activities.

Environmental Consequences of the Proposed Alternatives

Analysis Methodology

Thirteen 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 air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and hazardous waste, health and safety, land use, noise, socioeconomics and environmental justice, transportation, visual resources, and water resources. For each resource area discussed in this EA, 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 Impacts

Exhibit ES-1, Summary of Environmental Impacts from the Proposed Action and Alternatives, presents a summary of the impacts on each resource area.

Exhibit ES-1. Summary of Environmental Impacts from the Proposed Action and Alternatives

Resource Area	Proposed Action	Alternative 1	Alternative 2	No Action Alternative
Air Quality	The total annual nitrogen oxides (NO_X) (26 kilograms), sulfur oxides (SO_X) (11 kilograms), carbon monoxide (CO) (1,962 kilograms), particulate matter (PM) (572 kilograms), and volatile organic compounds (VOCs) (213 kilograms) emissions from all RLVs are less than both the *de minimis* levels set by the Environmental Protection Agency and the level of emission considered significant for Oklahoma stationary sources. No hazardous air pollutants or ozone-depleting chemicals would be emitted. The minimal emissions of the haze-related pollutants associated with the proposed action are expected to have a negligible impact on visibility at the designated Class I area located 80 to 97 kilometers (50 to 60 miles) southeast of the CSIA. Carbon dioxide (CO_2) and water (H_2O) emissions would not substantially affect global warming because they would contribute only a small fraction of the total U.S. annual emissions of greenhouse gases.	The elimination of Concept Z vehicles under alternative 1 would result in a reduction in total emissions as compared to the proposed action. The overall impacts on air quality would be the same or less than those presented under the proposed action.	The elimination of Concept Y vehicles under alternative 2 would result in a reduction in CO_2, H_2O, and hydrogen (H_2) emissions. The overall impacts on air quality would be the same or less than those presented under the proposed action.	No launch or landing activities would occur; therefore, the ambient air quality would not be impacted.

Exhibit ES-1. Summary of Environmental Impacts from the Proposed Action and Alternatives

Resource Area	Proposed Action	Alternative 1	Alternative 2	No Action Alternative
Airspace	The CSIA has the capacity to accommodate the additional operations without substantially impacting airspace. Class A, Class E, and Special Use Airspace would not be substantially impacted due to the infrequency of launch operations and the availability of alternate routes to reroute commercial traffic activities. Because of the relative infrequency of launch operations, and the availability of alternate routes for commercial traffic activities, proposed launches would not be expected to result in degradation of the FAA's ability to control air traffic and provide necessary safety for flight operations in the airspace.	The impacts would be slightly less than those for the proposed action due to the reduced number of total launches.	The impacts would be slightly less than those for the proposed action due to the reduced number of total launches.	No launch or landing activities would occur; therefore, airspace would not be impacted.
Biological Resources	The noise associated with launches and landings would be less than that associated with military aircraft. The emissions associated with launches and landings would not impact biological resources. Threatened and endangered species would not be impacted by the proposed action. If threatened or endangered species are identified in the area, OSIDA would consult with U.S. Fish and Wildlife Service (USFWS), and implement mitigation measures.	The launch and landing of Concept X vehicles would not impact biological resources. The launch and landing of Concept Y vehicles would have the same impacts as those presented under the proposed action.	The launch and landing of Concept X and Z vehicles would not impact biological resources.	No launch or landing activities would occur; therefore, biological resources would not be impacted.

Exhibit ES-1. Summary of Environmental Impacts from the Proposed Action and Alternatives

Resource Area	Proposed Action	Alternative 1	Alternative 2	No Action Alternative
Cultural Resources	Launches and landings would not impact cultural resources. No new infrastructure would be constructed and the nearest historic site listed in the National Register of Historic Places is located approximately 13 kilometers (8 miles) northwest of CSIA. (National Register, 2005) Launches and landings would not impact any known cultural resources or traditions of the Cheyenne-Arapaho Tribe, the Chickasaw Nation, the Comanche Tribe, the Kiowa Tribe, or the Wichita Tribe.	The impacts would be the same as those for the proposed action.	The impacts would be the same as those for the proposed action.	No launch or landing activities would occur; therefore, cultural resources would not be impacted.

Exhibit ES-1. Summary of Environmental Impacts from the Proposed Action and Alternatives

Resource Area	Proposed Action	Alternative 1	Alternative 2	No Action Alternative
Geology and Soils	Concept X, Y, and Z vehicle launches would all use fuels and propellants that would not have any substantial impacts on geology and soils. Potential soil chemistry-altering emissions from launches would be distributed over a large area and would not pose substantial impacts. The limited number of launches and the procedures in place to prevent spills would limit the likelihood of soil contamination, erosion, or soil loss. Impacts to soils from crash debris would not be substantial due to the low probability of a crash and the legal requirement to cleanup any residual hazardous materials. In addition, the proposed action would not result in exposure of individuals or structures to potential adverse effects from seismic activity or substantial erosion or loss of topsoil.	The impacts would be the same as those for the proposed action.	The impacts would be the same as those for the proposed action.	No launch or landing activities would occur; therefore, geology and soils would not be impacted.
Hazardous Materials and Hazardous Waste Management	No substantial impacts regarding hazardous materials and hazardous waste management are anticipated because all propellants and other hazardous materials would be handled, stored, and used in compliance with all applicable regulations. Procedures are in place to minimize potential impacts from spills of propellants.	The impacts from hazardous materials and hazardous waste management would be slightly less than that of the proposed action due to the reduced number of propellants that would be required for operations.	The impacts from hazardous materials and hazardous waste management would be slightly less than that of the proposed action due to the reduced number of propellants that would be required for operations.	No launch or landing activities would occur; therefore, hazardous materials and waste would not be impacted.

Exhibit ES-1. Summary of Environmental Impacts from the Proposed Action and Alternatives

Resource Area	Proposed Action	Alternative 1	Alternative 2	No Action Alternative
Health and Safety	The health and safety conditions associated with the proposed action would not result in substantial health and safety impacts. Existing safety procedures and regulations would be followed in the transport, handling, and management of propellants/industrial chemicals to prevent any harmful exposure. Flight safety procedures will be addressed in the Mission and Safety Review.	The impacts would be the same as those for the proposed action.	The impacts would be the same as those for the proposed action.	No launch or landing activities would occur; therefore, health and safety would not be impacted.
Land Use	No substantial impacts are anticipated because major land use changes would not occur under the proposed action, and OSIDA does not currently have plans to alter the existing land use for the Spaceport Territory. Land use, including individual isolated, residential structures, like those surrounding the CSIA, may be considered compatible within the Day Night Level (DNL) 65 decibel (dB) noise contour where the primary use of land is agricultural and adequate noise attenuation is provided. The proposed action does not require any physical or constructive use that would impair any Section 4(f) properties.	The impacts would be the same as those for the proposed action.	The impacts would be the same as those for the proposed action.	No launch or landing or activities would occur; therefore, land use would not be impacted.

Exhibit ES-1. Summary of Environmental Impacts from the Proposed Action and Alternatives

Resource Area	Proposed Action	Alternative 1	Alternative 2	No Action Alternative
Noise	No substantial noise impacts would be expected from jet engine powered operations associated with Concept X and Z vehicles. Rocket engine powered operating noise associated with Concept X and Z vehicles may range from 60 to 70 A-weighted decibels at ground level; this is roughly equivalent to the C-141A aircraft, and would not result in a change in noise exposure in excess of the applicable threshold of significance. Rocket engine launch noise from Concept Y vehicles would range from 76 to 86 A-weighted decibels; this noise level is similar to existing jet engine noise at the CSIA and would not be expected to result in a change in noise exposure in excess of applicable thresholds of significance. Concept X vehicles would produce sonic booms that range from 1.1 to 1.9 pounds per square foot. Concept Y vehicles would not reach supersonic speeds and therefore would not produce sonic booms. Concept Z vehicles would produce sonic booms that range from 0.5 to 0.7 pounds per square foot. Assuming up to 52 launches per year of these vehicles, the C-weighted day night average noise level would be less than the 61 C-weighted day night average noise level standard.	The impacts would be the same as those for the proposed action.	The impacts would be the same as those for the proposed action.	No launch or landing activities would occur; therefore, noise levels would not be impacted.

Exhibit ES-1. Summary of Environmental Impacts from the Proposed Action and Alternatives

Resource Area	Proposed Action	Alternative 1	Alternative 2	No Action Alternative
Socioeconomics and Environmental Justice	No substantial impacts are anticipated because the proposed action does not result in any of the following: extensive relocation of residents where sufficient housing is not available; relocation of community businesses that would create severe economic hardship for the affected communities; disruption of local traffic patterns that substantially reduce the levels of service of the roads serving the airport and its surrounding communities; or a substantial loss in the community tax base. Minority populations, low-income communities, and children's health would not experience disproportionate adverse impacts from the proposed action.	The impacts would be the same as those for the proposed action.	The impacts would be the same as those for the proposed action.	No launch or landing activities would occur; therefore, socioeconomic conditions and environmental justice and children's health concerns would not be impacted.
Transportation	The limited number of launches would not result in a substantial increase in vehicle volume due to propellant, fuel, or raw material shipments. Road and rail systems in and around the CSIA would not experience unacceptable increases in the ratio of volume-to-capacity. Additional traffic management controls would minimize impacts from tourist activity during peak years.	The impacts would be the same as those for the proposed action.	The impacts would be the same as those for the proposed action.	No launch or landing activities would occur; therefore, infrastructure and transportation would not be impacted.

Exhibit ES-1. Summary of Environmental Impacts from the Proposed Action and Alternatives

Resource Area	Proposed Action	Alternative 1	Alternative 2	No Action Alternative
Visual Resources	No substantial impacts to visual resources are anticipated because the CSIA is a low visual sensitivity area and the activities under the proposed action would not be visually dominant in the viewshed around the CSIA.	The impacts would be the same as those for the proposed action.	The impacts would be less than those for the proposed action.	No launch or landing activities would occur; therefore, visual resources would not be impacted.
Water Resources	Wetlands and floodplains would not be impacted and no new discharges would be released into the wetlands. The fueling and assembly of launch vehicles may result in inadvertent spills or releases of fuel or materials that may impact surface water and ground water. OSIDA or the launch operator would clean up any spills and excavate and remove any contaminated soil associated with an incidental spill or release, resulting in a small impact.	The impacts would be slightly less than for the proposed action, because there would be fewer vehicle preparations and less of a chance for accidental spills or releases.	The impacts would be slightly less than for the proposed action, because there would be fewer vehicle preparations and less of a chance for accidental spills or releases.	No launch or landing activities would occur; therefore, water resources would not be impacted.

Cumulative Impacts of the Proposed Alternatives

Cumulative impacts are "the incremental impact of the actions when added to other past, present, and reasonably foreseeable future action regardless of what agency (Federal or non-Federal) or person undertakes such other actions." (40 CFR 1508.7) The cumulative impacts analysis for this EA focuses on those past, present, and reasonably foreseeable future actions that have the potential to contribute to cumulative impacts. These actions include the cumulative effect of the proposed action/preferred alternative as it would occur over the five-year term of the launch site operator license, the continued use of the CSIA as a training facility for military and general aviation aircraft, and the proposed future use of the CSIA as a location for testing rocket engines. The proposed action has been evaluated for cumulative impacts on air quality, airspace, biological resources, hazardous materials, health and safety, noise, socioeconomic impacts, transportation, visual resources, and water resources. The results of this evaluation are summarized below.

- **Air Quality** - Cumulative air quality impacts associated with the proposed action are not anticipated given that the CSIA is currently in attainment for all criteria pollutants; the emissions associated with the proposed action were estimated using worst-case assumptions; and the increase in emissions associated with the proposed action is relatively small. Furthermore, none of the alternatives to the proposed action would result in higher emissions than the proposed action and thus no cumulative air quality impacts are expected under any of these alternatives. Potential short-term impacts of emissions from rocket engine testing would be mitigated through proper choice of weather conditions and/or burn times.

- **Airspace -** Cumulative airspace impacts associated with the proposed action are not anticipated given that coordination and scheduling procedures would be developed with the Air Route Traffic Control Center (ARTCC) and military users of the CSIA.

- **Biological Resources -** The cumulative noise and emissions would result from ongoing commercial, military, and private aviation activities, future rocket engine testing, as well as from the proposed action. The biological resources affected would be those that have been able to tolerate the existing noise and emissions associated with an active airfield, therefore, the cumulative impacts on biological resources are expected to be minor.

- **Hazardous Materials and Hazardous Wastes** - Cumulative impacts from hazardous materials and hazardous waste management could occur on the portions of the CSIA with historic soil and ground water contamination. However, substantial cumulative impacts associated with the proposed action are not anticipated due to the extensive remediation activities that have been completed at the site.

- **Health and Safety** - Cumulative health and safety impacts associated with the proposed action are not anticipated given that the risk to human health and safety from rocket engine testing would be small and would be limited by safety precautions in place.

- **Noise -** Background noise at the CSIA would increase with the increased level of activity resulting from the addition of launches and landings. Because of the relative infrequency of launches, landings, engine tests, and aircraft operations, the cumulative noise impacts would be relatively small. Sonic booms from supersonic vehicles at high altitudes would create no substantial impacts because of their relatively low magnitude, infrequent occurrence, and occurrence over unpopulated areas.

- **Socioeconomics -** Cumulative socioeconomic impacts associated with the proposed action are not anticipated given the proposed action's small relative size to the workforce in the surrounding counties and the minimal impacts from a population and residential living standpoint. The beneficial cumulative socioeconomic impact could be greater than the direct impact of the proposed action.

- **Transportation -** Over OSIDA's five-year operating period, cumulative transportation impacts could occur because the number of launches (and thus, the number of shipments of propellants and other materials) would rise from 16 in 2006 to 54 in 2010. Cumulative transportation impacts associated with engine testing are not anticipated given the limited number of engine tests and infrequent shipments.

- **Visual resources -** Cumulative visual resource impacts associated with the proposed action are not anticipated given the less than one percent increase in flight operations at the CSIA. The rocket-powered launches of Concept Y vehicles would be limited to a maximum of two per year to prevent substantial cumulative impacts on visual resources.

- **Water Resources -** Cumulative impacts on water resources may result from incidental spills and releases associated with aircraft preparation, rocket engine test preparation, and launch vehicle preparation. Such spills or releases may impact surface water and ground water. OSIDA or the proponent of the activity would clean up any spills or releases and excavate and remove any contaminated soil associated with an incidental spill or release resulting in a small cumulative impact.

Mitigation Measures

The mitigation measures presented in Exhibit ES-2 may be implemented as directed by any license, permit, or related documentation issued by the FAA for this proposed action.

Exhibit ES-2. Mitigation Measures

Resource Area	Mitigation Measures
Air Quality	▪ Minimization of unnecessary traffic to, from, and within the CSIA
Airspace	▪ Surveying the potentially affected airspace prior to launches to ensure no potential conflicts ▪ Scheduling the affected airspace prior to launches to minimize potential conflicts
Biological Resources	▪ Should the whooping crane be identified in or near the wetlands at CSIA, OSIDA would consult with USFWS, and implement mitigation measures to ensure that the activities at the CSIA would not be likely to

Resource Area	Mitigation Measures
	adversely affect the whooping crane. Potential mitigation measures may include monitoring the whooping crane during launch and landing or rocket engine testing activities to document the impacts, or scheduling launches and landings when the whooping crane is not present.
Hazardous Materials/Waste Management	▪ Use of spill prevention, containment, and control measures while transporting equipment and materials ▪ Use of impermeable ground cover and spill containment berms when conducting fueling operations ▪ Bulk hazardous materials (e.g., 210 liter [55 gallon] drums of anti-freeze, hydraulic fluid, compressed welding gases) would be stored in approved containers that meet National Fire Protection Association industrial fire protection codes and required containment systems. ▪ Spill response materials (e.g., sorbents, drain covers, mops, brooms, shovels, drum repair materials and tools, warning signs and tapes, and personal protective equipment) would be readily available for use in the event of an unplanned release. ▪ Storage of hazardous materials would be in protected and controlled areas designed to comply with site-specific spill prevention, control, and countermeasures plans. ▪ Hazardous materials would be inspected before accepting a shipment (e.g., to validate container integrity and expiration date). ▪ Hazardous materials would be purchased in appropriately sized containers (e.g., if the material is used by the can, it would be purchased by the can rather than in bulk sized containers). ▪ Purchasing excess hazardous materials would be avoided. ▪ Hazardous material containers would be appropriately labeled. ▪ Containerization of waste to prevent discharges ▪ Prevention of litter ▪ Controlling access to waste by wildlife
Health and Safety	▪ Prevention of access to hazardous operations areas by non-essential personnel ▪ Follow safety and health procedures and regulations
Transportation	▪ Shipping and delivery of vehicles, vehicle components, and propellant would be conducted under routine procedures in accordance with applicable FAA and Department of Transportation safety standards to minimize possible impacts to transportation.

Relationship Between Short-Term Uses and Long-Term Maintenance and Enhancement of the Environment

Short-term uses of the environment are considered those that occur over a period of less than the life of the proposed action. Conversely, long-term uses of the environment include those impacts that would persist for a period of five years or the life of the proposed action.

Short-term commitments of the proposed action would include labor, capital, and fossil fuels that result directly from renovation of facilities to accommodate potential tenants and vehicle assembly prior to launch at the proposed Oklahoma Spaceport.

From the long-term perspective, the increased utilization of the CSIA would enhance the local and regional economies through new business development. Economic growth in Southwestern Oklahoma is an important vision for OSIDA. Increased activity would also provide increased revenue for improving and maintaining the aging infrastructure of the CSIA.

Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that use of these resources may have on future generations. The use or destruction of specific resources (e.g., energy and minerals) that cannot be replaced within a reasonable time frame is termed an irreversible resource commitment of that resource.

The proposed action would not be expected to result in the loss of threatened or endangered species or cultural resources such as archaeological or historic sites.

The proposed action would result in an increased use of aviation fuel and other propellants required by the RLVs, as well as miscellaneous fuels required by supporting ground vehicles such as tanker trucks. Additionally, raw materials may be required for the assembly of vehicles or vehicle components, or the renovation of facilities at the CSIA. Energy would also be irreversibly and irretrievably committed to the proposed action. Facilities would utilize natural gas or electricity in support of operations.

Adverse Environmental Effects That Cannot Be Avoided

In general, most known adverse effects resulting from implementation of the proposed action would be mitigated through project planning and design measures, consultation with appropriate agencies, and the use of Best Management Practices. As a result, most potential adverse effects would be avoided and those that cannot be avoided would not be expected to result in a substantial impact to the environment.

Adverse environmental impacts that cannot be avoided include short-term noises that may startle or otherwise impact wildlife; the release of small amount of pollutants to the atmosphere; and minor increased generation of hazardous waste at the CSIA.

Consultation with appropriate agencies and implementation of appropriate mitigation measures would help to minimize potential impacts.

Secondary or Induced Impacts

The Council on Environmental Quality (CEQ) defines secondary impacts as "those that are caused by an action and are later in time and farther removed in distance but still foreseeable." Some development projects pose the potential for induced or secondary impacts on the surrounding areas. A secondary or induced impact would exist when a proposed project causes a shift in population growth, public service requirements, or changes in local or regional economic activity that are influenced by the changes produced by implementing the proposed action.

Issuing a launch site operator license to OSIDA for the operation of a launch and landing site at the CSIA would not result in substantial induced impacts. Although the proposed action would support and facilitate limited growth, it would not induce growth. Additionally, there are no known specific future development activities that would be dependent on the proposed action. Therefore, no secondary impacts are expected to result from the proposed action or alternatives analyzed in this EA. The use of the CSIA by launch operators conducting launches and landings of Concept X, Y, and Z vehicles would not result in substantial induced impacts.

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ACRONYMS and ABBREVIATIONS

ADT	Average Daily Traffic
AFB	Air Force Base
AGL	Above Ground Level
AQCR	Air Quality Control Regions
Ar	Argon
ARP	Office of Airports
ARTCC	Air Route Traffic Control Center
AST	Office of Commercial Space Transportation
BNSF	Burlington Northern Santa Fe
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CO	Carbon monoxide
CO_2	Carbon dioxide
CSLAA	Commercial Space Launch Amendments Act
CSIA	Clinton-Sherman Industrial Airpark
dB	Decibel
DERP	Defense Environmental Restoration Program
DEQ	Department of Environmental Quality
DNL	Day Night Level
DoD	Department of Defense
DOT	Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
FAA	Federal Aviation Administration
FBO	Fixed Base Operator
FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FONSI	Finding of No Significant Impact
FR	Federal Register
FSS	Flight Safety System
FUDS	Formerly Used Defense Sites
GPS	Global Positioning System
H_2	Hydrogen
HAP	Hazardous Air Pollutant
HCl	Hydrogen Chloride
He	Helium
HTPB	Hydroxyl-terminated polybutadiene
IFR	Instrument Flight Rules
IIP	Instantaneous Impact Point

LOA	Letter of Agreement
LOX	Liquid oxygen
mg/m^3	Milligrams per cubic meter
$\mu g/ m^3$	Micrograms per cubic meter
MCL	Maximum Contaminant Level
MOA	Military Operations Area
MODA	Midwestern Oklahoma Development Authority
MOU	Memorandum of Understanding
MSL	Mean Sea Level
N_2	Molecular Nitrogen
N_2O	Nitrous oxide
NAAQS	National Ambient Air Quality Standards
NAS	National Airspace System
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NH_3	Ammonia
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_X	Nitrogen oxides
NOTAMs	Notices to Airmen
NPL	National Priorities List
National Register	National Register of Historical Places
O	Oxygen
O_2	Molecular Oxygen
O_3	Ozone
OAS	Oklahoma Archaeological Survey
ODEQ	Oklahoma Department of Environmental Quality
OHP	Oklahoma Highway Patrol
OSHA	Occupational Safety and Health Act
OSIDA	Oklahoma Space Industry Development Authority
Pb	Lead
PIC	Pilot in Command
PM	Particulate Matter
ppm	Parts per million
PSD	Prevention of Significant Deterioration
psf	Pounds per Square Foot
RCRA	Resource Conservation and Recovery Act
RLV	Reusable Launch Vehicle
ROI	Region of Influence
RP-1	Rocket Propellant-1
SAC	Strategic Air Command
SIP	State Implementation Plan
SEL	Sound Exposure Level
SO_2	Sulfur dioxide
SPCC	Spill Prevention, Control and Countermeasures

SWODA	Southwestern Oklahoma Development Authority
TCE	Trichloroethylene
TPH	Total Petroleum Hydrocarbons
TSCA	Toxic Substances Control Act
UP	Union Pacific
USACE	United States Army Corps of Engineers
USAF	United States Air Force
U.S.	United States
U.S.C.	United States Code
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UV	Ultraviolet
VOC	Volatile Organic Compound
VFR	Visual Flight Rules

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1 INTRODUCTION AND PURPOSE AND NEED

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 Federal Aviation Administration (FAA) Order 1050.1E, *Environmental Impacts: Policies and Procedures*, direct FAA lead agency officials to consider the environmental consequences when planning for, authorizing, and approving Federal actions. When the FAA Office of Commercial Space Transportation (AST) issues a license or permit, it is considered a Federal action and is subject to review as required by NEPA. When the FAA approves the transfer of ownership of an airport, it is also subject to NEPA review. The FAA is responsible for determining the extent of NEPA analysis that is appropriate. For this proposed action, the FAA has determined that an Environmental Assessment (EA) is appropriate.[3] An EA is a concise public document which briefly provides sufficient evidence for determining whether to prepare an environmental impact statement (EIS) or a finding of no significant impact (FONSI), aids compliance with NEPA when no EIS is necessary, and facilitates preparation of an EIS when one is necessary. An EA contains an analysis of environmental consequences of a proposed action and reasonable alternatives (including no action), cumulative impacts, and mitigation actions. The FAA is the lead Federal agency for this NEPA process and the U.S. Air Force (USAF) is a cooperating agency for this proposed action.

1.1 Background

OSIDA, a state agency, proposes to develop and operate a commercial launch site at the CSIA located adjacent to the town of Burns Flat, Oklahoma. The City of Clinton, Oklahoma currently owns the CSIA. According to State law, ownership of the land would have to be transferred to OSIDA before the land could be developed using state funds. Additionally, the City of Clinton has been given approval from the FAA Office of Airports (ARP) for the land transfer of the CSIA to OSIDA upon completion of the EA with a FONSI. The CSIA is currently used by both military and civilian aircraft primarily as a training facility. To operate a commercial launch facility, OSIDA must obtain a license from the FAA AST. Individual launch operators proposing to conduct launches at the CSIA must also obtain a license or permit, as appropriate, from the FAA.

Under the proposed action, the FAA would issue a launch site operator license for OSIDA to operate a launch facility at the CSIA and approve the land transfer of the CSIA. A license to operate a launch site authorizes a licensee to offer its launch site to a launch operator for each

[3] The FAA published a Notice of Intent to prepare an Environmental Impact Statement for this proposed project in the Federal Register (FR) (67 FR 65169) on October 23, 2002. However, OSIDA has since determined that their proposed action consists of only a subset of the activities that were originally proposed in the Notice of Intent. Therefore, the FAA reconsidered the scope of the analysis required to support the proposed action and alternatives and determined that an EA would more appropriately address the environmental consequences of the proposed action and alternatives. The original Notice of Intent included vertical and horizontal launches into orbital and suborbital trajectories, construction of facilities, ground activities, pre-flight and payload preparation, launch, reentry, landing/recovery, and vehicle manufacturing. On October 7, 2005, the FAA issued a notice in the FR announcing that the proposed action would be addressed in an EA.

launch point, launch vehicle type, and weight class identified in the license application and upon which the licensing determination is based. 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) 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 rights in the use of airspace or outer space. (14 CFR § 420.41)

In addition to the NEPA environmental review and determination, a launch site operator license applicant must complete a Safety Review and Approval, including an Explosive Site Plan, Accident Investigation Plan, and Launch Corridor Analysis. The Explosive Site Plan ensures the launch site configuration is in accordance with the distance requirements for locating explosive hazard facilities. The Accident Investigation Plan contains the licensee's procedures for reporting, responding to, and investigating launch site accidents. The Launch Corridor Analysis defines the flight corridors in which debris from a non-nominal flight would be expected to impact. Air Traffic Airspace Management at the FAA must assess the proposed action in terms of potential impacts to the FAA airspace management to ensure safe and efficient operation of the National Airspace System (NAS).

As part of this proposed action, the FAA would approve the transfer of ownership of the CSIA from the City of Clinton, Oklahoma, to OSIDA. The CSIA would continue to operate as a general aviation airport following the transfer of ownership.

Under the proposed action, the FAA also may issue launch licenses or permits to individual operators for launches from the CSIA. Individual operators proposing to launch vehicles from the CSIA would need to apply for a launch license or permit from the FAA. The vehicles proposed to be launched at the CSIA would be horizontally launched reusable launch vehicles (RLVs) using suborbital trajectories. In this document, RLVs are launch vehicles that have stages or components that can return to Earth and be recovered or reused. 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)[4] does not leave the surface of the Earth. The vehicles proposed to be launched at the CSIA may carry space flight participants,[5] scientific experiments or other payloads.[6]

There are two types of RLV licenses described in 14 CFR § 431.3. "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 authorized for the mission. A mission-specific license authorizing an RLV mission may

[4] The IIP of a launch vehicle is the projected impact point on Earth where the vehicle would land if its engines stop or where vehicle debris, in the event of failure and break-up, would land. The notion of a "vacuum" IIP reflects the absence of atmospheric effects in performing the IIP calculation. If the vacuum IIP never leaves the Earth's surface, the vehicle would not achieve Earth orbit and would therefore be on a suborbital trajectory.

[5] 'Space flight participant' means an individual who is not crew, carried within a launch vehicle or reentry vehicle.

[6] For purposes of this document, the payload is the item that an aircraft or rocket carries over and above what is necessary for the operation of the vehicle in flight.

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 license or the expiration date stated in the reentry license, whichever comes first. 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."

In some instances it may be appropriate for the FAA to issue experimental permits to companies to conduct operations from the CSIA. The Commercial Space Launch Amendments Act of 2004 (CSLAA) gave the FAA the authority to issue experimental permits. These permits are for launches and reentries of reusable suborbital rockets. The purpose of the experimental permit regime is to reduce the regulatory burden on developers of RLVs during a launch vehicle's development phase. An experimental permit is limited to reusable suborbital rockets flown for the following purposes:

- Research and development to test new design concepts, new equipment, or new operating techniques;
- Showing compliance with requirements as part of the process for obtaining a license; or
- Crew training before obtaining a license for a launch using the design of the rocket for which the permit would be issued. (49 U.S.C. § 70105a(d))

Currently, the FAA issues experimental permits on a case-by-case basis. To that end, the FAA developed *Guidelines for Experimental Permits for Reusable Suborbital Rockets*, May 2005, to assist applicants and the FAA pending a final rulemaking implementing experimental permits.

1.2 Federal Agency Involvement

Two Federal agencies are involved in this proposed action, the FAA and the USAF. Within the FAA, AST is responsible for issuing a launch site operator license and any launch licenses or permits, as appropriate; and the Airports Division is responsible for approving the land transfer of the CSIA from the City of Clinton to OSIDA. The USAF is the primary user of the CSIA for aircrew training including landing and departures. In addition, the USAF's current and yet undefined future activities could be impacted by the use of the CSIA as a launch site.

1.2.1 Role of the FAA

AST's mission is to ensure protection of the public, property, and national security and foreign policy interests of the United States (U.S.) during a commercial launch or reentry activity and to encourage, facilitate, and promote U.S. commercial space transportation. AST's mission is accomplished through both the regulation of commercial space launch and reentry activities and the promotion of industry growth. Low-cost, reliable access to space is the foundation on which many other commercial and strategic applications of space technology are based. The benefits and spin-offs from these technologies contribute to almost every aspect of the ability of the U.S. to remain at the forefront of world technology development and economic prosperity.

The CSLAA promotes the development of the emerging commercial space flight industry and makes the Department of Transportation (DOT) and the FAA responsible for regulating commercial human space flight under 49 U.S.C. Subtitle IX, Ch. 701. The CSLAA requires a phased approach to regulating human space flight; that is, regulatory standards governing human space flight must evolve as the industry matures. The CSLAA requires that the FAA: (1) issue guidance or advisory circulars to guide the implementation of the CSLAA as soon as practical; (2) issue proposed regulations that include those relating to crew, spaceflight participants, and permits for launch or reentry of reusable suborbital rockets not later than December 23, 2005; and (3) issue final regulations not later than June 23, 2006.

Commercial launch companies have historically based their launch operations at Federal launch ranges operated by the Department of Defense (DoD) or the National Aeronautics and Space Administration (NASA). Until the development of commercial launch sites, Federal launch ranges provided commercial launch operators with facilities and launch support, including flight and range safety services. To enable and encourage the development and use of launch sites that are not operated or collocated with and not supported by a Federal launch range, the FAA established regulations for launches and reentries occurring from non-Federal launch sites (see 14 CFR Parts 401, 417, and 420). These regulations also provide licensed launch site operators with licensing and safety requirements to protect the public from the risks associated with launch and reentry activities at licensed sites. The decision to license a commercial launch or the operation of a commercial launch site by the FAA is considered a major Federal action; consequently, the FAA is responsible for analyzing the environmental impacts associated with licensing proposed commercial launches or proposed commercial launch sites.

The FAA ARP is responsible for approving the transfer of ownership of the CSIA from the City to Clinton, Oklahoma to OSIDA. This land transfer is a type of action that the FAA has found, based on past experience with similar actions, does not normally require an EA or EIS because it does not individually or cumulatively have a significant effect on the human environment. Accordingly, this type of action is normally categorically excluded. However, because the land transfer is interrelated with the decision to license operation of a commercial launch site, this EA addresses the requirements of both FAA AST and FAA ARP.

1.2.2 Role of the USAF

The USAF uses the CSIA primarily as an aircrew training facility for practicing airport landing approaches and departures, including tactical arrivals and departures. The CSIA is an auxiliary training location for Altus Air Force Base (AFB) and Vance AFB, both of which are located in Oklahoma. Altus AFB operates KC-135, C-5, and C-17 aircraft at the CSIA and Vance AFB operates T-37, T-6, T-38, and T-1 aircraft at the CSIA. The proposed action for this EA has the potential to impact current and yet undefined future USAF operations at the CSIA. Therefore, the FAA requested and the USAF agreed to participate as a cooperating agency in the preparation of this EA.

The USAF prepared an EA for the C-17 Program Changes at Altus AFB and the 97th Airlift Wing Commander signed a FONSI on August 19, 2004. The EA considered several possible actions including the possible construction of an Assault Landing Zone at the CSIA. The FONSI indicated that the USAF would pursue the proposed action, which was to accommodate the expanded C-17 training program without building a new Assault Landing Zone. Due to the lack of funding and authority to buy or lease land and build the Assault Landing Zone and the urgent need to produce more trained aircrews, the Commander opted for the proposed action. While the USAF has stated that the need still exists for a new Assault Landing Zone and the USAF continues to consider potential sites, including the CSIA, there is no reasonably foreseeable plan to locate such a facility at the CSIA. Accordingly, the cumulative impact from the construction and use of an Assault Landing Zone is not considered in this EA.

1.3 Site Operator and Launch Operator Involvement

1.3.1 Site Operator - OSIDA

The launch site operator license would be for the purpose of operating a facility to launch RLVs horizontally on suborbital trajectories. The launch facility may be used to launch manned vehicles or vehicles containing other payloads.

It is reasonably foreseeable that rocket engine testing would occur at the CSIA. Rocket engine testing is not covered under a launch site operator license; therefore, the impacts of this related activity are considered in the cumulative impacts section of this document.

The issuance of a launch site operator license would not permit OSIDA to conduct launches, only to offer the facility and infrastructure to launch operators. Individual launch operators proposing to conduct launches from the CSIA would need to obtain licenses or permits from the FAA. Launch providers would be responsible for ensuring that they have coordinated with the proper authorities regarding airspace usage. In addition, the City of Clinton, Oklahoma has received approval from the FAA ARP for the land transfer of the CSIA to OSIDA upon completion of the EA with a FONSI.

To gain approval to operate a launch site, an applicant shall demonstrate that for each launch point proposed for the launch site, at least one type of launch vehicle can be flown from the launch site safely. (14 CFR Part 420.19(a)) If an applicant proposes to have more than one type of launch vehicle flown from a launch point, the applicant shall demonstrate that each type of launch vehicle planned to be flown from the launch point can be flown safely from the launch point. (14 CFR § 420.19(b)) OSIDA intends to offer the site for the launch of several classes of RLVs. Therefore, it is necessary for OSIDA to demonstrate that each type of RLV proposed for launch from the CSIA can be launched safely.

Upon issuance of the required FAA license, OSIDA would open the CSIA to commercial launch operations; OSIDA plans to offer the site for horizontal suborbital launches in 2006. Descriptions of the various launch vehicle concepts proposed for launch from the CSIA are included in Section 2.1.4.

1.3.2 Launch Operator

Launch operators would be responsible for obtaining launch licenses or permits from the FAA to conduct launches at the CSIA. In instances where the proposed vehicle designs are similar to or the same as those discussed in this EA, the FAA may use the analysis in this document as the basis for an environmental determination of the impacts of launches. This environmental determination could be used to support licensing or permitting decisions for the launch of specific launch vehicles from the CSIA.

1.4 Purpose and Need

The purpose of the proposed action is to offer the CSIA as an alternative location to Federal facilities or other commercial sites for horizontal launches of RLVs using suborbital trajectories. The proposed action would allow OSIDA to offer the CSIA to customers wishing to conduct launch operations. Customers operating under a launch license may use the facility to provide for-profit launch services including tourism activities. Customers operating under an experimental permit may use the facility to conduct research, development, and testing of RLVs. These activities are consistent with the objectives of the CSLAA of 2004[7] and AST's mission to encourage, facilitate, and promote commercial launch and reentry activities by the private sector.

The purpose of the FAA action in connection with OSIDA'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 CSLAA, the Commercial Space Transportation Competitiveness Act, Executive Order 12465, 14 CFR Parts 400-450, the National Space Transportation Policy, and the National Space Policy. The purpose of the FAA action in connection with the proposed transfer of property from Clinton to OSIDA is to ensure that the transfer of the CSIA property is conducted in accordance with Federal laws and regulations, including, without limitation, applicable provisions of 49 U.S.C. Ch. 471 (§§ 47101-47153) and 14 CFR Parts 152 and 155.

The proposed action is needed to meet the demand for lower cost access to space. Given the infrastructure and development costs associated with constructing launch facilities, the Federal government has been the owner/operator or has leased/sold unused or excess infrastructure and provided expertise to commercial launch operators for the majority of commercial launches. However, with the increasing demand for access to space, commercial launch site operators have begun to develop proposals to offer launch sites not collocated with Federal facilities or operated by the DoD and NASA.

The FAA action is necessary in connection with OSIDA's request for licensure because the Secretary of Transportation has assigned the FAA AST responsibility, under the CSLAA and Executive Order 12465, for oversight of commercial space launch activities, including licensing of launch and reentry sites. The FAA action is necessary in connection with the proposed property transfer from Clinton to OSIDA, because the Secretary of Transportation is charged with responsibility for deciding whether a proposed transfer of any interest in Federal property for public airport purposes is consistent with the requirements of 49 U.S.C. 47151, and for ensuring compliance with an instrument conveying such an interest.

[7] Formerly the Commercial Space Launch Act, see 49 U.S.C. Subtitle IX, Chapter 701

1.5 Public Involvement

The CEQ implementing regulations for NEPA describe public involvement requirements (see 40 CFR § 1506.6). 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.

On October 23, 2002, the FAA issued a Notice of Intent in the FR (67 FR 65169) announcing the intent to prepare an EIS and conduct public scoping meetings. During scoping, the FAA invited the participation of Federal, state, and local agencies, Native American tribes, environmental groups, organizations, citizens, and other interested parties to assist in determining the scope and significant issues to be evaluated in this effort.

Two scoping meetings were held in November 2002 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 provided the public with an opportunity to learn more about the proposed project. The scoping meetings were held at the Western Technology Center, Burns Flat, Oklahoma on November 13, 2002 and at the Metro Technology Center, Springlake Campus, Oklahoma City, Oklahoma on November 14, 2002. The scoping meetings consisted of a presentation by the FAA, a public comment session, and an information poster session with representatives on hand to answer questions. The FAA presentation outlined the NEPA process, the proposed activities, and the role of public involvement in the NEPA process. The public involvement materials presented at these meetings can be reviewed and downloaded at the following Internet address http://www.okspaceporteis.com.

Five attendees provided oral comments at the scoping meetings. Two attendees spoke on behalf of OSIDA; the remaining three speakers were from the general public. Twelve written comments were also provided by the public during the scoping comment period. The majority of comments received were related to the benefits that additional activities at the CSIA could bring to the area, including the creation of jobs and economic growth and development in western Oklahoma. Concerns raised by the public included noise impacts to cattle, noise at night, sonic booms, potential water pollution, potential loss of land for the establishment of a safety zone, and storage of explosives and propellants at the CSIA. In addition to the scoping meetings, the public was provided the opportunity to comment via phone and fax numbers, mail, and e-mail. The comments and concerns raised by the public have been incorporated into this document, as appropriate.

The original Notice of Intent included vertical and horizontal launches into orbital and suborbital trajectories, construction of facilities, ground activities, pre-flight and payload preparation, launch, reentry, landing/recovery, and vehicle manufacturing. OSIDA has since determined that their proposed action consists of only a subset of the activities that were originally proposed in the Notice of Intent. Therefore, the FAA reconsidered the scope of the analysis required to support the proposed action and alternatives and determined that an EA would more appropriately address the environmental consequences of the proposed action and alternatives. On October 7, 2005, the FAA issued a notice in the FR announcing that the proposed action would be addressed in an EA.

The FAA held a public hearing to request comments on the Draft EA. The public hearing was held on March 9, 2006 at the Western Technology Center in Burns Flat, Oklahoma. All public comments received during the public comment period, including those received at the public hearing, were considered as appropriate in this Final EA. The meeting on the Draft EA consisted of a presentation by the FAA, a public comment session, and an information poster session with representatives on hand to answer questions. The FAA presentation outlined the NEPA process, the proposed activities, and the role of public involvement in the NEPA process. The public involvement materials presented at the meeting can be reviewed and downloaded at the following Internet address http://www.okspaceporteis.com.

Five attendees provided oral comments at the scoping meeting. Two attendees spoke on behalf of OSIDA; one on behalf of Rocketplane; one was an elected official; and one speaker was from the general public. Six written comments were also provided by the public during the Draft EA comment period – two of which were received via e-mail and four via regular mail. The majority of comments received were related to the benefits that additional activities at the CSIA could bring to the area, including the creation of jobs and economic growth and development in western Oklahoma. A concern raised by the public was whether or not private individuals who own land that falls within the Spaceport Territory would receive fair market value in the event the land is purchased, in addition to concerns about the Spaceport's potential impact to housing values and mineral rights. Other concerns included potential spills and their impacts on surface water and ground water, and the impacts on general aviation operations and the National Airspace System (NAS). In addition to the public meeting on the Draft EA, the public was provided the opportunity to comment via fax, mail, and e-mail. The comments and concerns raised by the public have been incorporated into this document, as appropriate. Specific responses to comments are available in Appendix C.

1.6 Related Environmental Documentation

The CEQ NEPA implementing regulations state that agencies shall incorporate material by reference when the effect will be to cut down on bulk without impeding agency and public review of the action. The incorporated material must be cited in the statement and its content briefly described. The DOT, NASA, and USAF have previously analyzed the environmental effects of launches, launch site operations, and activities at the CSIA that are hereby incorporated by reference. Other planning and site-specific documents that were used as references in the preparation of this EA are cited as appropriate. The following NEPA documents were used by the FAA in the preparation of this EA and are incorporated by reference.

- DOT. *Final Environmental Assessment for the East Kern Airport District Launch Site Operator License for the Mojave Airport*, February 2004.

- DOT. *Final Environmental Assessment for the Site, Launch, Reentry, and Recovery Operations at the Kistler Launch Facility*, Nevada Test Site, April 2002.

- Department of the Air Force. *Final Environmental Assessment for C-17 Program Changes for Altus Air Force Base, Oklahoma*, July 2004.

- Department of the Air Force. *Proposed Acquisition of Real Estate Interests for Altus Air Force Base*, March 1998.

- Department of the Air Force. *Environmental Assessment for Specialized Undergraduate Pilot Training for Vance Air Force Base*, Oklahoma, February 1997.

- Department of the Air Force. *Final Environmental Assessment of Slow Routes and Instrument Routes for Altus Air Force Base*, Oklahoma, February 1996.

In accordance with CEQ NEPA implementing regulations, this EA tiers from the following programmatic documents:

- DOT. *Final Programmatic Environmental Impact Statement for Licensing Launches*, May 2001.

- DOT. *Final Programmatic Environmental Impact Statement for Horizontal Launch and Reentry of Reentry Vehicles*, January 2006.

"Tiering refers to the coverage of general matters in broader environmental impact statements (such as national program or policy statements) with subsequent narrower statements or environmental analyses (such as statements) incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared." (40 CFR § 1508.28) This EA summarizes the relevant analyses from the PEIS for Licensing Launches and the PEIS for Horizontal Launch and Reentry of Reentry Vehicles and concentrates on issues that are specific to this action.

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2 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 Proposed Action/Preferred Alternative

The proposed action/preferred alternative is for the FAA to issue a launch site operator license to OSIDA for the CSIA. The FAA may also issue launch licenses or permits to individual operators for launches from the CSIA. OSIDA intends to operate a launch site at the CSIA by providing customers a site from which to conduct horizontal launches of RLVs using suborbital trajectories. The requirements for obtaining and possessing a license to operate a launch site are contained in 14 CFR Chapter III, part 420. Under the regulations, a license applicant is required to provide the FAA with information sufficient to conduct environmental and policy reviews and determinations.

This EA is intended to provide the information and analysis required to fulfill the NEPA requirements for the FAA to make a determination to prepare an EIS or FONSI regarding the issuance of a launch site operator license and the licensing or permitting of the launch of certain types of launch vehicles, and the transfer of ownership of the CSIA.

The completion of the environmental review process does not guarantee that the FAA would issue a launch site operator license to OSIDA for the CSIA. The project must also meet all 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 any particular launch proposed from the site. All individual launch license and permit applications would be subject to separate FAA review.

OSIDA has identified three types of horizontally launched RLVs that are considered typical of those vehicles proposed to be launched from the CSIA. These vehicles are identified in this analysis as Concept X, Concept Y, and Concept Z. Descriptions of these vehicles are provided in Section 2.1.4. The proposed action/preferred alternative would include the operation of a launch site to support launches of all three types of vehicles.

The following subsections provide background and description of the proposed action/preferred alternative, alternatives to the proposed action, and the no action alternative.

2.1.1 OSIDA

OSIDA, the launch site operator license applicant, is a State agency created by the Oklahoma legislature in 1999 through Senate Bill 720. The Space Industry Tax Incentive Act (Senate Bill 719) encourages commercial aerospace development in the State through tax credits. OSIDA's mission is to create a launch facility in southwest Oklahoma, attract space industry to the State, enhance economic development of the State, and encourage space-related technology in the state school system at all levels. OSIDA has a seven member volunteer board of directors appointed by the Governor and confirmed by the Senate. The Executive Director oversees agency operations. OSIDA has entered into memoranda of understanding (MOUs) with various interested parties who wish to conduct commercial launches of RLVs and participate in aerospace related activities in Oklahoma. OSIDA identified the CSIA as the preferred location for the launch facility and named the proposed site the "Oklahoma Spaceport."

2.1.2 CSIA

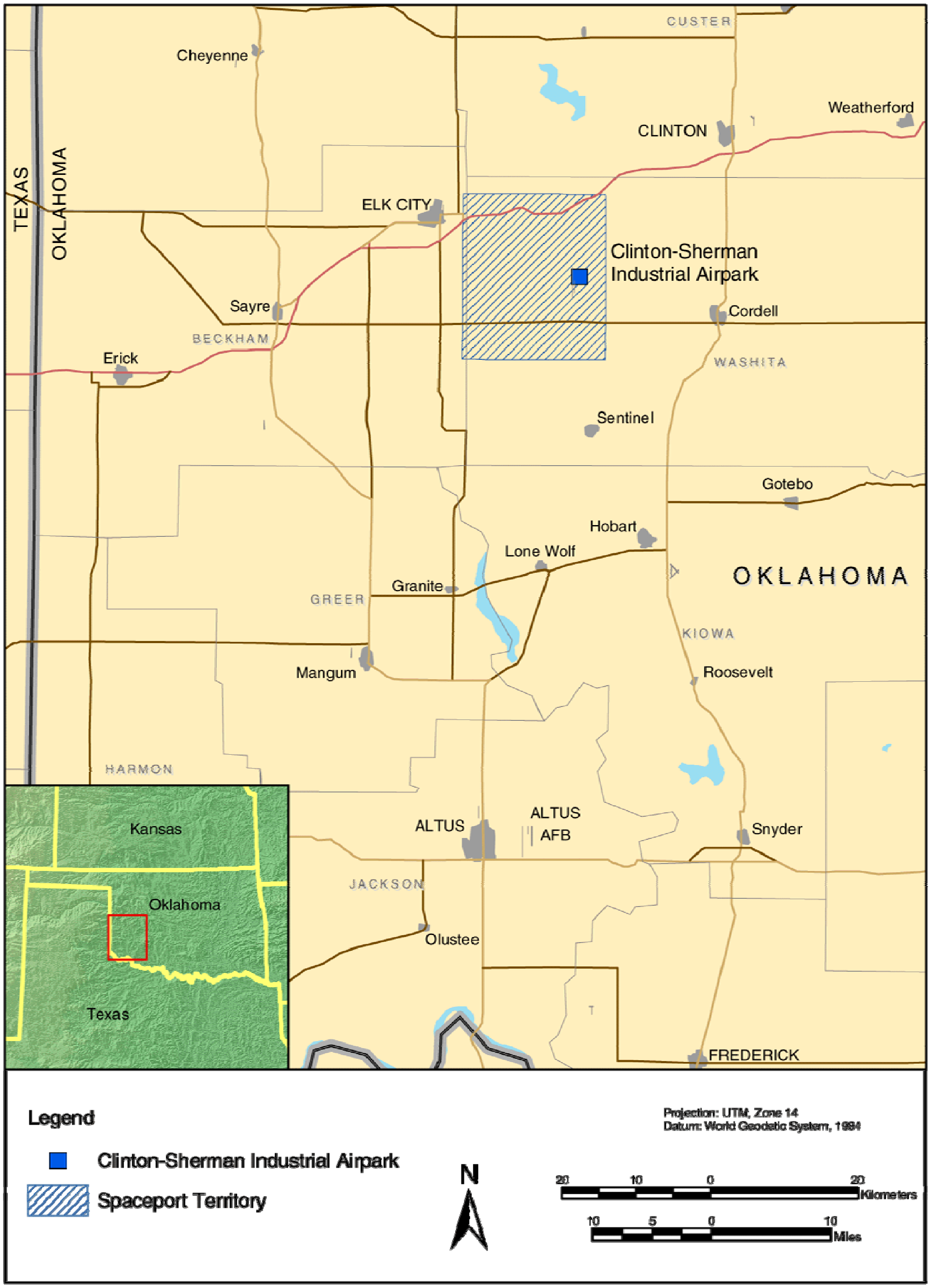
The CSIA is located approximately 160 kilometers (100 miles) west of Oklahoma City and 11 kilometers (7 miles) south of Interstate 40. The 1,090-hectare (2,700-acre) site is owned by the City of Clinton and is included within a 435-square kilometer (168-square mile) area designated by the Oklahoma state legislature as a Spaceport Territory.[8] Exhibit 2-1 shows the location of the Spaceport Territory in relation to the CSIA.

In 1942 the DoD purchased over 2,000 hectares (5,000 acres) to develop the Clinton Naval Air Station. The facility was used primarily as a training facility for pilots. Training operations ceased at the facility in 1946 and the land and infrastructure were acquired by the City of Clinton. At that time, the facility was renamed the Clinton-Sherman Airport and began operation as an industrial airpark. In 1955, approximately 1,090 hectares (2,700 acres) of the site were transferred to the USAF for use as a Strategic Air Command (SAC) fighter and bomber base. This portion of the facility was renamed the Clinton-Sherman AFB. Numerous facilities, including 900 housing units and a new runway were constructed at the base. Between 1955 and 1964, an additional 1,660 hectares (4,101 acres) of surrounding land were acquired through purchases and easements. (Benham Group, 1995)

During the 1960s, military operations were de-emphasized and the Clinton-Sherman AFB was formally closed on December 31, 1969. The USAF maintained the facility until the property was deeded back to the City of Clinton on June 25, 1971. At that time the former AFB was renamed the Clinton-Sherman Industrial Airpark. The housing units were purchased by the Midwestern Oklahoma Development Authority (MODA) and were sold in the late 1970s. In 1993, the City of Clinton leased the CSIA to Southwestern Oklahoma Development Authority (SWODA) to manage and maintain the facility. (Benham Group, 1995) The City of Clinton currently owns the CSIA, and OSIDA must obtain a formal land transfer to develop the land. This land transfer would need to be approved by FAA ARP following completion of this EA.

[8] This Spaceport Territory was designated to provide a launch pad and a geographic area contiguous to a launch facility that would be used to protect the surrounding areas from health and safety hazards as a result of the operation of the launch facility. In addition to establishing the Territory, the Legislature also established a Spaceport Territory Advisory Council made up of a member of the Washita County Commissioners and the Mayors of Burns Flat and Canute. Their authority includes setting zoning, collecting fees, ownership of utilities and roads, and the power to condemn up to 10 hectares (25 acres) of land in the territory. See Section 3.9.3.1, for more detail on the Spaceport Territory.

Exhibit 2-1. Location of the Oklahoma Spaceport Territory



2.1.2.1 Existing Facilities

The CSIA has several existing buildings and hangars that could be used by potential customers. The Spaceport Operation Center would be located in Building 501, which is located at the corner of C Avenue and 4th Street. This facility was previously used for computer science classes and currently houses OSIDA's administrative offices. This facility is equipped with power, phone, and fiber optic capabilities to meet OSIDA's needs for administrative and operational purposes. OSIDA would have direct communication with the control tower during launch operations and would keep a staff member in the control tower during launch operations. The control tower is equipped with an auxiliary generator to provide continuous communication. OSIDA also would have two-way battery powered communication between the control tower and the control center in the event of a power failure.

The CSIA includes six hangars, ranging in size from about 1,579 to 3,066 square meters (17,000 to 33,000 square feet) (see Exhibit 2-2) and a fueling building measuring 557 square meters (6,000 square feet). A vacant manufacturing facility is also available.

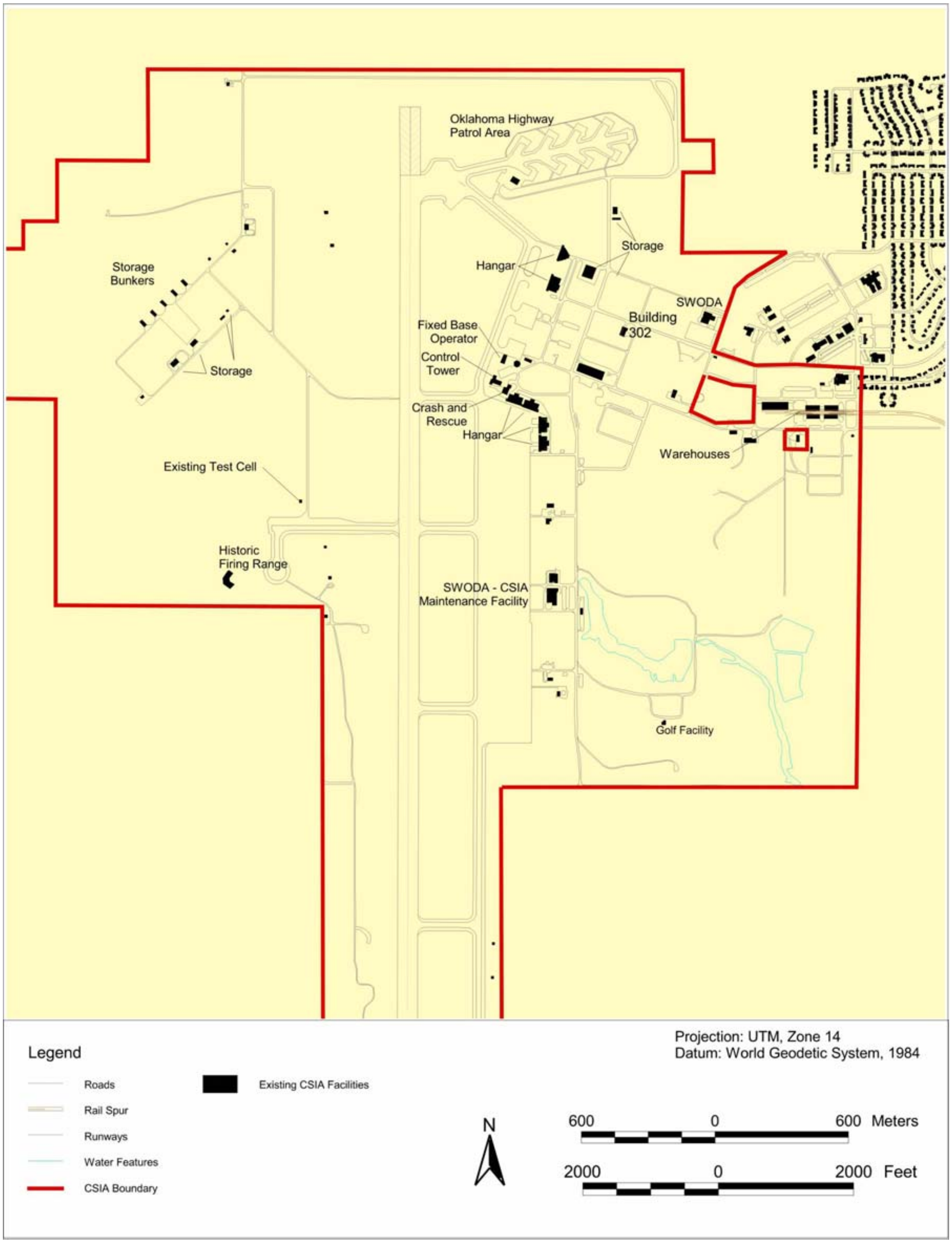
Exhibit 2-2. Existing Hangar at CSIA

Source: SWODA, 2005

Exhibit 2-3 shows the existing facilities at the CSIA. The CSIA has two runways. The main runway, designated 17R/35L, is about 4,115 meters (13,500 feet) long and 91 meters (300 feet) wide. A smaller parallel runway, designated 17L/35R, is about 1,585 meters (5,200 feet) long and 46 meters (150 feet) wide and is marked on the parallel taxiway and into the ramp area. General aviation aircraft use the smaller runway and USAF aircraft primarily use the main runway. (SWODA, 2005)

The Airpark is connected with the Farmrail railroad by a spur that joins the main line about 11 kilometers (7 miles) southeast of the Airpark. The rail spur may require inspection and evaluation prior to use.

Exhibit 2-3. Existing Facilities at the CSIA



2.1.2.2 Current Uses

In 2003, there were approximately 47,000 aircraft operations conducted at the CSIA. Most of these were military operations, with Vance AFB accounting for roughly 24,000, Altus AFB for about 16,000, and other military installations accounting for 1,600. The remaining operations consisted of civilian operations, overflights of the airport, and instrument approaches.

The military conducts takeoffs and landings and transition training, which includes normal and emergency visual and instrument approaches and landings. Training may also include missed approaches, low approaches, touch-and-gos, refused landings, and full stop landings.

It is reasonably foreseeable that static rocket engine testing would occur at the CSIA. OSIDA may continue to offer the CSIA as a location to test these types of engines. Rocket engines would be tested using a mobile trailer tied down to the test area. During tests, the mobile trailer would be located near Building 44 at the CSIA. Rocket engines that are tested at the CSIA would either be incorporated into vehicles that are launched at the CSIA or they could be incorporated into vehicles that are launched at other facilities.

The rocket engines tested at the CSIA would consist of Rocketdyne 88 and similar engines that use liquid oxygen (LOX) and Rocket Propellant-1 (RP-1) as propellants. A maximum of 16 tests could be conducted per year at the CSIA with each test lasting up to 100 seconds. The largest of these tests could require up to approximately 5,761 kilograms (12,700 pounds) of LOX and 2,404 kilograms (5,300 pounds) of RP-1, per test. The smallest tests could require approximately 204 kilograms (450 pounds) of LOX and 86 kilograms (190 pounds) of RP-1, per test. For the purposes of this analysis, it was assumed that all 16 annual engine tests would be the largest types of tests and therefore, this analysis considers the worst case scenario. While not a part of the licensing process, the testing of rocket engines is considered as part of the cumulative impacts discussion for this EA.

2.1.2.3 Decommissioning Activities

Decommissioning would occur if launch activities were approved and conducted at the site and OSIDA eventually decided to stop operating the CSIA as a launch site. If launch activities ceased at the CSIA, the site would continue existing operations as a general aviation airport and USAF training facility. In addition, depending on the terms of the transfer agreement, it is possible that if launch activities ceased at the CSIA, the land would be returned to the City of Clinton. The specific terms of this return of the site would be determined as part of the land transfer agreement and are outside the scope of this EA.

2.1.3 Proposed Activities

This EA addresses the overall impacts to the environment of the proposed operations anticipated for the five-year period supporting the launch site operator license issued by the FAA.

Therefore, the activities analyzed in the proposed action are those associated with the launching and landing Concept X, Y, and Z launch vehicles at the CSIA, as follows:[9]

- Transporting the vehicle, vehicle components, and propellants to the CSIA via road, rail, air, or a combination of the three methods;
- Assembling the various vehicle components;
- Conducting ground-based tests and checkout activities;
- Loading the pilot, passengers, and/or other payload;
- Fueling the launch vehicle;
- Towing or moving the launch vehicle to the proper launch or takeoff location;
- Igniting the rocket motors;
- Collecting any debris from the runway prior to vehicle landing; and
- Recovering and transporting the launch vehicle from the runway after landing.

The FAA issues licenses or permits for the operation of the vehicles and the launch site. The proposed activities would not include any construction at the CSIA. Exhibit 2-4 shows the proposed locations for various activities at the CSIA including the operations control center, fuel holding area, fuel loading area, oxidizer storage area, and oxidizer and passenger loading areas.

Horizontally launched vehicles may use rocket engines, turbojet engines, or jet powered assist vehicles during takeoff. These vehicles would takeoff and land horizontally from the runway at the CSIA. Vehicles landing at the CSIA may use powered or unpowered methods. The various types of vehicles proposed to be launched from the CSIA are described in Section 2.1.4. The launch vehicle and any assist aircraft would both be piloted. The launch vehicle operators would be required to comply with the FAA's current version of the *Guidelines for Commercial Suborbital Reusable Launch Vehicle Operations with Flight Crew*. Because some of the vehicles may also carry fare paying passengers the FAA's current version of the *Guidelines for Commercial Suborbital Reusable Launch Vehicle Operations with Space Flight Participants* may also apply.

There are two launch and landing corridors proposed to be used from the CSIA. The primary corridor would use the airspace to the northwest of the CSIA and the alternate corridor would use the airspace to the southwest. Exhibits 2-5 and 2-6 show the two proposed operating corridors for the CSIA. All launch-related activity would occur within the designated corridors. The amount of area used would depend on the specific mission. Prior to launches from the CSIA, the launch operator would be responsible for complying with all applicable FAA licensing or permitting requirements, including any required calculations regarding expected casualties. The FAA would consider safety concerns as part of the mission and safety analysis prior to making a decision about issuing a launch site operator license to OSIDA or a launch license or permit to a launch operator.

[9] The specific activities associated with launching and landing each type of concept vehicle are described in Section 2.1.4.

Exhibit 2-4. Proposed Facilities for the CSIA

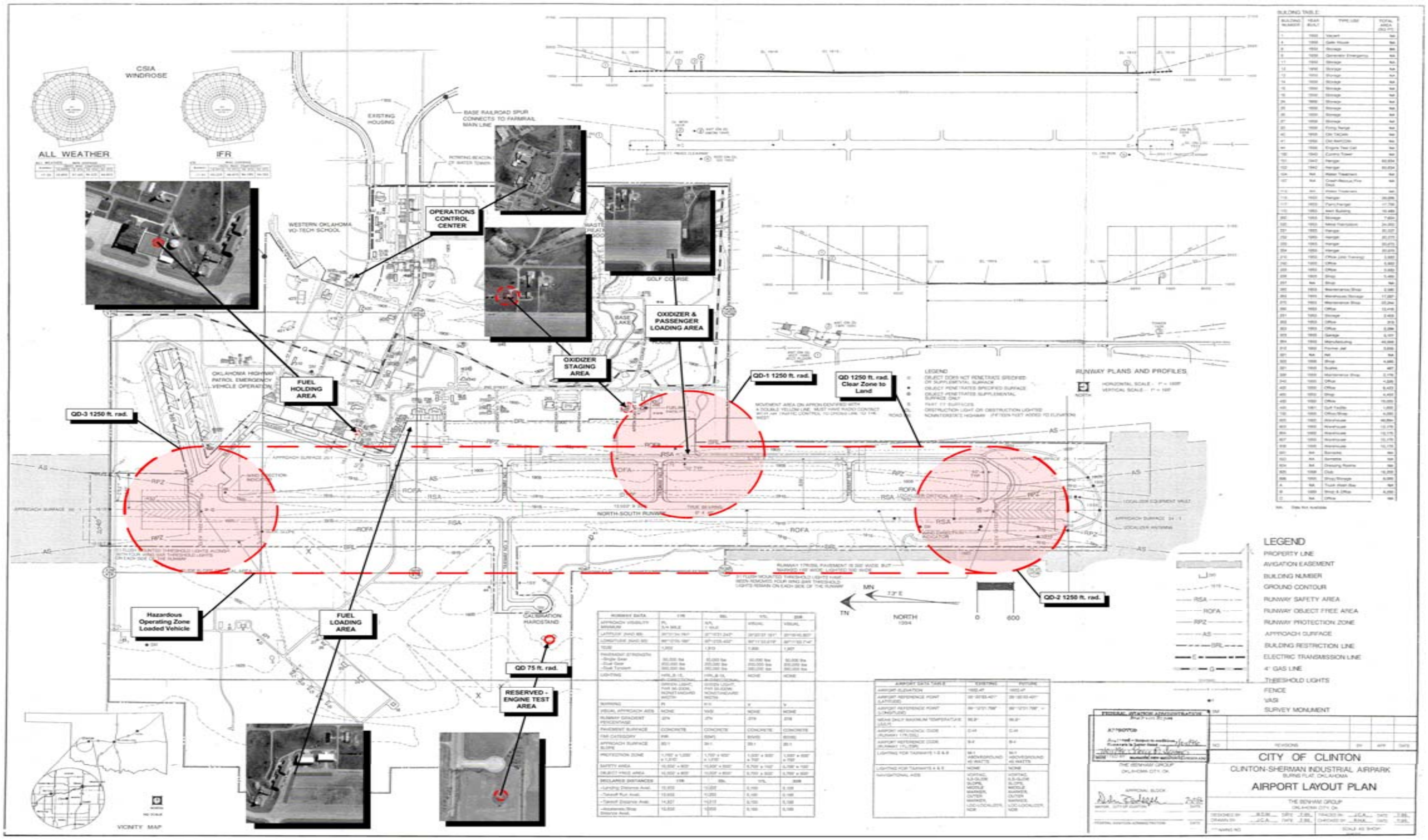


Exhibit 2-5. Proposed Northwest Corridor for the CSIA

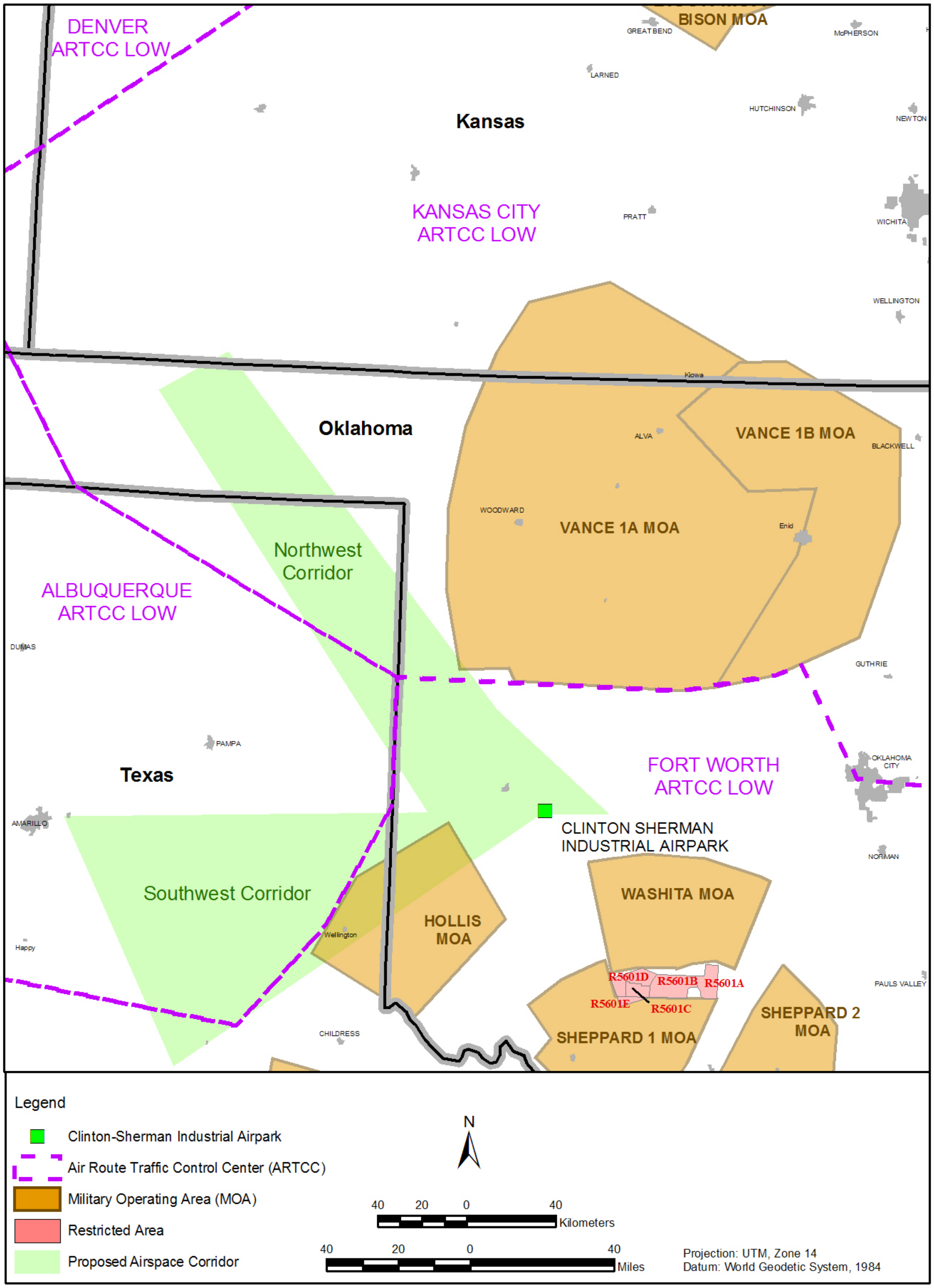
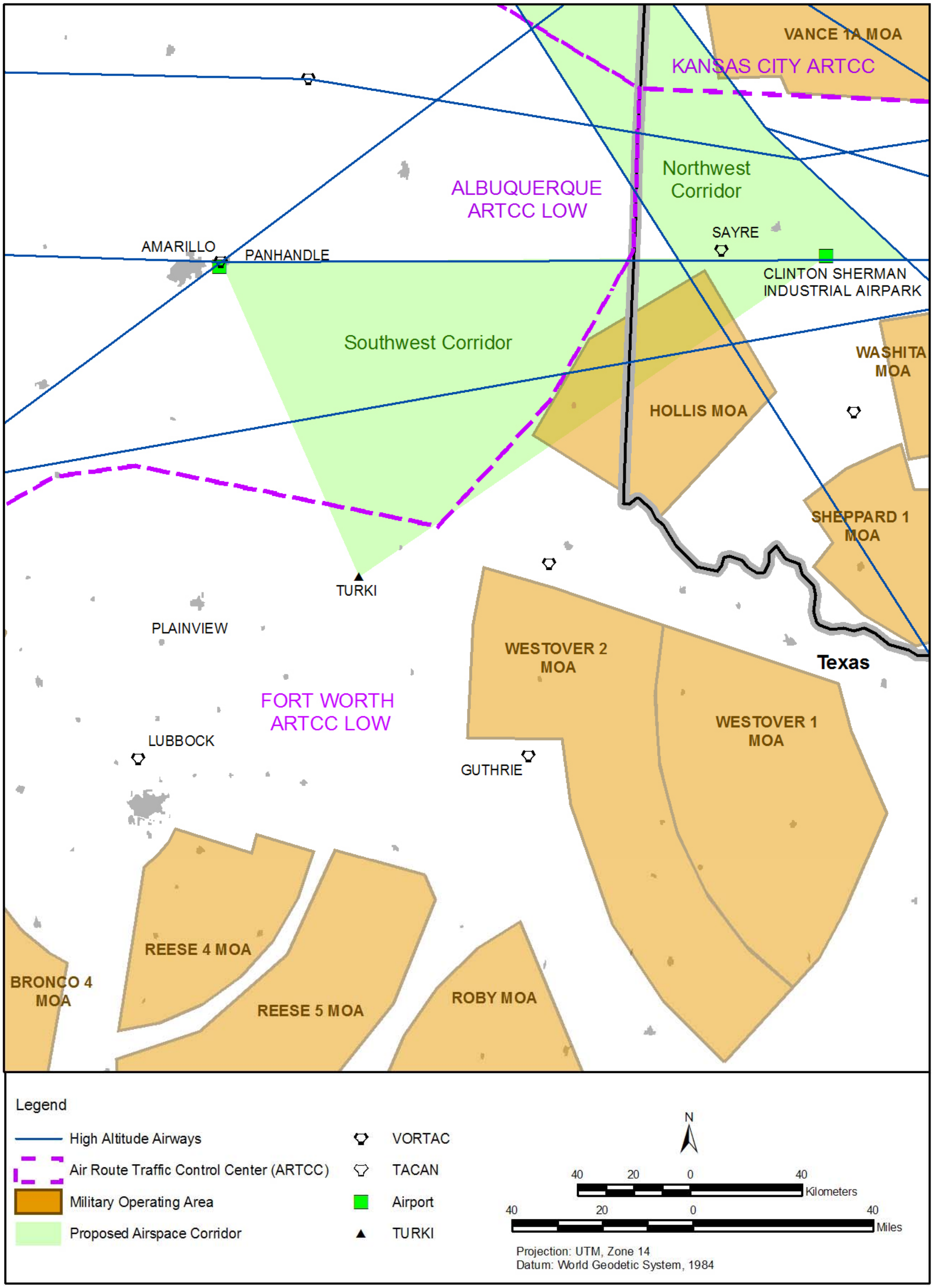


Exhibit 2-6. Proposed Southwest Operational Corridor



2.1.4 Launch Vehicle Concepts

OSIDA has identified three types of suborbital horizontally launched RLVs that are considered typical of the vehicles that would operate from the CSIA. The potential users of the launch site would be responsible for obtaining any necessary permits or approvals including a launch license or permit for specific missions from the FAA. This EA may be used as the basis for the FAA to make a determination about licensing or permitting the launches of some types of launch vehicles from the CSIA. Launch vehicles proposed to be launched from the CSIA would only use suborbital trajectories and therefore, would not repeatedly orbit the Earth. Launch vehicles would launch and land horizontally and would not require runway lengths in excess of existing infrastructure at the CSIA.

2.1.4.1 Concept X

Description of Launch Vehicle

Launch vehicles included in Concept X would be a single component. The vehicle would have two turbojet engines using Jet-A fuel (kerosene) and two rocket engines using kerosene and LOX as propellants. Total thrust of the engines would be 266,893 Newtons (60,000 pounds force). The wingspan of the representative vehicle would be approximately 8 meters (25 feet) and its length would be approximately 14 meters (45 feet). The weight of the launch vehicle when fully fueled would be approximately 8,410 kilograms (18,500 pounds) base line. Exhibit 2-7 shows a representative Concept X launch vehicle.

Exhibit 2-7. Representative Concept X Vehicle

Description of Flight Profile

Concept X launch vehicles would take off horizontally under turbojet power from the main runway at the CSIA. Concept X vehicles require a runway length of 2,438 meters (8,000 feet) for takeoff. Following takeoff, the vehicle would ascend to an altitude from 5,490 to 9,140 meters (18,000 to 30,000 feet) where rocket engines on the vehicle would be ignited. The launch vehicle would climb under rocket power until the rocket propellants are consumed or the rocket engines are turned off. The vehicle would glide unpowered along a parabolic trajectory until reaching apogee (the highest point in the flight trajectory). The launch vehicle would then descend. Turbojet engines would be restarted at a specific altitude and the vehicle would fly to a powered, horizontal landing at the CSIA.

Pre-Launch Activities

Launch operators would be required to notify OSIDA two weeks in advance of a planned launch. OSIDA would coordinate all operations with the control tower chief. The control tower chief and the Spaceport Manager would notify the launch operator of other activities on the airport, resolve conflicts for use, and notify other appropriate airspace scheduling agencies. Mission rehearsals would be conducted with all flight and ground support crews prior to each launch, and would be repeated with various failure scenarios, and irregular performance to ensure crew readiness.

Launch Activities

At an altitude between 5,490 and 9,140 meters (18,000 and 30,000 feet) turbojet engines would be turned off and rocket engines would be ignited. The launch vehicle would use a flight path angle of approximately 72 degrees until propellant is consumed or rocket engines are turned off. The vehicle would continue to coast to apogee. Apogee for Concept X vehicles would likely occur at approximately 106 kilometers (66 miles) altitude. After reaching apogee, the vehicle would descend to an altitude of between 6 and 8 kilometers (4 and 5 miles) where turbojet engines would be restarted.

Landing Activities

The pilot in command (PIC) of the launch vehicle would request authorization from the air traffic control to land at the CSIA. The vehicle would make a powered horizontal landing on the designated runway. In the unlikely event of an emergency landing, the PIC would attempt to reach the closest potential abort site. Potential abort sites for trajectories along the northwest corridor could include existing airports in Oklahoma and Texas including:

- Elk City, Oklahoma
- West Woodward, Oklahoma
- Gage, Oklahoma
- Higgins, Texas
- Follett, Texas
- Canadian, Texas
- Perryton, Texas
- Liberal, Texas
- Miami, Texas

However, any airport within range with a runway of at least 1,219 meters (4,000 feet) would be a candidate for an emergency landing location. Because Concept X launch vehicles would not be launched within the proposed southwest corridor, no abort sites have been identified in this area.

Launch Manifest

Exhibit 2-8 shows the number of launches proposed per year for Concept X launch vehicles at the CSIA. The total maximum number of launches of Concept X launch vehicles would be 144 over the five-year period.

Exhibit 2-8. Maximum Number of Launches of Concept X Launch Vehicles Per Year

Year	2006	2007	2008	2009	2010
Maximum Number of Launches	12	12	24	48	48

2.1.4.2 Concept Y

Description of Launch Vehicles

Launch vehicles included in Concept Y would be a single component. The rocket engine would be turned on while the launch vehicle is on the runway at the CSIA. The rocket engine would use LOX and either kerosene or alcohol as propellants. The wingspan of the representative vehicles would be approximately 8 meters (27 feet) and the length of the vehicle would be approximately 6 meters (19 feet). The weight of the vehicle when fully fueled and ready for takeoff would be approximately 1,150 kilograms (2,600 pounds). Exhibit 2-9 shows a representative Concept Y launch vehicle.

Exhibit 2-9. Representative Concept Y Launch Vehicle

Concept Y launch vehicles would be piloted and the PIC would have cockpit displays capable of monitoring the status of the vehicle. Communication would be possible between the PIC and the ground crew. Very High Frequency radio would be used for communications. Ground and air traffic control frequencies would be used to communicate with the CSIA. In some instances, it may be necessary to use a dedicated frequency for in-company communications. In all instances, safety information would be relayed to all relevant participants. The PIC would be familiar with high performance aircraft, aerobatic flight, glide flight, and unpowered landing.

The PIC would be responsible for activating the Flight Safety System (FSS). This may consist of a number of steps, which would be undertaken by the PIC to ensure that the vehicle glides to a safe landing at the primary landing location at the CSIA or at a designated emergency landing location. The steps that a PIC might take to activate the FSS would include turning off the engine run switch or closing the propellant pre-valves, in both instances stopping the flow of propellant to the engine and thereby stopping the engine. It may also be possible for the PIC to take steps to vent pressure in the LOX tank or dump the LOX, which would also cause the engines to stop working. This process, however, may take up to a minute to complete and therefore would be used only if other methods failed to cut the engine off. The vehicle would carry a fault-tolerant life support system to ensure that the pilot has adequate oxygen during the mission.

Description of Flight Profile

Concept Y vehicles would launch horizontally from a runway at the CSIA and would fly northwest or southwest along a steep ascent trajectory until the propellants are expended or rocket engines are turned off. The vehicles would coast unpowered along a parabolic trajectory until reaching apogee. They would then coast down until pullout and glide to a descent to the CSIA. Upon reaching the CSIA it may be necessary to conduct additional maneuvers to expend excess energy before performing an unpowered horizontal landing.

Pre-Launch Activities

OSIDA has established procedures for customers to provide notification for upcoming launches. Each launch operator would be required to notify OSIDA two weeks in advance of a planned launch. OSIDA would coordinate all operations with the control tower chief. The spaceport manager would notify the launch operator of other activities on the airport, resolve conflicts for use, and notify other appropriate airspace scheduling agencies. In addition, each operator would be required to comply with scheduling procedures for the individual special use airspace to be used.

Pre-launch activities would include a mission readiness review in which a series of tests would be conducted on vehicle systems, engine systems, and mission procedures. These tests would be conducted until the vehicle consistently passes all mission requirements. The vehicle would then be fueled and would undergo a pre-launch check.

The pre-launch check would be conducted in a fashion similar to conventional aircraft. An engineer would check all safety-critical and high-risk systems with the PIC, checking off each system or component as ready for takeoff. The PIC, mission conductor, and crew chief each have the duty and authority to abort or delay the launch at any time, if he/she feels that an unsafe or hazardous launch condition exists. Prior to launch, a brief test of the engines and ignition system may be conducted. This would involve firing each engine for a short duration to verify proper ignition and shutoff. After completing the pre-launch and engine check the launch vehicle would be moved to the launch location, by towing or pushing the vehicle to the appropriate location. Communication with the air traffic control tower would be confirmed and the PIC would confirm the previous authorization for the launch and landing.

Launch Activities

The rocket engines would be turned on and the vehicle would take off horizontally, using a flight path angle of approximately 20 to 50 degrees and fly northwest or southwest. The vehicle would use a steep ascent trajectory until its propellant supply is exhausted or engines are turned off. The vehicle would continue on a parabolic trajectory for 4 to 240 seconds, and coast to apogee. Apogee for Concept Y vehicles would likely occur at approximately 4,000 meters altitude (13,000 feet) above mean sea level (MSL). After reaching apogee, the vehicle would glide to a pullout and energy management area, approximately 10 kilometers (6 miles) downrange of the CSIA to expend excess energy before landing. It may be necessary to fly several circular patterns to expend excess energy before gliding back to the CSIA. At the CSIA, the vehicle may fly several additional circular patterns to expend excess energy.

Landing Activities

The PIC would announce his intentions to land on the control tower frequency prior to landing at the spaceport. The vehicle would make an unpowered horizontal landing on the designated runway. In the unlikely event of an emergency landing, the PIC would attempt to reach one of the potential abort sites. Because of the relatively short downrange distance traveled by Concept Y vehicles, the abort site would be the CSIA.
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Launch Manifest

Exhibit 2-10 shows the number of launches proposed per year for Concept Y launch vehicles at the CSIA. The total maximum number of launches of Concept Y launch vehicles would be 10 over the five-year period.

Exhibit 2-10. Maximum Number of Launches of Concept Y Launch Vehicles Per Year

Year	2006	2007	2008	2009	2010
Maximum Number of Launches	2	2	2	2	2

2.1.4.3 Concept Z

Description of Launch Vehicle

Launch vehicles included in Concept Z consist of two components, a carrier aircraft and a mated suborbital launch vehicle. The aircraft would have turbojet engines using Jet-A fuel. Total thrust of the engines would be less than 35,600 Newtons (8,000 pounds force). The carrier aircraft would carry the launch vehicle to the designated launch release altitude. The launch vehicle could use a hybrid rocket engine with nitrous oxide (N_2O) and hydroxyl-terminated polybutadiene (HTPB) as propellants. The launch vehicle would use only suborbital trajectories. Concept Z launch vehicles would launch and land horizontally and would not require runway lengths in excess of existing infrastructure at the CSIA. Exhibit 2-11 shows one representative Concept Z launch vehicle.

Exhibit 2-11. Representative Concept Z Launch Vehicle

The carrier aircraft and launch vehicle would both be piloted. The wingspan of the representative carrier aircraft would be approximately 25 meters (82 feet) and its length would be approximately 9 meters (30 feet). The wingspan of the representative launch vehicle would be approximately 5 meters (17 feet) and its length would be approximately 6 meters (20 feet). The weight of the launch vehicle when fully fueled would be approximately 3,175 kilograms (7,000 pounds).

The PIC would have cockpit displays monitoring the status of the vehicle. Communication between the PIC and ground crew would be accomplished by standard aircraft-band Very High Frequency radio. The PIC would also be equipped with a “hot mike” (live microphone) audio on the video telemetry downlink for communications between the PIC and the ground crew. A mobile ground station within the CSIA property would be set up during flight tests for data monitoring and recording flight parameters. The vehicle’s avionic displays would be duplicated on a Mission Control monitor.

The PIC would be responsible for flight safety decisions. Mission control would provide data and recommendations and would direct abort if parameters exceed normal mission operating limits. The PIC would also be responsible for shutting down the rocket motor burn system if parameters exceed normal mission limits. The vehicle propulsion system would also contain an internal automatic-shutdown mode should system critical operating parameters be exceeded. The PIC may release N_2O during both nominal and non-nominal missions. During nominal missions 45 kilograms (100 pounds) of N_2O would be released at altitudes between 54,864 and 36,576 meters (180,000 and 120,000 feet).

A small oxygen bottle would be carried in the cabin of the carrier aircraft and launch vehicle to maintain oxygen levels for the pilots. Carbon dioxide (CO_2) would be scrubbed by an absorber system. Humidity in the cabin would be controlled by passing air through the absorber system to remove water vapor.

Description of Flight Profile

The carrier aircraft and launch vehicle would take off horizontally from the CSIA. The aircraft would ascend to an altitude from 16 to 20 kilometers (10 to 12 miles) and the launch vehicle would be released from the carrier aircraft. Rocket engines on the launch vehicle would be fired as the aircraft pulls away. The carrier aircraft would make a powered horizontal landing on the designated runway after releasing the launch vehicle. The launch vehicle would climb until propellants are consumed. The vehicle would glide unpowered along a parabolic trajectory until reaching apogee (the highest point in the vehicle's flight trajectory). The launch vehicle would then descend and glide unpowered, to a horizontal landing at the CSIA.

Pre-Launch Activities

Launch operators would be required to notify OSIDA two weeks in advance of a planned launch. OSIDA would coordinate all operations with the control tower chief. The control tower chief and the Spaceport Manager would notify the launch operator of other activities on the airport, resolve conflicts for use, and notify other appropriate airspace scheduling agencies. In addition, each operator would be required to comply with scheduling procedures for the individual special use airspace to be used. Mission rehearsals would be conducted with all flight and ground support crews prior to each launch, and would be repeated with various failure scenarios and irregular performance to ensure crew readiness.

Launch Activities

The launch vehicle would be mated to the carrier aircraft. The aircraft, carrying the launch vehicle, would take off horizontally from the runway. The launch vehicle would be released from an altitude between 16 to 20 kilometers (10 to 12 miles) and the rocket engine on the launch vehicle would be ignited. The launch vehicle would use a flight path angle of approximately 85 degrees until propellant is consumed (after approximately 65 seconds of climbing). The vehicle would continue to coast to apogee. Apogee for Concept Z vehicles would likely occur at approximately 100 kilometers (62.5 miles) altitude. After reaching apogee, the vehicle would descend in a controlled manner.

Landing Activities

The PIC of the carrier vehicle would request authorization from the air traffic control tower to land at the CSIA after releasing the launch vehicle. The carrier aircraft would make a powered horizontal landing on the designated runway. The PIC of the launch vehicle would request authorization from the air traffic control tower to land at the CSIA. The vehicle would make an unpowered horizontal landing on the designated runway. In the unlikely event of an emergency landing, the PIC would attempt to reach the potential abort sites. Potential abort sites for trajectories along the northwest corridor could include existing airports in Oklahoma and Texas including

- Elk City, Oklahoma
- West Woodward, Oklahoma
- Gage, Oklahoma
- Higgins, Texas
- Follett, Texas
- Canadian, Texas
- Perryton, Texas
- Liberal, Texas
- Miami, Texas

However, any airport within gliding range with a runway of at least 1,219 meters (4,000 feet) would be a candidate for an emergency landing location. Because Concept Z launch vehicles would not be launched within the proposed southwest corridor, no abort sites have been identified in this area.

Launch Manifest

Exhibit 2-12 shows the number of launches proposed per year for Concept Z launch vehicles at the CSIA. The total maximum number of launches of Concept Z launch vehicles would be 15 over the five-year period.

Exhibit 2-12. Maximum Number of Launches of Concept Z Launch Vehicles Per Year

Year	2006	2007	2008	2009	2010
Maximum Number of Launches	2	2	3	4	4

2.1.4.4 Summary of Launch Vehicle Concepts

The different launch vehicle concepts proposed for launch from the CSIA are summarized in Exhibit 2-13.

Exhibit 2-13. Summary of Launch Vehicle Concepts Proposed for Launch from the CSIA

	Concept X	Concept Y	Concept Z
Ignition Source at Ground	Jet Power	Rocket Power	Jet Power (Assist Aircraft)
Launch Vehicle Propellant Type	Kerosene (RP-1) or Alcohol and LOX	Kerosene or Alcohol and LOX	N_2O and HTPB
Use of Assist Aircraft	No	No	Yes
Landing Type	Powered	Unpowered	Unpowered[10]

[10] The assist aircraft would have a powered landing, only the launch vehicle would land unpowered.

2.1.5 Propellant Storage

As a result of the proposed action both liquid and solid propellants could be stored temporarily at the CSIA. These propellants could include: jet fuel, RP-1, alcohol, LOX, N_2O, and HTPB.[11]

The staging area for fuels would be located on an existing 19 square meter (200 square foot) concrete pad located north of the Fixed Base Operator building and water tank, Building 106. The oxidizer staging area would be located on an existing concrete pad contiguous with Building 285 near Apron Road number 6. The staging areas would be located outside of the quantity distance area for the flight vehicles. All facilities that contain explosive hazards would be equipped with lightening protection systems.

2.2 Potential Future Activities

Potential future activities that could be considered by OSIDA include launches to orbital trajectories, reentries from orbit, construction activities to support recreation facilities or an administration complex, and manufacturing activities. Each potential future activity is described below. However, these activities are not mature enough for analysis in this EA. They are described here to present the current vision for the CSIA. As OSIDA's planning progresses, if these activities are deemed to be reasonably foreseeable, it would be necessary for OSIDA to request a modification to their launch site operator license for the new proposed activities. It also would be necessary to consider the environmental impacts of those activities at that time.

2.2.1 Launches to and Reentries from Orbital Trajectories

In the future, OSIDA may offer the CSIA to customers launching payloads into prescribed orbits for commercial and government customers. OSIDA may also offer the CSIA to customers reentering vehicles or payloads from Earth orbit or outer space. Reentry, as defined in 14 CFR 401.5, means "to return or attempt to return, purposefully, a reentry vehicle and its payload, if any, from Earth orbit or from outer space to Earth. The term reenter; reentry includes activities conducted in Earth orbit or outer space to determine reentry readiness and that are critical to ensuring public health and safety and the safety of property during reentry flight. The term 'reenter; reentry' also includes activities conducted on the ground after the vehicle lands on the Earth, to ensure the reentry vehicle does not pose a threat to public health and safety or the safety of property." OSIDA may offer the CSIA for reentries of vehicles returning from Earth orbit or outer space for vehicles launched from a location other than the CSIA. Should future activities at the CSIA expand to include orbital launches and reentries, the FAA would need to consider licensing reentry activities.

2.2.2 Construction Activities

Construction could occur at the CSIA to support a more complex commercial base of operations including buildings such as vehicle processing facilities or a permanent rocket engine test cell.

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[11] N_2O and HTPB are not explosive or flammable unless combined in a rocket motor.

As other companies become interested in locating at the CSIA, additional facilities may be constructed within the proposed launch facility. OSIDA may propose to develop a 7-hectare (17-acre) area as an administration complex to create an industrial space park complex. A 420-square meter (4,500-square feet) visitor's complex within the southwest corner of the administration complex could be developed. The grassy area north of the control tower could be utilized as a viewing area for launch activities. A security fence could be added to the area and access to the area could be monitored by security guards during launch activities.

A 12-hectare (30-acre) complex could be developed to serve as a hangar and facility for assembling aircraft. This complex could also include training facilities for space tourism passengers. Training facilities at the CSIA could include a centrifuge and other unspecified facilities along the apron. Other proposals include development of recreation facilities in the area of the existing golf course including a small hotel, a driving range, an amusement park and additional golf course holes.

OSIDA also may construct a permanent rocket engine test cell at the CSIA to test rocket engines. The engines that would be tested could be incorporated into vehicles that are launched at the CSIA or in vehicles launched at other facilities.

2.2.3 Manufacturing Activities

In the future, OSIDA may decide to offer the CSIA to users who wish to manufacture some of the components of the vehicles and their propulsion systems on site. A vacant manufacturing facility located at the CSIA was recently remodeled and could potentially be available to a manufacturer in the future. The existing manufacturing facility is located near the control tower and hangars. If manufacturing activities became a viable consideration in the future, OSDIA would be required to comply with all applicable laws and regulations pertaining to this type of activity.

2.3 Alternatives to the Proposed Action

The FAA identified two alternatives to the proposed action, which are considered in this EA.

2.3.1 Alternative 1 – Concept X and Y Vehicles Only

This alternative would involve the issuance of a launch site operator license to OSIDA for the CSIA that would allow only the launch of Concept X and Y vehicles from the CSIA. This alternative could also include the issuance of a launch license or permit to a potential Concept X or Y launch operator for launches from the CSIA. Concept Z vehicles currently exist and have been licensed by the FAA to operate from other facilities, thus it is reasonably foreseeable that these vehicles could operate from the CSIA in the five year timeframe discussed in this analysis. However, OSIDA does not currently have an MOU with any company proposing to launch Concept Z vehicles. Because OSIDA holds MOUs with companies proposing to launch Concept X and Y vehicles, the FAA has proposed this alternative to consider the issuance of a launch site operator license to OSIDA for the CSIA that would allow Concept X and Y vehicles to be launched from the CSIA.

2.3.2 Alternative 2 – Concept X and Z Vehicles Only

This alternative would involve the issuance of a launch site operator license to OSIDA for the CSIA that would allow only Concept X and Z vehicles to be launched from the CSIA. This alternative could also include the issuance of a launch license or permit to a potential Concept X or Z launch operator for launches from the CSIA. The proposed Concept Y vehicles would take off from the runway at the CSIA under rocket power, while Concept X and Z vehicles propose to fire rocket engines at an altitude of at least 5,490 meters (18,000 feet). The FAA has proposed this alternative because the issuance of a license to OSIDA to operate a launch facility to launch Concept X and Z vehicles may reduce the amount of rocket emissions that reach the ground and reduce the amount of noise experienced on the ground during launches.

2.4 No Action Alternative

Under the no action alternative, the FAA would not issue a launch site operator license to OSIDA and there would be no commercial launches from the CSIA. In addition, the FAA would not issue launch licenses or permits to any operators for launches from the CSIA. The CSIA would continue to be available for existing aviation and training related activities.

2.5 Alternatives Considered But Not Carried Forward

The alternatives discussed below were considered and eliminated from further analysis.

2.5.1 Alternative Launch Operations

Alternative launch operations were considered for the CSIA, including the following operations.

2.5.1.1 Vertical Launch Vehicles

The OSIDA board of directors met in June 2004 and decided not to pursue vertical launches from the CSIA at this time. The board decided to focus their development and marketing efforts on horizontally launched RLVs using suborbital trajectories. If in the future OSIDA decides to consider vertical launches from the CSIA, a supplemental environmental analysis would need to be conducted.

2.5.1.2 Horizontally Launched RLVs Using Aerial Fueling

Horizontally launched RLVs using aerial fueling would take off under jet engine power from a conventional runway. At a designated altitude (typically between 6,100 and 15,240 meters [20,000 and 50,000 feet] above MSL), a tanker airplane would transfer liquid propellants to the launch vehicle. The tanker airplane would disengage after the propellants are transferred and the launch vehicle would ignite its rocket engines once the tanker airplane cleared the area. Both the tanker aircraft and the launch vehicle would return and land under jet power. Although launch vehicles based on this concept have been proposed, they are in a less mature stage of development than the three vehicle concepts described in Section 2.1.4. The production and launch of this vehicle concept is not reasonably foreseeable within the five-year timeframe of this EA and therefore is not analyzed in this document. If in the future this vehicle concept becomes ready for analysis, it would be necessary to prepare a separate environmental analysis to assess potential impacts.

2.5.1.3 Vehicles Launched from Other Sites and Landing at the CSIA

Although launch vehicle operators have proposed to develop launch vehicles that would launch from one location and land in another location, the development of these vehicles is not considered reasonably foreseeable within the five-year timeframe for this EA. Therefore, this vehicle concept is not considered in this EA. If in the future this vehicle concept becomes ready for analysis, it would be necessary to prepare a supplemental environmental analysis.

2.5.2 Alternative Locations within Oklahoma

Alternative locations within the state of Oklahoma were considered for the establishment of a launch site. Because OSIDA is a state agency, possible locations were limited to Oklahoma. The alternative sites include Sayre Municipal Airport, Sayre, Oklahoma; Frederick Municipal Airport, Frederick, Oklahoma; and Hobart Municipal Airport, Hobart, Oklahoma.

For a launch site to meet the needs of the operators of the proposed vehicle concepts, it must have adequate infrastructure and available airspace. Required infrastructure in this case includes a runway length to accommodate takeoff/launch of horizontal launch vehicles (at least 2,438 meters [8,000 feet]) and airspace suitable for the proposed flight requirements. Exhibit 2-14 summarizes the available infrastructure and airspace at the alternative launch site locations.

Exhibit 2-14. Summary of Available Resources at Various Launch Site Locations

Infrastructure and Airspace	Launch Site Locations			
	CSIA	Sayre	Hobart	Frederick
Runway Length in meters (feet)	Main 4,115 (13,500) Supplemental 1,585 (5,200)	Main 1,529 (5,017)	Main 1,613 (5,293) Supplemental 1,613 (5,293)	Main 1,829 (6,000) Supplemental 1,463 (4,800)
Airspace	No airspace restrictions	Hollis Military Operating Area	Adjacent to Washita, Shepard, and Hollis Military Operating Area	Hollis Military Operating Area

Source: AirNav,2005

All four locations have runways; however, only the CSIA has a runway of at least 2,438 meters (8,000 feet) needed to accommodate takeoff of Concept X launch vehicles. All four locations have sufficient runway lengths (1,219 meters [4,000 feet]) to accommodate an emergency landing or abort of Concept X, Y or Z vehicles. Airspace requirements for specific vehicles would need to be determined on a case-by-case basis; however, it is possible that the restricted airspace over Sayre, Hobart, and Frederick would pose additional challenges for potential launch operators. Because the CSIA possesses the resources and infrastructure needed to support Concept X, Y, and Z vehicles it has been identified as the preferred alternative. Sayre, Hobart, and Frederick Municipal Airports may in the future identify specific launch vehicle concepts or specific launch operators for which their facility possesses the resources and infrastructure necessary to support the proposed operations. The use of any of these three sites to support launch operations would require separate environmental analyses.

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3 AFFECTED ENVIRONMENT

This section describes the environmental characteristics that may be affected by the proposed action and alternatives. 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.

The affected environment is discussed in terms of 13 resource areas: air quality, airspace, biological resources, cultural resources, geology and soils, hazardous materials and hazardous waste, health and safety, land use, noise, socioeconomics and environmental justice, transportation, visual and aesthetic resources, and water resources.

3.1 Overview of Proposed Operational Area

This section provides an overview of the proposed operational area. This includes a description of the onsite and offsite areas in the region where the action is proposed to occur. In this section, the onsite area refers to the CSIA and the offsite area refers to the surrounding areas.

The exact boundary of the region of influence (ROI) is dependent upon the resource area. Some resources may be affected up to 48 or 64 kilometers (30 or 40 miles) from the CSIA boundary, while effects on others may only reach a few miles. For example, the socioeconomic and environmental justice ROIs extend to all eight counties in the SWODA area, while the land use ROI encompasses only the CSIA, the town of Burns Flat, and parts of Washita County. This section presents an overview and historical perspective of the onsite CSIA area and the surrounding region. The specific ROI for each resource area will be discussed following the definition of the resource and will form the boundary for considering the existing condition and environmental impacts.

3.1.1 Onsite Region of Influence

The CSIA is located in the northwest portion of Washita County, Oklahoma, adjacent to the town of Burns Flat and about 165 kilometers (102 miles) west of Oklahoma City. The CSIA currently operates as an industrial airpark and encompasses approximately 1,092 hectares (2,700 acres). The aerial photograph shown in Exhibit 3-1 was taken in June 2001 from an area southwest of the CSIA looking toward the northeast. The large runway and ramp area can be seen in the photograph. Most of the existing structures are located to the northeast (upper right) of the large ramp area. Existing structures include hangars, warehouses, and a manufacturing facility, all of which are currently vacant. A nearby farmhouse can be seen in the southwest corner (bottom left) of the photograph. Several other farmhouses are located to the west, south, and southeast of the facility. Also visible in the photograph is the agricultural land in the area surrounding the CSIA.

Exhibit 3-1. Aerial View of the CSIA

During World War II (WWII), the current site of the CSIA was a U.S. Navy base called the Clinton Naval Air Station, encompassing approximately 2,072 hectares (5,120 acres). The facility was used for pilot training and developing and testing remotely piloted aircraft. Exhibit 3-2 shows the facility during this time period. The aerial photograph was taken from northwest of the facility looking toward the southeast. The horizontal runway farthest from the camera is in the same location as the current 4,115-meter (13,500-foot) runway at the CSIA. Three large hangars can also be seen in the southern portion (upper left) of the photograph. The hangar structures no longer exist; however, the concrete pads are still intact. The control tower is the only remaining structure from this time period.

Following WWII, ownership of the facility was transferred from the War Assets Administration to the City of Clinton. The Sherman Iron Works leased a portion of the facility and began salvaging and smelting parts from surplus combat aircraft at the site. The facility was renamed the Clinton-Sherman Airport and operated as a municipal airpark between 1946 and 1955. As seen in Exhibit 3-2 below, thousands of surplus aircraft were brought to the facility to be decommissioned following WWII.

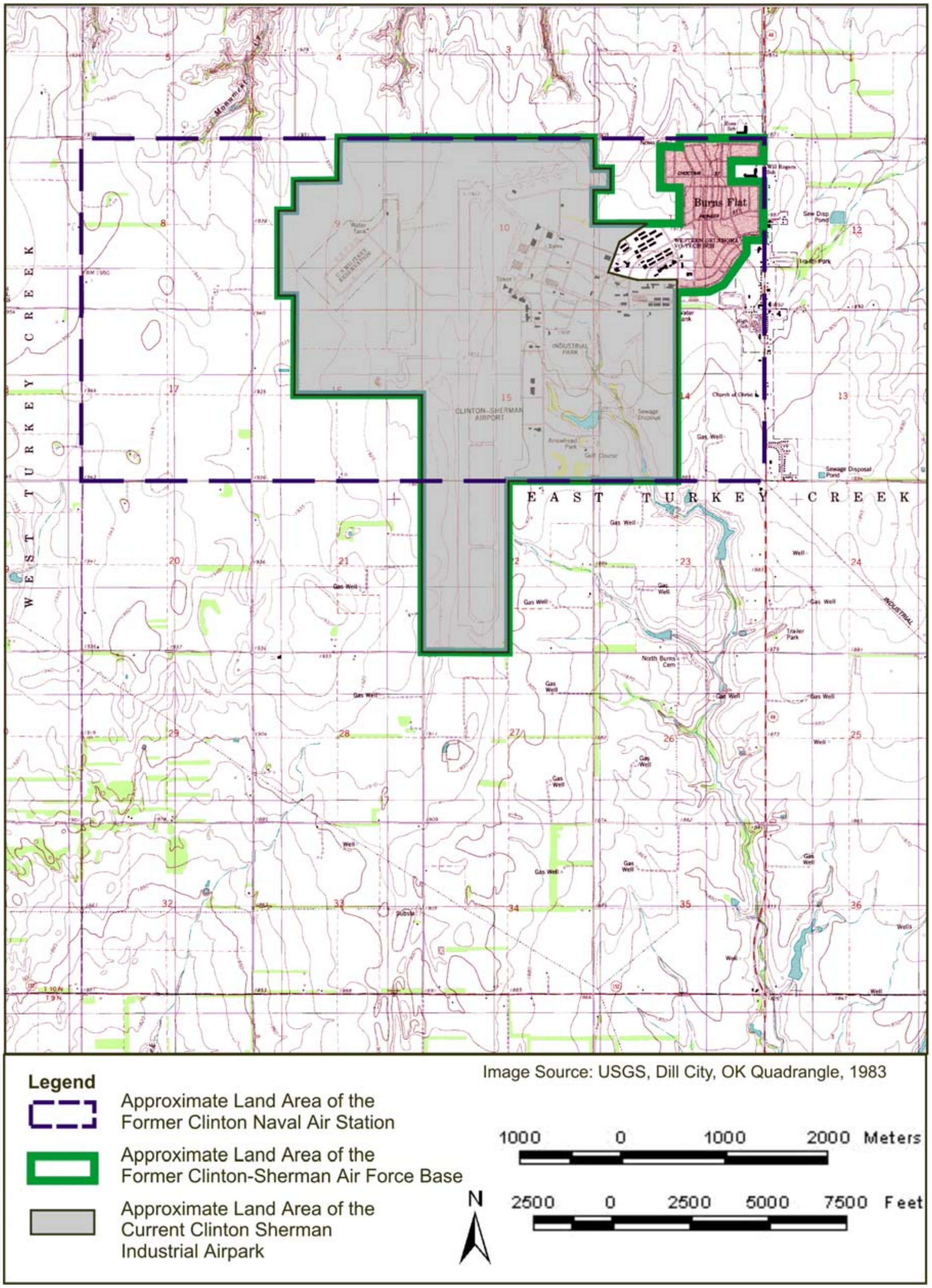
Exhibit 3-2. Aerial View of the CSIA in Operation as the Clinton Naval Air Station

The land was deeded to the USAF in 1955 and the facility became the Clinton-Sherman AFB. The AFB became an operational base for SAC fighters and bombers during the Cold War era. According to the SAC Master Plan Report, the AFB was home to the 70th Bombardment Wing, the 902nd Air Refueling Squadron, unspecified miscellaneous administrative aircraft authorized by the 70th Combat Support Group, and approximately 3,000 military and 300 civilian personnel.

Most of the current infrastructure at the CSIA is a result of additions and improvements made by the USAF beginning in 1955. In 1969 the facility was deeded back to the City of Clinton and has operated as an industrial airpark since. Several structures have been removed due to dilapidation, the presence of asbestos and diminished activities at the site. Exhibit 3-3 shows the CSIA during its operation as the Clinton-Sherman AFB, and Exhibit 3-4 illustrates the approximate boundaries of the Clinton Naval Air Station, the Clinton-Sherman AFB, and the CSIA.

Exhibit 3-3. View along Ramp Area at CSIA in Operation as Clinton-Sherman AFB

Exhibit 3-4. Overlay of Clinton Naval Air Station, Clinton-Sherman AFB, and CSIA



3.1.2 Offsite Region of Influence

As seen in Exhibit 3-1, the CSIA is surrounded on all sides by farming and agricultural land and is adjacent to Oklahoma State Highway 44. As noted in Section 3.1.1, the CSIA is adjacent to the town of Burns Flat. The major population centers closest to Burns Flat are Elk City, which is located to the west about 33 kilometers (21 miles), and Clinton, which is located to the northeast about 32 kilometers (20 miles).

3.1.3 Climate

Washita County has generally hot summers and mild to very cool winters. The average temperature is 4 degrees Celsius (4^{o}C) [40 degrees Fahrenheit (40^{o}F)] in the winter and 27^{o}C (81^{o}F) in the summer. The mean annual temperature for Washita County is 15.2^{o}C (59.3^{o}F) and the mean annual precipitation is 78 centimeters (30.8 inches). (OCS, 2002a)

About 46 centimeters (18 inches) or 69 percent of the annual precipitation falls during the growing season, which is April through September. (OCS, 2002a) Thunderstorms occur, on average, about 45 days each year in southwestern Oklahoma. (OCS, 2002b) Late spring and early summer are the peak seasons for these storms, averaging about eight thunderstorms per month. (OCS, 2002b) The average annual snowfall in this region is between 15 and 23 centimeters (6 and 9 inches). (OCS, 2002a)

Annual average relative humidity is approximately 65 percent. (OCS, 2002b) March and April are the windiest months, with prevailing winds from the south to southwest in far western Oklahoma. (OCS, 2002b) Dust storms sometimes occur in spring when strong winds blow over dry, unprotected soils. Ice storms, floods, droughts, and tornadoes are a threat in almost any part of Oklahoma. Oklahoma averages 54 tornadoes per year, 15 of them rating F2 or higher on the Fujita scale. (OCS, 2002b) An F2 tornado is considered a significant tornado with wind speeds between 181 and 251 kilometers per hour (113 and 157 miles per hour). Washita County averages 39 tornadoes per year, most of which occur between late March and mid-June. (OCS, 2002a)

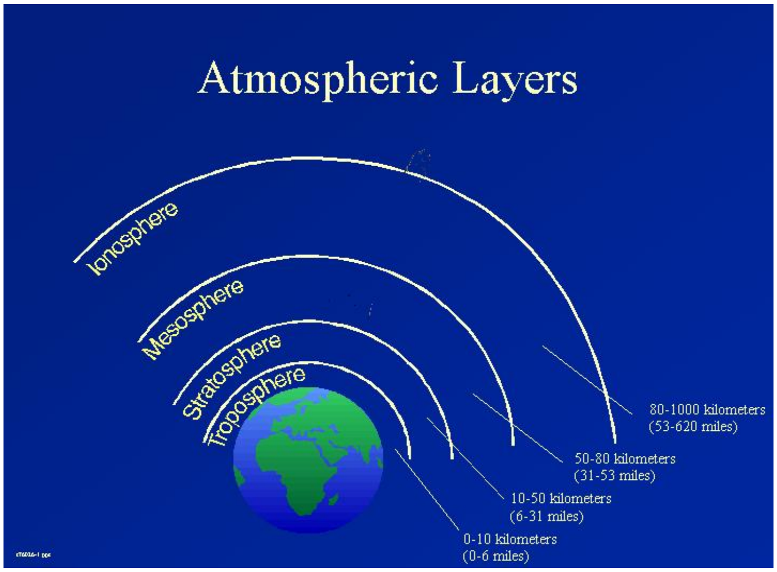
3.2 Air Quality

3.2.1 Definition of Resource

3.2.1.1 Atmospheric Layers

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). Exhibit 3-5 shows the altitude ranges associated with the atmospheric layers.

Exhibit 3-5. Altitude Range for Atmospheric Layers



Source: ICF Kaiser, 1998

More than 99 percent of the total atmospheric mass is concentrated within 40 kilometers (25 miles) of the Earth's surface. The upper boundary at which gases disperse into space lies at an altitude of approximately 1,000 kilometers (621 miles) above sea level. (NASA, 2003) The higher layers of the atmosphere, which consist of the mesosphere and ionosphere, differ significantly in composition from the lower regions and also contain a significant proportion of ionized (electrically charged) gas atoms and molecules. (Space Science Division, Naval Research Laboratory, 2003) The following subsections describe each layer of the atmosphere in terms of approximate altitude, temperature, air density, and air composition.

Troposphere

The troposphere is the lowest level of the atmosphere extending from the Earth's surface to approximately 8 to 16 kilometers (5 to 10 miles) in height. For the purposes of this EA, the discussion of air quality within the troposphere presents the conditions that occur at or below 914 meters (3,000 feet) above ground surface. The 914 meters (3,000 feet) above ground surface is appropriate for evaluating air quality impacts in the troposphere because the Federal government (Environmental Protection Agency [EPA]) uses that altitude to assess contributions of emissions to the ambient air quality and for the *de minimis* calculations under the Clean Air Act (CAA). (EPA, 1992)

Stratosphere

The stratosphere is the second major layer of the atmosphere and occupies the region from 10 to 50 kilometers (6 to 31 miles) above the Earth's surface. The two potential air quality impacts of concern in the stratosphere are global warming and ozone depletion. Global warming refers to long-term fluctuations in temperature, precipitation, wind, and other elements of the Earth's climate system. Atmospheric gases affect the Earth's surface temperature by absorbing solar radiation that is reflected by the Earth's surface back into space. The concentration of these gases, known as "greenhouse gases," is increasing as a result of human activities. (EPA, 2001) Carbon dioxide (CO_2) is the most significant greenhouse gas resulting from human activity, which represented approximately 84 percent of total greenhouse gas emissions in 2001.

Ozone present in the atmosphere 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. Most of the UV-shielding ozone layer over the Earth's surface is contained within the stratosphere. (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.) Stratospheric ozone can be destroyed through chemical and photochemical reactions. As a result, the presence of pollutants that are key components of these reactions (especially chlorine) can result in ozone depletion. The presence of particulate matter (PM) may affect stratospheric ozone; however, the exact impact of PM on ozone depletion is unclear.

Mesosphere

The mesosphere is located between 50 and 80 kilometers (31 to 50 miles) above the Earth's surface. The mesosphere is the coldest layer of the atmosphere with the temperature decreasing as the altitude increases. The coldest temperatures at the mesopause (the upper boundary of the mesosphere) can reach -100°C (-148°F). (Manchester Metropolitan University, 2000) In the mesosphere, objects entering the Earth's atmosphere begin to heat up due to friction with air molecules. (Encyclopedia of the Environment, 2006) Ozone and water (H_2O) are found in negligible concentrations in this layer. The air composition in this layer is made up of lighter gases that are stratified according to their molecular weight due to gravitational separation. (NASA, 2003) Because air density is negligible, objects tend to move at high speeds.

Ionosphere

The ionosphere (also known as the thermosphere) is located above the mesosphere and begins between 80 and 105 kilometers (50 to 65 miles) above the Earth's surface and is considered to extend upwards to 2,000 kilometers (1,243 miles), though it has no well-defined upper boundary. (Lutgens, 1995) The ionosphere accounts for only a fraction of the atmosphere's mass as gas molecules are extremely sparse in this layer. The ionosphere is noted for its concentration of ions and free electrons. Gases such as Helium (He), argon (Ar), oxygen (O), molecular oxygen (O_2), CO_2, atomic Nitrogen (N), nitric oxide (NO), and molecular nitrogen (N_2) absorb solar radiation passing through the ionosphere and are split into ions and free electrons. (University of Leicester, 2004) The level of ionization depends on sunspot activity, season, geographic location, and the gas being ionized. (National Oceanic and Atmospheric Administration [NOAA], 2004)

3.2.1.2 Regulations

The following subsections present a discussion of the pollutants regulated under the CAA (ambient air quality standards for criteria pollutants, air toxics [hazardous air pollutants (HAPs)], and regional haze).

Criteria Pollutants

The primary Federal legislation that addresses air quality is the CAA of 1970 (as amended in 1977 and 1990). The purpose of the CAA is to preserve air quality and to protect public health and welfare. Under the authority of the CAA and amendments, EPA established a set of National Ambient Air Quality Standards (NAAQS) for criteria pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), 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 by addressing the effects of air pollution on vegetation, soil, materials, visibility, and other aspects of the general welfare. Oklahoma has also developed state ambient air quality standards similar to the NAAQS. Oklahoma's ambient air quality standards are presented in the Oklahoma Administrative Code, Title 252, Chapter 100. (OAC 252:100)

Concentrations of criteria air pollutants in ambient air are used to determine ambient air quality in the U.S. by comparing them to the maximum allowable airborne concentrations specific in the applicable air quality standards for these pollutants. Exhibit 3-6 summarizes the Federal and Oklahoma ambient air quality standards.

The CAA requires the adoption of NAAQS to protect the public health, safety, and welfare from known or anticipated effects of criteria air pollutants. According to EPA guidelines, an area with air quality better than the NAAQS is designated as being in attainment, while areas that currently have or have had worse air quality are classified as nonattainment or maintenance areas, respectively. Pollutants in an area may be designated as unclassified when data are lacking for EPA to form a basis of attainment status. Air quality monitors are used to determine compliance with the NAAQS and to evaluate the impact of pollution control strategies. EPA uses the monitoring results to designate areas into the following categories.

1. **Nonattainment Areas –** Locations where measured concentrations exceed the NAAQS. Areas designated as nonattainment for ozone are classified as marginal, moderate, serious, severe, extreme, or Section 185A (previously called transitional). Areas designated as nonattainment for PM or CO are classified as moderate or serious.
2. **Maintenance Areas –** Previously designated nonattainment areas that have been redesignated because they have demonstrated compliance with the NAAQS for a period of time.
3. **Attainment Areas –** The areas of the country in which ambient pollutant concentrations have always been in compliance with the NAAQS, or have been redesignated after a number of years as a maintenance area.
4. **Unclassifiable –** Areas where no ambient monitoring record exists. Most of the areas are rural, remote areas and are assumed to be in attainment.

Exhibit 3-6. Federal and Oklahoma Ambient Air Quality Standards

Pollutant	Average Time	Oklahoma Standards[a]	National Standards[b]	
		Concentration	Primary[c,d]	Secondary[c,e]
O_3	1 hour	235 micrograms[g] per cubic meter (μg/m^3) (0.12 parts per million [ppm])[f]	235 μg/m^3 (0.12 ppm)	Same as primary
CO	8 hours	10 milligrams[h] per cubic meter (mg/m^3) (9 ppm)	10 mg/m^3 (9 ppm)	Same as primary
	1 hour	40 mg/m^3 (35 ppm)	40 mg/m^3 (35 ppm)	Same as primary
NO_2	Annual Arithmetic Mean	100 μg/m^3 (0.053 ppm)	100 μg/m^3 (0.053 ppm)	Same as primary
SO_2	Annual Arithmetic Mean	80 μg/m^3 (0.03 ppm)	80 μg/m^3 (0.03 ppm)	Same as primary
	24 hours	365 μg/m^3 (0.14 ppm)	365 μg/m^3 (0.14 ppm)	1,300 μg/m^3 (0.5 ppm)
	3 hours	None	1,300 μg/m^3 (0.5 ppm)	Same as primary
PM_{10}	Annual arithmetic Mean	50 μg/m^3	50 μg/m^3	Same as primary
	24 hours	150 μg/m^3	150 μg/m^3	Same as primary
$PM_{2.5}$	Annual arithmetic Mean	None	15 μg/m^3	Same as primary
	24 hours	None	65 μg/m^3	Same as primary
Pb	Quarterly Arithmetic Mean	1.5 μg/m^3	1.5 μg/m^3	Same as primary

[a] These standards must not be exceeded in areas, external of buildings, where the general public has access.
[b] These standards, other than for ozone and those based on annual averages, must not be exceeded more than once per year. The ozone standard is attained when the expected number of days per calendar year with a maximum hourly average concentration above the standard is equal to or less than one.
[c] Concentration is expressed first in the units in which it was adopted and is based on a reference temperature of 25°C (77°F) and a reference pressure of 760 millimeters (30 inches) of mercury. All measurements of air quality must be corrected to a reference temperature of 25°C (77°F) and a reference pressure of 760 millimeters (30 inches) of mercury; parts per million (ppm) in this table refers to ppm by volume or micromoles of pollutant per mole of air.
[d] National primary standards are the levels of air quality necessary, with an adequate margin of safety, to protect the public health.
[e] National secondary standards are the levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
[f] Parts per million by volume or micromoles per mole of gas
[g] Micrograms = 10^{-6} grams
[h] Milligrams = 10^{-3} grams

The official list of nonattainment areas and a description of their boundaries can be found in the Code of Federal Regulations (40 CFR Part 81) and pertinent Federal Register notices. EPA maintains an unofficial list on the Internet at http://www.eps.gov/oar/oaqps/greenbk/ondex.html.

For areas that are designated nonattainment, the CAA establishes levels and timetables for each region to achieve attainment of the NAAQS. States must prepare a State Implementation Plan (SIP), which documents how the region will reach its attainment levels by the required date. The SIP includes inventories of emissions within the area and establishes emissions budgets that are designed to bring the area into compliance with the NAAQS. In maintenance areas, the SIP documents how the State intends to maintain compliance with NAAQS.

In addition, any proposed Federal action (such as the proposed licensing of a launch facility) in a nonattainment or maintenance area must be demonstrated to meet the requirements of the General Conformity Rule (40 CFR 51, 40 CFR 93). This rule mandates that the Federal government not engage, support, or provide financial assistance for licensing or permitting, or approve any activity not conforming to an approved SIP.

Air Toxics

In addition to the NAAQS, the CAA also authorizes EPA to regulate emissions of 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 or birth defects, or adverse environmental and ecological effects. EPA is required to control 188 HAPs; a complete list of these HAPs can be found at http://www.epa.gov/ttn/atw/orig189.html. Two HAPs, hydrogen chloride (HCl) and chlorine (Cl) are sometimes components of rocket engine emissions, depending on the propellant type.

Regional Haze

Under the regional haze rule (64 Fed. Reg. 35714, dated July 1, 1999), States are required to develop SIPs to address visibility at designated mandatory Class I areas, including 156 designated national parks, wilderness areas, and wildlife refuges. General features of the regional haze rule are that States are required to prepare an emissions inventory of haze-related pollutants (i.e., volatile organic compounds [VOCs], nitrogen oxides [NO_X], SO_2, PM_{10}, $PM_{2.5}$, and ammonia [NH_3]) from all sources in constituent counties. Most States will develop their regional haze SIP in conjunction with their $PM_{2.5}$ SIP over the next several years.

3.2.2 Region of Influence

Identifying the ROI for air quality assessment requires knowledge of the pollutant types, source emission rates and release parameters, the proximity relationships of project emission sources to other emission sources, and local and regional meteorological conditions. For inert pollutants (i.e., all pollutants other than ozone and its precursors), the ROI is generally limited to an area extending no more than a few kilometers downwind from the source. The ROI for ozone may extend much further downwind than the ROI for inert pollutants; however, as the project area has no heavy industry and very few automobiles, tropospheric ozone and its precursors are not expected to be of concern.

The ROI for launch activities is a circular area with a 5-kilometer (3.1-mile) radius centered on the launch site. This ROI distance was determined using a Gaussian air dispersion model to predict the distance from the facility where the highest concentration of launch emissions could occur (1.25 kilometer [0.8 mile]) and then conservatively assuming the ROI is four times this distance.

3.2.3 Existing Conditions

The following sections discuss air quality in the ROI in terms of compliance with standards and regulations.

3.2.3.1 Compliance with Air Quality Standards

The U.S. is divided into Air Quality Control Regions (AQCR), which because of common meteorological, industrial and/or socioeconomic factors are considered single units for air pollution. The CSIA is located in the Southwestern Oklahoma AQCR 189. This area has been designated as unclassifiable/attainment for all NAAQS. (40 CFR Part 81.337) The nearest nonattainment area is the Metropolitan Dallas-Fort Worth Intrastate AQCR 215, located approximately 360 kilometers (224 miles) southeast of the CSIA in north central Texas, which is classified as serious non-attainment for ozone. (40 CFR 81.344)

3.2.3.2 Compliance with Prevention of Significant Deterioration (PSD)

PSD is a regulation incorporated in the CAA that limits increases of pollutants in clean air areas even though ambient air quality standards are being met. The CAA area classification scheme for PSD establishes three classes of geographic areas and applies increments of different stringency to each class. Class I areas include parks and wilderness areas, Class II areas are those in attainment or unclassified, and Class III areas are those in nonattainment.

Entities planning construction or modification of a facility that is in an attainment area may be subject to PSD regulations if classified as a “major” source or “major” modification. A new source is considered major if it is one of 28 specifically designated industrial categories and has the potential to emit more than 91 metric tons (100 tons) per year of a regulated pollutant. If the new source is not one of the designated industrial categories, it is considered major if it has the potential to emit more than 227 metric tons (250 tons) per year of a regulated pollutant. A modification is considered major if it occurs at an existing major source and causes emission increases of regulated pollutants above “significant” emission rate levels defined in the regulations (and summarized in Exhibit 3-7). Major sources must obtain a PSD permit from the state prior to either building a new facility or introducing modifications. (40 CFR 52.21)

Exhibit 3-7. Emission Rate Increases Considered "Significant" for PSD Regulations

Pollutant	PSD Significant Emission Rate (tons per year)
NO_X	40
CO	100
VOC	40
Particulate Matter	25
PM_{10}	15
SO_2	40
Sulfuric Acid Mist	7
Pb	0.6

Source: 40 CFR 51.166(b)(23)(i)

The CSIA is located in a PSD Class II area. The nearest PSD Class I Area to the CSIA is the Wichita Mountains Wilderness Area located approximately 75 kilometers (46 miles) to the south. The nearest PSD Class III area is Dallas-Fort Worth, Texas, located approximately 360 kilometers (224 miles) southeast of CSIA.

Emissions of pollutants from current CSIA operations are below Federal and state permitting requirements. The nearest air quality monitoring stations are located in Lawton, Oklahoma, approximately 106 kilometers (66 miles) to the southeast, and Clinton, Oklahoma, approximately 26 kilometers (16 miles) to the northeast.

3.3 Airspace

The following sections describe the types and uses of airspace and how they are controlled, the ROI for the proposed action, and the existing airspace environment within the ROI.

3.3.1 Definition of Resource

Airspace is the defined space above a nation, which is under its jurisdiction. Airspace is limited horizontally, vertically, and temporally. The FAA designs and manages the NAS 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 types of airspace are dictated by the number and type of aircraft that are predicted to use the airspace, the complexity of the aircraft's movements, the nature of the operations conducted within the airspace, the required level of safety, and the level of national and public interest in the airspace. The FAA manages commercial and general aviation activity within the airspace and the military, with FAA oversight, manages military aviation activity within Special Use and Other airspace.

3.3.1.1 Controlled and Uncontrolled Airspace

Controlled airspace requires air traffic control services for instrument flight rules (IFR) flights and for visual flight rules (VFR) flights where applicable. (DoD, 2002) Operators of aircraft within controlled airspace are subject to specific pilot qualifications, operating rules, and equipment requirements. Controlled airspace can be classified as Class A, B, C, D, or E. (FAA, 2005) Exhibit 3-8 provides descriptions of the airspace classifications. Uncontrolled airspace is for aircraft operating under VFR and is not classified by the FAA. Uncontrolled airspace can extend up to 4,420 meters (14,500 feet) above MSL and is referred to as Class G airspace. (DoD, 2002)

Exhibit 3-8. U.S. Airspace Classification

Classification	Controlled or Uncontrolled	Description
Class A	Controlled	Includes U.S. airspace over the waters within 22 kilometers (12 nautical miles) of the coast of the 48 contiguous states from 5,486 meters (18,000 feet) above MSL up to and including flight level 600 (18,288 meters or 60,000 feet MSL). Excludes Alaska, Hawaii, Santa Barbara Island, Farallon Island, and the airspace south of latitude 25 degrees 04 minutes 00 seconds North. Aircraft must be equipped with two-way radio capable of maintaining communications with air traffic control. All aircraft must receive appropriate air traffic control clearance and operate under IFR unless otherwise authorized.
Class B	Controlled	Ranges from the surface to 3,049 meters (10,000 feet) MSL surrounding the nation’s busiest airports in terms of IFR operations or passenger enplanements. Individually tailored and consists of a surface area and two or more layers, and is designed to contain all published instrument procedures once an aircraft enters the airspace.
Class C	Controlled	Ranges from the surface to 1,220 meters (4,000 feet) above the airport elevation and surrounding those airports that have an operational control tower, that are serviced by a radar approach control, and that have a certain number of IFR operations or passenger enplanements. Usually consists of a surface area with a 9 kilometer (5 nautical mile) radius, and an outer circle with a 19 kilometer (10 nautical mile) radius

Classification	Controlled or Uncontrolled	Description
		that extends from 366 meters (1,200 feet) to 1,220 meters (4,000 feet) above the airport elevation.
Class D	Controlled	Ranges from the surface to 762 meters (2,500 feet) above the airport elevation and surrounding those airports that have an operational control tower. Individually tailored, and when instrument procedures are published, the airspace will normally be designed to contain the procedures.
Class E	Controlled	Generally defined as any controlled airspace that is not Class A, B, C, or D and includes uncontrolled airspace above flight level 60.
Class G	Uncontrolled	Airspace that is not classified by the FAA.

Source: DoD, 2002

3.3.1.2 Other Airspace Uses

- **Special Use Airspace** - airspace where limitations are placed upon aircraft “activities because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities.” (FAA, 2005) Examples of Special Use airspace are alert areas, controlled firing areas, Military Operating Areas, prohibited areas, restricted areas, and warning areas. (DoD, 2002)

- **Military Training Routes** - airspace “of defined vertical and lateral dimensions established for the conduct of military flight training at airspeeds in excess of 250 knots (287 miles per hour).” (FAA, 2003a)

- **En route Airways and Jet Routes** - established IFR flight paths used by commercial and private aircraft. However, the FAA is gradually allowing pilots to develop their own flight plans that follow more efficient and economic routes. (DoD, 2002)

- **Airports and Airfields** - describe “an area on land or water that is used or intended to be used for the landing and takeoff of aircraft and includes its buildings and facilities.” (FAA, 2003a)

3.3.2 Region of Influence

The ROI includes the airspace over the CSIA and airspace within the northwest and southwest corridors where the vehicles proposed to be launched from the CSIA would operate.

3.3.3 Existing Conditions

3.3.3.1 En Route Airways and Jet Routes

Civilian aircraft flying within the NAS must follow designated airways, which are an invisible three-dimensional network of routes throughout controlled airspace. Two fixed airway systems have been established for air navigation: low-altitude Victor Routes (V-Routes) and high-altitude Jet Routes (J-Routes). V-Routes run from 213 meters (700 feet) Above Ground Level (AGL) up to but not including 5,486 meters (18,000 feet) MSL and serve general aviation and smaller commuter flights flying within these altitudes. J-Routes run from 5,486 meters (18,000 feet) above MSL to flight level 450 and serve commercial aircraft frequently traveling between major airports. There are a total of 33 en route V-Routes and 26 J-Routes that transect the airspace within the proposed Oklahoma Spaceport airspace of interest.

3.3.3.2 Air Traffic Control

Air traffic control is the service provided by the appropriate authority to promote the safe, orderly, and expeditious flow of air traffic. (FAA, 2005) Current CSIA operations fall within the Fort Worth Air Route Traffic Control Center (ARTCC), which controls en route IFR traffic between terminal areas and provides limited services to VFR traffic. The airspace of interest, with respect to this proposed action, falls principally within the boundaries of the Kansas City and Fort Worth ARTCCs, with the exception of the far northwestern corner of the airspace within the Denver ARTCC boundary and the western/southwestern airspace within the Albuquerque ARTCC boundary. Special Use airspace remains under the control of the respective using agency when in use, but may be released to the controlling agency when inactive for use by all air traffic. The CSIA Control Tower or the appropriate ARTCC would provide aircraft separation and safety advisories within Class A and B airspace, separation service to aircraft (operating under IFR), and to the extent practicable, traffic advisories to those aircraft operating under VFR. There is currently no defined upper altitude limit for the airspace of interest to the proposed Oklahoma Spaceport, but as part of the licensing process it would be necessary to prepare the appropriate airspace agreements to clearly define how vehicles launching and landing at the CSIA would be accommodated.

3.4 Biological Resources

3.4.1 Definition of Resource

Biological resources include the vegetation and wildlife that make up the ecosystem of the affected environment. Protected and regulated elements of the flora and fauna include

- State- and federally-listed threatened and endangered species and their designated critical habitat,
- Migratory Birds, and
- Invasive Species.

Because the location of the proposed action is in the western central portion of Oklahoma, regulations regarding essential fish habitat and marine mammals would not apply for the proposed action.

3.4.2 Region of Influence

The ROI would include areas downwind of the runway where launch emissions would likely drift, and areas where the noise levels associated with the activities under the proposed action would exceed the current noise profile for the aircraft operations at CSIA.

3.4.3 Existing Conditions

The CSIA is situated in an ecological region identified as the North American Grasslands (Samson, et al, 1998, 2000) and is included within a sub-region of the North American Grasslands described as the Bluestem-grama prairie. (Samson, et al, 1998, 2000) Most of the western half of the State of Oklahoma lies within the Bluestem-grama prairie. This sub-region is named for the most dominant prairie grass types (*Andropogon spp*. and *Bouteloua spp*.) in the area.

This area comprises the majority of the continental North American native grasslands, and is characterized as one of the most biologically productive of all ecological communities. (Samson, et al, 1998, 2000) High productivity in this region is attributed to high retention of nutrients, efficient biological recycling, and a structure that supports a vast array of animal and plant life.

3.4.3.1 Vegetation

The undeveloped portions of the CSIA comprise approximately 32 percent of the land, and are relatively flat and covered with primarily non-native grasses and agricultural crops. The developed areas, approximately 65 percent of the land, include commercial and residential building, the airport runways, roads, driveways, parking lots, and buildings. The remaining three percent of the land is made up of open water and ditches. Numerous windrows of deciduous trees are located at the CSIA as well as grouped plantings around the developed areas. (United States Army Corps of Engineers [USACE], 1999) Vegetation surrounding the CSIA is generally composed of a combination of man-made landscapes, agricultural land, and prairie. The two most common grass species occurring in prairie areas include bermuda grass (*Cynodon dactylon*) and weeping love grass (*Eragrostis spp*.). Ornamental trees and shrubs are located at CSIA. Trees are sparsely located throughout western Oklahoma, but typically occur near surface drainage features or along fence lines on agricultural lands. Frequently occurring types of woody vegetation in Washita County include elm (*Ulmus spp*.), cedar (*Juniperus spp*.), dogwood (*Cornus florida*), oak (*Quercus spp*.), walnut (*Juglans spp*.), and cottonwood (*Populus spp*.).

Thick riparian vegetation and a limited number of small trees exist around the rim of Base Lake, and a small narrow wetland occurs at the confluences of the two south-trending ditches north of Base Lake. (USACE, 1999) Emergent vegetation and a tight cluster of deciduous trees are associated with this small narrow wetland, and submergent and emergent wetland vegetation are located along and within the tributaries of Little Elk Creek and in Base Lake, located along the eastern portion of the CSIA.

Invasive species of concern on the rangelands that occur in and around the CSIA include: Sericea lespedeza (*Lespedeza cuneata*), eastern red cedar, (*Juniperus virginiana*) bull thistle (*Cirsium vulgare*), musk thistle (*Carduus nutans*), Scotch thistle (*Onopordium acanthium*), distaff thistle (*Carthamus lanatus*), and Canada thistle (*Cirsium arvense*).

3.4.3.2 Wildlife

Numerous migratory birds and small foraging mammals have been identified during site visits to the CSIA. Small mammals use the site despite the ongoing aircraft operations, approximately 129 operations per day. Up to 87 percent of the operations involve military aircraft, which include the C-5 Galaxy transport plane. Large amounts of open space and diverse habitats at the CSIA likely contribute to the success of the wildlife on site. Skunks, foxes, rabbits, squirrels, and coyotes are the most commonly sighted mammals at the CSIA. Livestock including cattle can be found on farmlands near the CSIA. The Washita National Wildlife Refuge is located on Lake Foss approximately 18 kilometers (11 miles) north of the CSIA. (USACE, 1999)

Exhibit 3-9, lists the wildlife that has been or may be found utilizing the habitats present at CSIA.

Exhibit 3-9. Wildlife Potentially Present at CSIA

Avian		
Harris' sparrow	Ferruginous hawk[1]	Great tailed grackle
American kestrel	Red-winged blackbird	Barn owl[b]
Eastern meadowlark	Northern harrier	American tree sparrow
Merlin	Yellow-headed blackbird	Loggerhead shrike[b]
Western meadowlark	Red-tailed hawk	Chipping sparrow
Prairie falcon[a]	Common grackle	Common night hawk
Brewer's blackbird	Swainson's hawk[b]	Clay colored sparrow[c]
Mourning dove	Dickcissel	Northern bobwhite quail
Field sparrow	Scissor-tailed flycatcher	Grasshopper sparrow
Eastern kingbird	Western kingbird	Lark sparrow
Northern mockingbird	Savannah sparrow	Brown thrasher
Song sparrow	Sprague's pipit	Eastern bluebird
Vesper sparrow	White-crowned sparrow	Buff-breasted sandpiper[c]
American goldfinch	Killdeer	Blue grosbeak
Black-bellied plover[c]	Horned lark	Lesser golden-plover[c]
Lark bunting	Upland sandpiper	Chestnut-collared longspur
Double-crested cormorant	Lapland longspur	Whooping crane[d] [12]
Mammal		
Desert shrew[b]	Thirteen-lined ground squirrel	Deer mouse
Black-tailed prairie dog[b]	Northern grasshopper mouse	Eastern cotton tail

[12] The whooping crane was first listed on March 11, 1967. It is currently designated as Endangered in the Entire, except where listed as an experimental population within the area covered by the listing. The species is known to occur in Oklahoma. A recovery plan has been developed for this species and critical habitat has been designated.

Plains harvest mouse	Black tailed jackrabbit	Prairie vole
Nine-banded armadillo	Hisbid cotton rat	Opossum
Ord's kangaroo rat	Striped skunk	Plains pocket gopher
Coyote	Western big-eared bat[b]	
Amphibian		
Tiger salamander	Couch's spadefoot toad	Great plains toad
Northern cricket frog	Western narrow-mouthed toad	Red spotted toad
Texas toad	Woodhouse's toad	
Reptile		
Ornate box turtle	Great plains rat snake	Earless lizard [b]
Plains hognose snake	Texas horned lizard[b]	Prairie kingsnake
Southern prairie snake	Prairie lined racerunner	Black-headed snake
Prairie ringneck snake	Blind snake	Texas longnosed snake[b]
Bullsnake	Common garter snake	Western plains garter snake
Fish		
Gizzard shad	Longear sunfish	Black bullhead
Orange-spotted sunfish	Channel catfish	White crappie
Orangethroated darter	Emerald shiner	Plains killifish
Golden shiner	Brook silverside	Bullhead minnow
Largemouth bass	Fathead minnow	Bluegill

Source: modified from USACE, 1999
Notes: [a] State species of special concern, Category 1
[b] State species of special concern, Category 2
[c] Migrant, fall and spring
[d] Possible migrant, fall and spring

Some of species listed in Exhibit 3-9 are unlikely to be present at CSIA due to the lack of appropriate habitat (e.g., the loggerhead shrike) or due to focused eradication efforts (i.e., the black-tailed prairie dog). The state-listed species of special concern that may occur on the CSIA because of the presence of suitable habitat include

- Barn owl,
- Ferruginous hawk,
- Prairie falcon,
- Swainson's hawk,
- Desert shrew,
- Earless lizard,
- Texas horned lizard, and
- Texas longnosed snake. (USACE, 1999)

The Ferruginous hawk (*Buteo regalis*) is the only species of concern (Species of Special Concern) listed for Washita County. Previous studies indicate that other species of concern, including the Texas horned lizard, earless lizard, western big-eared bat, Swainson's hawk, and the loggerhead shrike may be present. (Benham Group, 1995 as cited in Department of the Air Force, 2002) Species of Special Concern are those where current evidence indicates the species is especially vulnerable to local extinction because of a limited range, low population or other factors. The other state-listed species of special concern listed in Exhibit 3-9 are unlikely to be present at CSIA due to the lack of suitable habitat.

3.4.3.3 Threatened or Endangered Species

The Oklahoma Natural Heritage database does not contain any records of occurrences of state or federally-listed rare, threatened, or endangered species occurring at CSIA. The Final Remedial Investigation report prepared by the U.S. Army Corps of Engineers found that there were no federally protected species possibly occurring in the region of the site [CSIA]. (USACE, 1999)

Previous studies indicate that the endangered whooping crane may be found in or near the wetlands at CSIA during its spring and fall migration. (Department of the Air Force, 2004)

3.5 Cultural Resources

3.5.1 Definition of Resource

Cultural resources include "historic properties" as defined in the National Historic Preservation Act (NHPA), as districts, sites, buildings, structures and objects included in or eligible for the National Register of Historic Places (National Register). In addition, cultural resources include Native American Resources (sacred sites and traditional cultural properties).

3.5.2 Region of Influence

For the purpose of this EA and in accordance with (36 CFR § 800.16), which defines the concept of "area of potential effect" below, the ROI has been defined as the boundary of the CSIA.

(d) Area of potential effects means 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.

3.5.3 Existing Conditions

Much of the CSIA has been previously disturbed by historical activities of the U.S. Navy, and USAF. According to the Oklahoma Archaeological Survey (OAS), there are no previously recorded prehistoric or early historic archeological sites or homesteads within the CSIA boundary. The CSIA Master Plan states that there are several (not identified) archeological sites in the vicinity of the CSIA. (Benham Group, 1996) The OAS advises that there are both prehistoric and early historic archeological sites in the surrounding area, the nearest of which is approximately 0.8 kilometers (0.5 miles) from the north boundary of the CSIA.

There are no buildings or structures at the CSIA listed on the National Register; however, the air traffic control tower and attached administration building exhibit characteristics that may make them eligible for listing on the National Register. To date, no formal nomination process has been initiated. A total of seven historic sites are listed on the National Register in Washita County, with the nearest historic site located approximately 13 kilometers (8 miles) northwest of the CSIA in Canute, Oklahoma. (National Register, 2005)

The CSIA is located within the Cheyenne-Arapaho Nation. The FAA has identified seven American Indian tribes that may be affected by the proposed action.

- Wichita
- Apache
- Caddo
- Kiowa
- Comanche
- Cheyenne-Arapaho
- Chickasaw

As of August 1, 2005, FAA has received confirmation from one Indian tribe, the Wichita, that the proposed action would not affect any of their interests.

3.6 Geology and Soils

3.6.1 Definition of Resource

The geology of a particular area can be described as the physical nature and history of the earth, the composition of the rocks from which it is composed, and the changes in which it has undergone or is undergoing. Soils are defined as that earth material which has been modified and acted upon by physical, chemical, and biological agents so as to be able to support rooted plants.

3.6.2 Region of Influence

The ROI would include the geology and soils located within the boundary of the CSIA. The ROI is confined to the boundary of the CSIA because the operation of a launch site at the CSIA is not expected to result in impacts that would impact geology and soils outside of the launch area.

3.6.3 Existing Conditions

3.6.3.1 Geology

The CSIA is located near the central axis of the Anadarko Basin geologic province. In geologic terms, a basin is a broad tract of land characterized by a bowl shaped depression where the rocks are all tilted towards a common center. The Anadarko Basin, the deepest basin in the Continental United States, is bounded by a series of uplift areas: to the south by the Wichita-Criner Uplift, to the east by the Nemaha Uplift, to the north by the Central Kansas Uplift and to the west by the Cimarron Arch. The basin is asymmetrical and covers an area of about 129,500 square kilometers (50,000 square miles), including almost all of western Oklahoma. (Henry, 1995)

Generally, the geology of the basin is characterized by layers of sedimentary rocks of varying thickness (as much as 12,000 meters [39,370 feet] at their deepest) overlaying igneous basement rocks. The sedimentary rocks consist predominantly of sandstones, limestones and shales and range in age from Cambrian (540 to 510 million years old) to Permian (300 to 250 million years old). The igneous rocks consist of rhyolites and granites and range in age from the pre-Cambrian (about 700 to 540 million years old) to the Cambrian. (Henry, 1995)

3.6.3.2 Topography of the CSIA

The topography at the CSIA ranges from nearly level to smoothly sloping uplands. The surface elevations at the CSIA vary from approximately 572 meters (1,875 feet) above MSL in the southeastern portion of the site to 590 meters (1,937 feet) above MSL in the northwestern portion. (USGS, 1990)

3.6.3.3 Geology of the CSIA

The geologic units exposed at the surface in the vicinity of the CSIA consist of Permian age sedimentary rocks and quaternary age (modern) alluvium deposits. The Permian age sedimentary units include the Cloud Chief Formation, which is a reddish brown shale with interbedded siltstone and sandstone that is about 122 meters (400 feet) thick; the Doxey Shale, which is a reddish-brown shale and siltstone that is about 48 meters (190 feet) thick; the Elk City Sandstone, which is a reddish-brown, fine-grained sandstone with minor silt and clay that is about 56 meters (185 feet) thick; and the Rush Springs Formation, which is a fine-grained sandstone with dolomite and gypsum beds that is about 91 meters (300 feet) thick. (Heran, 2003)

The quaternary alluvium deposits in the CSIA study area consist mainly of alluvial and terrace deposits that range in thickness up to about 52 meters (170 feet). These deposits are mostly stream related and are discussed in the following soils section.

3.6.3.4 Soils

The soils within the CSIA fall within the Grandfield-Dill-Quinan general soils unit. (USACE, 1999) The soils within this unit are characterized as deep to shallow, nearly-level to rolling, well-drained loamy soils that formed from the weathering of weakly consolidated sandstone.

The specific soils located within the CSIA consist of the Altus and Granfield Soils, Dill-Quinan Complex, Grandfield fine sandy loam, Obaro silty clay loam, St. Paul silt loam, and the Woodward–Clairemont complex.

The Altus and Grandfield soils (zero to one percent slopes) are deep, well-drained, nearly level soils found on upland areas. The map unit consists of approximately 60 percent Altus soils, 35 percent Grandfield soils and five percent Dill soils. The Altus soils are high in natural fertility and in organic matter content. Runoff of these soils is very slow, and permeability is moderate. The Grandfield soils are medium in organic matter content and in natural fertility. Permeability of these soils is moderate and runoff is very slow. The Dill fine sandy loam is medium in natural fertility and organic matter. The permeability of these soils is moderately rapid and the runoff is medium.

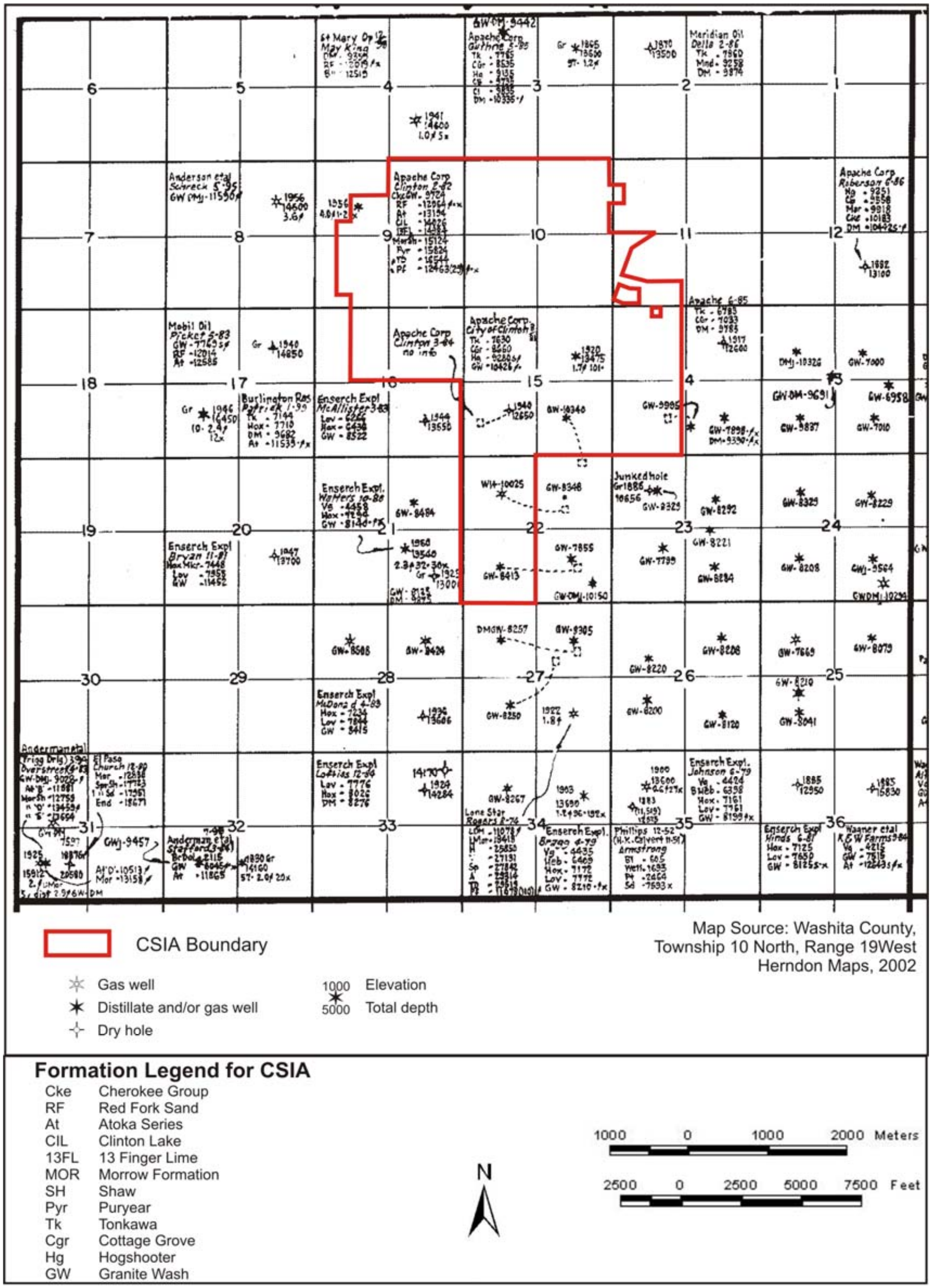
The Dill-Quinan complex (three to five percent slopes) consists of moderately deep and shallow, well drained, gently sloping soils found on upland areas. The slopes are smooth and convex in shape. The Quinan fine sandy loam is calcareous (composed of calcium carbonate) throughout with low natural fertility and organic content. The permeability of these soils is moderately rapid, the runoff is rapid and the available water capacity is low. The natural fertility and the organic matter content of Obaro silty clay loam are high. The permeability is moderate and the runoff is medium. The natural fertility and organic matter content of St. Paul silt loam is high. The permeability of these soils is moderately slow and the runoff is medium.

The Woodward–Clairemont complex consists mainly of moderately deep and deep, well-drained soils located in narrow drainage ways that cut into smoother upland areas. Slopes range from zero to 45 percent through these drainage areas. The Woodward loam makes up approximately 66 percent of the mapped areas. The natural fertility and organic content of Woodward loam is medium. The permeability is moderate. The runoff and the available water capacity of these soils are medium. The natural fertility of Clairemont silt loam is high and the permeability is moderate.

3.6.3.5 Mineral Resources

The Anadarko basin is a prolific producer of both oil and natural gas. The CSIA is situated within the Burns Flat oil field. The Elk City oil field is located to the west and to the south is the Dill City gas field. (Benham Group, 1996) Several of the oil and gas wells are located on the CSIA and surrounding area. Exhibit 3-10 depicts a Herndon Map (September 2, 2002), which depicts the locations of oil and gas wells on and in the vicinity of the CSIA in Township 10 North, Range 19 West, Washita County, Oklahoma. The map indicates that four wells have been drilled on the surface area of the CSIA (north west quarter of Section 9, the south west quarter of Section 14, the northeast quarter of Section 15, and the southwest quarter of Section 15 [depicted as a dry hole]). Four wells with surface locations in quarter sections adjoining the CSIA to the east and south have been directionally drilled under the CSIA (north east quarter of Section 22 [two locations], the south east quarter of Section 22, and the north east quarter of Section 27). The oil and gas production from these wells is derived predominantly from formations associated with what is commonly referred to as the Granite-Wash. The depths of production range from approximately 2,517 meters (8,257 feet) below sea level to 3,677 meters (12,064 feet) below sea level.

Exhibit 3-10. Herndon Map Displaying Oil and Gas Wells at the CSIA



3.6.3.6 Seismicity

The ROI is not characterized as a particularly seismically active area. Between 1974 and 2003, 17 earthquakes were recorded in Oklahoma, which accounts for less than 0.1 percent of the total earthquakes recorded in the U.S. during this time period. (United States Geological Survey [USGS], 2005) In particular, between 1990 and 2001 there were no recorded seismic activities in the ROI. (USGS, 2003a) The closest substantial fault to the CSIA is the Meers Fault which has two sections that are located in Oklahoma in Comanche and Kiowa counties. (USGS, 2003b) Because of the potential for activity along the Meers Fault, earthquake hazard and damage reduction information has been incorporated into the Oklahoma Strategic All-Hazards Mitigation Plan. (Central U.S. Earthquake Consortium, 2005) However, because the potential of seismic activity in the ROI is unlikely, this topic will not be further addressed in the consideration of environmental consequences.

3.7 Hazardous Materials and Hazardous Waste Management

3.7.1 Definition of Resource

Hazardous wastes are defined by the Resource Conservation and Recovery Act (RCRA) Section 1004(5) as “a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may (a) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible or incapacitating reversible illness or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of or otherwise managed.” While the definition refers to “solids”, it has been interpreted to include semisolids, liquids, and contained gases. (Wentz, 1989) Hazardous waste is further defined in 40 CFR 261.3 as any solid waste that possesses hazardous characteristics of toxicity, ignitability, corrosivity, or reactivity, or is listed as a hazardous waste in Subpart D of 40 CFR Part 261.

Hazardous materials and hazardous wastes are also encompassed within the definition of hazardous substances as identified in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. Sections 9601-9675) and the Toxic Substances Control Act (TSCA) (15 U.S.C. Sections 2601-2671). The Hazardous Materials Transportation Act (49 U.S.C. Section 1801, Parts 172-173) regulates the transportation of hazardous materials. (Legal Information Institute, 2005)

3.7.2 Region of Influence

The ROI for potential impacts from Hazardous Materials and Hazardous Waste Management is the entire CSIA, including launch and support facilities.

3.7.3 Existing Conditions

3.7.3.1 Current Site Operations

Management of hazardous waste must comply with RCRA, as amended by the Hazardous and Solid Waste Amendments of 1984. (42 U.S.C. Section 6901-6992) The State of Oklahoma possesses regulatory authority delegated by the U.S. Environmental Protection Agency (EPA) to require that hazardous waste be handled, stored, transported, disposed, or recycled in compliance with applicable regulations. The State's hazardous waste management regulations are promulgated by the Oklahoma Hazardous Waste Management Act, 27A O.S.§ 2-7-101 *et seq.*, the Hazardous Waste Fund Act, 27A O.S. § 2-7-301 *et seq.*, the Oklahoma Hazardous Waste Reduction Program, 27A O.S. § 2-11-201 *et seq.*, and the Recycling, Reuse and Source Reduction Incentive Act, 27A O.S. § 2-11-301 *et seq.* (Oklahoma Department of Environmental Quality [DEQ], 2004)

The CSIA stores Jet-A and 100-octane low lead aviation gasoline in aboveground storage tanks that have been installed and are maintained in compliance with appropriate local, State, and Federal standards and regulatory requirements. Total storage capacity is 37,854 liters (10,000 gallons). A number of hazardous materials are used and stored onsite at the CSIA for general operations such as aircraft maintenance, including

- Unleaded gasoline,
- Diesel fuel,
- Acetylene,
- Oxygen,
- Paint,
- Waste oil,
- Motor oil,
- Gear lubricant,
- Hydraulic oil, and
- Tractor hydraulic fluid.

The following hazardous materials would be used and stored onsite in support of engine testing at the CSIA.

- Kerosene, UN1223, hazard class 3
- Oxygen, refrigerated liquid (cryogenic liquid), UN1073, hazard class 2.2

The following hazardous materials would also be used and stored onsite in support of launch activities at the CSIA.

- Helium, compressed, UN1046, hazard class 2.2
- Gaseous oxygen, UN1072, hazard class 2.2
- Nitrous oxide (liquid), UN2201, hazard class 2.2
- Nitrous oxide (gaseous), UN1070, hazard class 2.2
- HTPB

The only hazardous waste generated annually at the CSIA is approximately 757 liters (200 gallons) of used motor oil. The oil is transported offsite by a licensed vendor. There are no permitted hazardous waste storage facilities at the CSIA.

Standard operating procedures have been established for hazardous waste operations, which include controls to protect personnel and the environment during operations involving hazardous materials. The CSIA follows directives on the applicable Material Safety Data Sheets and Right-to-Know directives for any hazardous materials/waste with which employees come in contact. The Clinton-Sherman Fire Department has developed a set of *Tactical Guidelines for Fuel Spill Procedures*, which establishes responsibility, outlines personnel duties, and provides resources and guidelines for use in the control, clean-up, and emergency response for spills or releases. (Clinton-Sherman Fire Department, 2003)

3.7.3.2 Historic Site Operations

Releases and disposal of hazardous substances and petroleum products occurred historically at the CSIA as a result of USAF and U.S. Navy activities. Maintenance and operational activities often resulted in the release of wastes at both the point of activity and in several landfills; however, most releases occurred prior to the passage of environmental statutes and regulations, and occurred using practices that were acceptable at the time. The U.S. Army Corps of Engineers (USACE) investigated the CSIA in early 1990 to determine its eligibility for funding under the Defense Environmental Restoration Program (DERP) Formerly Used Defense Sites (FUDS). Site surveys concluded that existing contamination was a result of DoD activities and that the CSIA was eligible for cleanup under DERP-FUDS. (USACE, 1998)

USACE performed several remedial investigations, a feasibility study, and a human health and environmental risk assessment during the mid to late 1990s to characterize the existing contamination and determine remedial actions that are protective of human health and the environment. (USACE, 1998) Some preliminary environmental restoration work was also completed at this time. USACE began long-term monitoring of ground water and removal of contaminated soil in March 2001. (Oklahoma DEQ, 2001a) A summary of major remediation actions conducted at the CSIA is found in Exhibit 3-11 below.

Three Superfund sites were identified in proximity to the Clinton-Sherman Industrial Airpark. These sites include Burns Flat City Dump, Flight System Inc., and the Old Clinton-Sherman Airport. None of the three sites were listed on the National Priorities List and all three have been classified by the EPA as “no further remedial action planned.” The last listing of activity at each of the three sites occurred as follows: Burns Flat City Dump, 1980; Flight System Inc., 1981; and Old Clinton-Sherman Airport, 1986.

Exhibit 3-11. Summary of Remediation Actions at the CSIA

Remediation Action	Description of Action	Issue
Building Demolition and Debris Removal	Six abandoned buildings at the CSIA were demolished.	The buildings were considered safety hazards.
Petroleum Storage Tank Leakage Evaluation and Removal	26 underground storage tanks, 4 aboveground storage tanks, 2 miles of transfer pipeline, 2 pump stations, and 4 fuel transfer stations were removed. Fuel-contaminated soil was removed and replaced with clean soil.	Leaks from underground and aboveground storage tanks were contributing to soil contamination.
Ordnance and Explosive Waste Identification and Removal	Site surveys did not reveal the presence of ordnance or explosive materials. No further action was recommended.	Ordnance and explosive wastes were suspected in former ammunition bunkers, a detonation pit, and a machine gun target area.
Creation of an Alternate Water Supply	In coordination with several local and regional agencies, 6 new wells and a water treatment plant were installed on a property owned by the City of Clinton. An additional system was constructed to pump potable water from the City of Clinton water treatment plant located at Clinton Lake through an existing pipeline to the CSIA water tank.	In December 1989, the Oklahoma State Department of Health closed three water supply wells when trichloroethylene (TCE) solvent contamination was found in the well water. Another well was closed due to its petroleum odor. Three other wells were restricted to use only during times of peak demand. Due to the shortage of water, USACE was authorized to address the loss of water supplied to CSIA.

Remediation Action	Description of Action	Issue
Soil and Water Contamination Study and Cleanup	Samples from 112 ground water monitoring wells, surface water, sediment, and surface and subsurface soils were collected and analyzed. Contaminated soils were excavated to a depth of 0.46 meters (1.5 feet) and removed. USACE is conducting monitored natural attenuation for ground water until remediation goals are achieved. Systematic monitoring is also used to track any migration of ground water contamination.	Soil and water contamination was suspected in 4 landfills, the base lake, a hangar maintenance area, a fuel yard, and a fire training area. VOCs, base-neutral/acid-extractable organics, and metals were identified in soils. VOCs, metals, and total petroleum hydrocarbons (TPH) were identified in ground water.

3.8 Health and Safety

3.8.1 Definition of Resource

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. A safety analysis is included as part of the licensing process and therefore, this analysis only considers health and safety as it pertains to the assessment of environmental impacts.

3.8.2 Region of Influence

The ROI for health and safety of workers includes the immediate work areas, launch facilities, and support sites located at the CSIA. The ROI for public safety includes locations outside the CSIA that may have the potential to be impacted by the proposed action, such as the safety hazard area under the vehicle's flight path.

3.8.3 Existing Conditions

Currently at the CSIA, all National Fire Protection Association, Occupational Safety and Health Administration and applicable state and Federal guidelines for health and safety are followed. Compliance with these regulations is the responsibility of SWODA; however, OSIDA would evaluate flight hazards and conduct safety reviews for vehicles launched from the proposed Oklahoma Spaceport.

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

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

As the airpark manager, SWODA conducts regular safety inspections at the CSIA and has established standard operating procedures to meet occupational and system safety requirements. The CSIA has an onsite fire department and emergency response capabilities that could be available during launches. Exhibit 3-12 shows the fire and rescue facility at the CSIA.

Exhibit 3-12. Fire and Rescue Department at CSIA

3.9 Land Use

3.9.1 Definition of Resource

The EPA defines land use as "the way land is developed and used in terms of the kinds of anthropogenic activities that occur (e.g., agriculture, residential areas, and industrial areas)." (EPA, 2005a) Land use is a critical element in understanding the context in which the proposed action will occur.

The FAA must also consider impacts under Section 4(f) of the Department of Transportation Act. Section 4(f) of the Department of Transportation Act was re-codified and renumbered as Section 303(c) of 49 U.S.C., and provides that the Secretary of Transportation will not approve any program or project that requires the use of any publicly owned land from a public park, recreation area, wildlife or waterfowl refuge of national, state, or local significance, or land from an historic site of national, state, or local significance as determined by the officials having jurisdiction. These provisions apply unless there is no feasible and prudent alternative to the land use and the project includes all possible planning to minimize harm resulting from the use.

3.9.2 Region of Influence

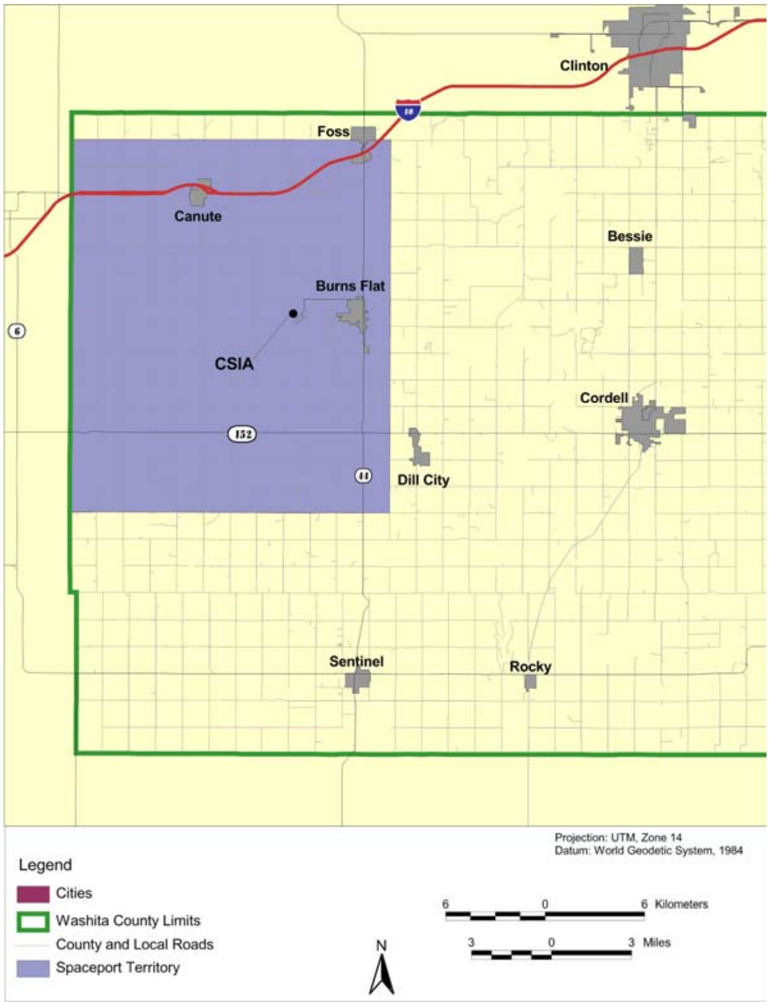
For the purposes of describing land use in this EA, the ROI for land use includes the Spaceport Territory as defined below, which encompasses the CSIA, the town of Burns Flat, and other parts of Washita County

3.9.3 Existing Conditions

3.9.3.1 Oklahoma Spaceport Territory

In 1999, Oklahoma State Senate Bill 720 (SB 720) created OSIDA and also established the Oklahoma Spaceport Territory. (Oklahoma State Senate, 1999) The geographical area of the territory is located within the limits of Washita County and includes the communities of Burns Flat, Foss, and Canute. A map depicting the boundaries of the Spaceport Territory is provided in Exhibit 3-13.

Exhibit 3-13. Oklahoma Spaceport Territory



The Spaceport Territory was designed to provide a launch pad and a geographic area contiguous to a spaceport. This geographic area would be used to protect the surrounding area from health and safety hazards as a result of the operation of the spaceport. OSIDA was given municipal authority within the Spaceport Territory, as well as the authority to establish specific development criteria for any space industry development within the Territory. The OSIDA Board of Directors may regulate development within the Spaceport Territory. The Board may increase or decrease the geographical limits of the Spaceport Territory upon written consent of the simple majority of all land owners included within the existing territory, or by vote of a majority of landowners in the area to be annexed or excluded. However, there are currently no plans to adjust the geographical location or the size of the Spaceport Territory as designated by SB 720.

Pursuant to Section 12 of SB 720, the Spaceport Territory Advisory Council was founded in early 2002 to assist and advise OSIDA with respect to the establishment, operation, and maintenance of facilities within the Spaceport Territory. The Advisory Council is composed of a Washita County Commissioner, the Mayor of Burns Flat, and the Mayor of Canute. The Advisory Council may also make recommendations to OSIDA regarding land use and development, municipal annexation, zoning, construction, safety regulations and other matters that may be relevant to land use and development. There are currently no plans for additional development related to the proposed launch operations within the Spaceport Territory.

Neither OSIDA nor the Advisory Council will have superseding power over any existing municipality or other body of government within the Spaceport Territory.

3.9.3.2 CSIA

As described in Section 3.1, the CSIA is located in the northwest portion of Washita County, Oklahoma, adjacent to the town of Burns Flat and about 165 kilometers (102 miles) west of Oklahoma City. The CSIA encompasses an area of approximately 1,092 hectares (2,700 acres) and measures approximately 4 kilometers (2.4 miles) from east to west, and 5.7 kilometers (3.5 miles) from north to south at its widest points.

The title to the CSIA is currently owned by the City of Clinton. The FAA Airports Southwest Region is responsible for reviewing and approving any transfer of operating responsibility for federally obligated airports within the Southwest Region. Following completion of this EA, FAA Airports will make a decision regarding the transfer of the CSIA to OSIDA. The Region's review and approval of the proposed transfer is dependent in part upon the determination made from this environmental analysis. The transfer in ownership in the CSIA from the City of Clinton to OSIDA would occur at such a time that the Final EA has been completed with a FONSI.

The 1996 CSIA Master Plan defined seven categories of land use at the site. All land uses identified in the master plan still apply with the exception of residential.[13] However, the amount of land associated with each land use category has changed since the 1996 report. Therefore, the

[13] All barracks on site have been demolished and there are currently no plans to construct permanent residences at the CSIA.

figures identifying the total amount of land area for each land use have been updated for the purposes of this EA. The current land use of the CSIA can be broken down into the following categories and approximate values.

- **Open Space**, 791 hectares (1,956 acres) – This type of land use includes four subcategories defined below.

    - *Vacant*: land that has never contained buildings or structures.
    - *Vacant/previously used*: land that once contained structures that have since been demolished (e.g., former fuel unloading area, hangars, barracks).
    - *Restricted safety*: runway safety areas and object-free areas.
    - *Environmentally constrained*: areas located adjacent to the runways, taxiways, and landfills.

- **Airfield Pavement**, 100 hectares (248 acres) – This category covers runways, taxiways, aprons, and runway overruns.

- **Industrial**, 96 hectares (238 acres) – This category of land use includes fuel storage, airport maintenance facilities, warehouses, storage facilities, manufacturing facilities, utility facilities, munitions storage, firing ranges, and shops. The Oklahoma Highway Patrol (OHP) emergency vehicle operation located at the north end of the site is also included in this category. Some industrial land uses include activities that require them to be separated from other uses. The munitions storage area is vacant and no longer used, but due to prior usage and the construction of the facilities, it remains classified as industrial.

- **Outdoor Recreation**, 89 hectares (221 acres) – This type of area includes picnic areas, ball fields, and a nine-hole golf course. The various picnic areas and ball fields are not frequently used; however, the golf course is an active facility and utilized daily.

- **Aircraft Operations/Maintenance**, 12 hectares (29 acres) – This category includes areas along the flight line such as hangars, the control tower, the crash and rescue unit, the maintenance facility, and the fixed base operator (FBO). Currently, all hangars at the CSIA are vacant.

- **Administrative**, 3 hectares (8 acres) – This category of land use includes offices and medical-related service facilities.

Although OSIDA developed a Preliminary Land Use Plan in October 2001, the plan was conceptual and will most likely not be implemented. Therefore, the plan is not discussed in this EA because it is not reasonably foreseeable that this plan will be used.

3.9.3.3 Burns Flat and Other Areas Surrounding the CSIA

Land use in Burns Flat is managed by comprehensive city planning and zoning. (Oklahoma Department of Commerce, 2001)

Agricultural activities dominate the land use in the general area of the CSIA. In Washita County in 2001, there were over 80,937 hectares (200,000 acres) of crops that were planted and harvested. The majority of these crops were winter wheat, with smaller amounts of rye, sorghum, and soybeans. (National Agricultural Statistics Service, 2001)

3.9.3.4 Section 4(f)

The Federal statute that governs impacts on any publicly owned land is commonly known as the DOT Act, Section 4(f) provisions, although it was recodified and renumbered as Section 303(c) of 49 U.S.C. This order continues to refer to Section 4(f) because it would create needless confusion to do otherwise; the policies Section 4(f) engendered are widely referred to as "Section 4(f)" matters. Appendix A of FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures*, summarizes the following about Section 4(f) of the DOT Act:

> The Secretary of Transportation will not approve any program or project that requires the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance or land from an historic site of national, State, or local significance as determined by the officials having jurisdiction thereof, unless no feasible and prudent alternative exists to the use of such land and such program, and the project includes all possible planning to minimize harm resulting from the use.
>
> The FAA shall not approve any program or project which requires the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance as determined by the Federal, State, or local officials having jurisdiction thereof, or any land from an historic site of national, State, or local significance as so determined by such officials unless (1) no feasible and prudent alternative exists to the use of such land, and (2) such program includes all possible planning to minimize harm to such park, recreation areas, wildlife and waterfowl refuge, or historic sites resulting from such use. In carrying out the national policy, the FAA shall cooperate and consult with the Secretaries of the Interiors, Housing and Urban Development, and Agriculture, and with the States regarding potential impacts on such resources.

Several state and local recreational areas that might be considered Section 4(f) resources are located in the vicinity of the CSIA. Nearby outdoor recreation areas include the Washita National Wildlife Refuge, located on Foss Lake 19 kilometers (12 miles) to the north; the Black Kettle National Grassland, located 39 kilometers (24 miles) to the northwest; and the Quartz Mountain Resort located in the Altus-Lugart Wildlife Management Area 43 kilometers (27 miles) to the south. Numerous other lakes, state parks, and municipal parks are located within an 80-kilometer (50-mile) radius of the CSIA.

3.10 Noise

3.10.1 Definition of Resource

Noise is often defined as unwanted or annoying sound that is typically associated with human activity. Most sound does not consist of a single frequency, but rather a mixture of frequencies, with each frequency differing in sound level.

The amplitude of sound is described in a unit called decibels (dB). Decibels are measured on a logarithmic scale as the range of sound pressures encountered by human ears covers a very broad range, from the approximate human threshold of hearing 0.00002 Pascals to the approximate human threshold of pain at 200 Pascals (a 10 million fold range). The dB scale simplifies this range of sound pressures to a scale of 0 to 140 dB and allows the measurement of sound to be more easily understood. Although not exactly analogous, the decibel scale is similar to the commonly used earthquake Richter scale. As such, a 120 dB sound is not twice the amplitude of a 60 dB sound, but a 1,000-fold increase. In most cases, adding two identical sound sources would increase the decibel level by three dB (100 dB plus 100 dB equals 103 dB).

Noise sources can be continuous (e.g., constant noise from traffic on a busy street or refrigeration units) or transient (e.g., passing noise from a jet overflight or an explosion). Noise sources can also have a broad range of frequency content (pitch), which can be rather nondescript, such as noise from traffic, or can be very specific and readily identifiable, such as a whistle or a car alarm.

There are many methods for quantifying noise, depending on the potential impacts in question and on the type of noise. One useful noise measurement technique is to determine the increase in background noise levels by use of the one-hour average sound level, abbreviated Leq1H. The degree to which a new potentially intrusive sound can cause a noise impact is dependent in part on how much it increases the background noise levels. Leq measurements can also be specified for other time periods such as 8 or 24-hour periods. The Leq1H is usually A-weighted unless specified otherwise. A-weighting is a standard filter used in acoustics that approximates human hearing and in some cases is the most appropriate weighting filter when investigating the impacts of noise on wildlife as well as humans.

Another useful metric is the Day Night Level (DNL), which is the average sound level over an entire day (Leq24H), with 10 dB added between 10 PM and 7 AM to account for the increased annoyance of noise during these hours.

The most common acoustical metrics used to describe transient noises, such as a rocket launch, aircraft overflight, or a sonic boom, are sound exposure level (SEL), maximum fast sound level (Lmax), peak level (Peak), and unweighted peak level.

SEL is the total sound energy in a sound event if that event could be compressed into one second. In essence, SEL is an average sound level that is condensed into one second. This provides a normalized metric, so that two different noise events can be compared to each other. SEL can be reported with A-weighting or other weightings such as unweighted or C-weighted. Unweighted is the total amount of sound with no weighting applied. C-weighting approximates human response to loud, usually transient sounds, such as a sonic boom or gunshot, and in some cases may be a better predictor of animal response to loud sounds.

The Lmax, usually with A-weighting applied, is the greatest sound level reached during a sound event with a time weighting applied to the calculation. The time weighting causes the sound levels to be influenced by sounds that most recently occurred. The "fast" in "maximum fast sound level," refers to specific exponential moving average time weighting with a time constant of 1/8 of a second. As this metric does not average the sound over a period of time like the Leq measurements it is a good indicator of the loudest level the sound reaches.

The Peak sound level is the greatest instantaneous sound level reached during a sound event. Peak levels can also have various frequency weightings applied to them. Peak levels, though useful in some cases, can often be misleading. It can occur that a single peak in a complex waveform can be substantially greater than the majority of a sound event. Peak levels should always be presented along with one or more of the metrics described above to better describe the sound event. Unweighted peak sound level is simply the Peak sound level with no frequency weighting applied.

3.10.2 Region of Influence

Because sonic booms could be generated from launch vehicles exceeding the speed of sound, the ROI includes areas where these sonic booms could impact. For this proposed action, these areas could include portions of Oklahoma and the Texas Panhandle.

3.10.3 Existing Conditions

The primary existing noise sources at the CSIA are the various operations associated with an airfield. Background noise levels include sound from wind, rain, livestock, farming activities, traffic, and wildlife.

Persons and various biological resources that may be subject to stress and/or interference from noise are referred to as noise sensitive receptors. They may include residential communities and transient lodging (i.e., hotels and motels), hospitals, special care facilities, public or private educational facilities, libraries, parks, wildlife refuges, and wilderness areas. Adjacent to the CSIA to the east are primarily single-family private residences and a school and further east, the town of Burns Flat. To the north, west, and south are pasture/farmland and remote farm residences.

Responses of wildlife to noise vary based on the type of noise and its characteristics (e.g., amplitude, rise time, duration, and frequency content), the species of wildlife, hearing capability, location, habitat type, current activity of the animal, sex and age, previous experience with noise exposure and condition of the animal. (Manci, et al., 1988) Potential physiological impacts from noise can range from short term mild impacts, such as an increase in heart rate or small temporary changes in hearing to more damaging impacts such as permanent changes in hearing, metabolism and hormone balance to long term severe impacts such as chronic distress that is harmful to the health of wildlife species and their reproductive fitness. Potential behavioral impacts from noise also range greatly from minor responses including small changes in current behavior such as a 'heads up' response to more severe responses such as panic and escape flight responses that might result in physiological damage (falling, trampling, crashing, piling etc.). Behavioral responses of wildlife to noise can accompany physiological responses as well.

The existing 65 DNL contour at the CSIA has been previously delineated and includes approximately 4,804 hectares (11,871 acres) on and around the CSIA. Exhibit 3-14 shows the current DNL contours at the CSIA.

Exhibit 3-14. Current DNL Contours at the CSIA

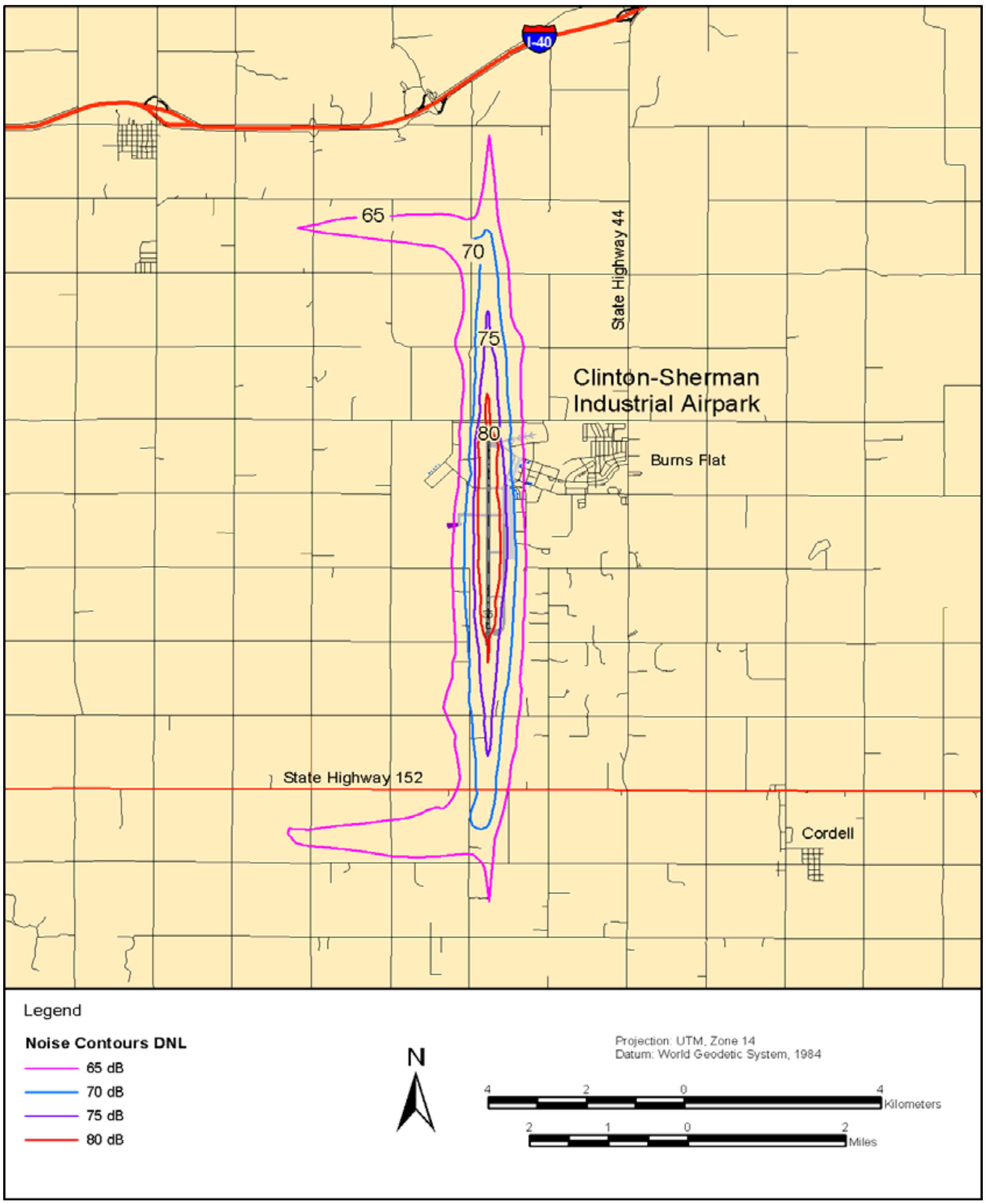


Exhibit 3-15 shows the acres of land covered in each of the noise contours as well as the population living in each noise contour. Instantaneous sound pressure levels have been calculated to be between 86 to 122 dB at discrete receptors within the DNL 65 dB contour. (Department of the Air Force, 2002) As described in Section 3.9.3.3, the majority of the land use around the CSIA is agricultural with some industry and residential uses located in Burns Flat. One single family house is located immediately to the north of the CSIA, approximately 2,000 feet to the northwest of the end of runway 17R. Residential structures are located in the Air Installation Compatible Use Zone clear zones and the accident potential zones. Noise complaints have not been identified as a problem for the facility.

Exhibit 3-15. Acres of Land and Population within Noise Contours at the CSIA

DNL Noise Contour (dBA)	Acres of Land	Population
65-70	3,382	38
70-75	1,472	8
75-80	292	3
>80	452	0

Source: Department of the Air Force, 1998b as cited in Department of the Air Force, 2002

No current activities at CSIA generate sonic booms. Except for the prohibition of nuisance noise, neither the state of Oklahoma nor local governments have established specific numerical environmental noise standards.

3.11 Socioeconomics and Environmental Justice

This section describes the existing socioeconomic and environmental conditions of the areas in the vicinity of the CSIA, including the town of Burns Flat, Oklahoma. Issues addressed in this section include demographics, employment/labor force, environmental justice, and children's health.

3.11.1 Definition of Resource

Socioeconomics is defined as the basic attributes and resources associated with the human environment, in particular societal and economic activity. Socioeconomic resources are described in terms of an area's population, housing, demographics, employment, and income.

Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Executive Order (EO) 12898, entitled *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, tasks Federal agencies to make achieving environmental justice part of their mission by identifying and addressing disproportionately high and adverse public health or environmental effects of programs, policies, and activities on minority and low-income populations. The CEQ defined "minority" to consist of the following groups: Black/African American, Asian, Native Hawaiian or Other Pacific Islander, American Indian or Alaska Native, and Hispanic populations (regardless of race). The Interagency Federal Working Group on

Environmental Justice guidance states that a minority population may be present in an area if the minority population percentage in the area of interest is “meaningfully greater” than the minority population in the general population. The CEQ defined low-income populations as those identified with the annual statistical poverty thresholds from the U.S. Census Bureau. The accepted rationale in determining what constitutes a low-income population is similar to minority populations, in that when the low-income population percentage within the area of interest is “meaningfully greater” than the low-income population in the general population, the community in question is considered to be low-income.

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.

3.11.2 Region of Influence

For the purposes of socioeconomics and environmental justice in this EA, the ROI includes not only the town of Burns Flat but the entire SWODA area, which encompasses a 48 to 64 kilometer (30 to 40 mile) radius of the CSIA. The SWODA region covers eight counties and approximately 18,200 square kilometers (7,030 square miles) in the southwestern section of Oklahoma.

3.11.3 Existing Conditions

Because the immediate area surrounding the CSIA is lacking the resources such as skilled laborers and commercial services to support the proposed action, this EA focuses on the entire SWODA area. The following eight counties are included in the SWODA region: Beckham, Custer, Greer, Harmon, Jackson, Kiowa, Roger Mills, and Washita. SWODA serves 46 cities and towns and 10 conservation districts in its geographical area.

This section briefly describes the socioeconomic characteristics of the SWODA region compared to those of the State of Oklahoma and the entire U.S. In some instances, SWODA is compared with Washita County and Burns Flat because the CSIA is located in Washita County and the town of Burns Flat is the closest population center. (See Exhibit 3-13 in the Land Use section).

Data characterized in this section includes population and population density; education; economics and housing; employment and labor force; demographic information as it relates to environmental justice; and age distribution as it relates to children’s health,

3.11.3.1 Population and Population Density

According to Census 2000 data, the SWODA region is home to a total population of 108,990, which is 3.2 percent of Oklahoma’s total population. SWODA’s average population density is six persons per square kilometer (15.5 persons per square mile). Exhibit 3-16 below presents the population and population density figures from the 2000 U.S. Census.

Exhibit 3-16. Population and Population Density, 2000

Geographic Area	Population	Population Density, persons per square kilometer (mile)
United States	281,421,906	30.7 (79.6)
Oklahoma	3,450,654	19.4 (50.3)
SWODA Region	108,990	6 (15.5)
Washita County	11,508	4.4 (11.5)
Burns Flat	1,782	764.5 (1,980)

Source: U.S. Census Bureau, 2000

3.11.3.2 Education

Exhibit 3-17 depicts the educational profile of people 25 years and older as reported in the 2000 U.S. Census. The data for the SWODA region generally follow the same trend as state and national percentages. However, a slightly lower percentage of the SWODA population holds a Bachelor's degree, and a greater percentage of the SWODA population did not complete high school.

Exhibit 3-17. Education Profile of Populations Over the Age of 25, 2000

Education Completed	U.S.	Oklahoma	SWODA Region	Washita County	Burns Flat
Not completing high school	19.6%	19.4%	23.5%	20.2%	14.8%
High school graduate, including equivalency	28.6%	31.5%	34.4%	39.1%	37.4%
Some college, no degree	21%	23.4%	21.6%	22.2%	26.3%
Associate degree	6.3%	5.4%	4.6%	3.4%	6.1%
Bachelor's degree	15.5%	13.5%	10.4%	10.4%	10.7%
Graduate or professional degree	8.9%	6.8%	5.5%	4.7%	4.8%

Source: U.S. Census Bureau, 2000
Numbers may not total to 100 due to rounding.

3.11.3.3 Economics and Housing

Exhibit 3-18 presents a comparison of some economic and housing characteristics obtained from Census 2000 data. The information indicates that the SWODA region has a lower median household income and per capita income than the U.S., Oklahoma, Washita County, and Burns Flat. Additionally, SWODA has a higher percentage of its population living in poverty.

SWODA's homeownership rate is slightly higher than that of the U.S. and Oklahoma, while the median value of owner-occupied housing units is significantly lower than that of Oklahoma and the U.S.

Exhibit 3-18. General Economic and Housing Profile of the Population

Economic Characteristics	U.S.	Oklahoma	SWODA Region	Washita County	Burns Flat
Median Household Income (1999)	$41,994	$33,400	$27,564	$29,562	$32,530
Per Capita Income (1999)	$21,587	$17,646	$14,953	$15,528	$14,350
Percent of Individuals living below poverty (1999)	12.4%	14.7%	17.9%	15.5%	15.6%
Total number of housing units (2002)	115,904,641	1,541,518	49,951	5,455	622
Homeownership rate (2000)	66.2%	68.4%	72%	74.7%	56.3%
Median value of owner-occupied housing units (2000)	$119,600	$70,700	$44,100	$39,800	$41,300

Source: U.S. Census Bureau, 2000
Note: The 2000 Census reports provided data from various years, as indicated in the first column of the table.

3.11.3.4 Employment and Labor Force

Currently, there are seven tenants leasing facilities at the CSIA including a restaurant, SWODA, OSIDA, OHP, Oklahoma Department of Environmental Quality (ODEQ), an FBO, and a medical clinic. Some vacant facilities are occasionally leased on a monthly basis for storage. The potential labor force for the proposed Oklahoma Spaceport is assumed to include the population living within the ROI. Therefore, the potential labor force is approximated by the population living within the SWODA region, which encompasses a 48 to 64 kilometer (30 to 40 mile) radius of the CSIA and 108,990 people.

Exhibit 3-19 presents the unemployment statistics according to the 2000 U.S. Census. The data show that the unemployment rate in the SWODA region is below the state and national averages.

Exhibit 3-19. Unemployment Rates, 2000

Geographic Area	Unemployment Rate
U.S.	3.7 %
Oklahoma	3.3 %
SWODA Region	2.9 %
Washita County	2.3%
Burns Flat	3.4%

Source: U.S. Census Bureau, 2000

Exhibit 3-20 identifies the percentage breakdown of the labor categories in which people are employed. The SWODA region appears to be similar to the national and state occupational

Exhibit 3-20. Percent of Population Employed by Occupation, 2000

Occupations	U.S.	Oklahoma	SWODA Region	Washita County	Burns Flat
Management, Professional, and Related	33.6%	30.3%	30.3%	30.2%	25.7%
Service	14.9%	15.5%	18.2%	16.3%	22.8%
Sales and Office	26.7%	26.6%	21.8%	20.4%	20.3%
Farming, Forestry, and Fishing	0.7%	0.9%	3.2%	3%	0.5%
Construction, Extraction, and Maintenance	9.4%	11.3%	12.9%	13.3%	17.8%
Production, Transportation, and Material Moving	14.6%	15.4%	13.7%	16.8%	12.8%

Source: U.S. Census Bureau, 2000
Numbers may not total to 100 due to rounding.

profiles. The only exception is that SWODA has a slightly higher percentage of its population working in the farming, forestry, and fishing category.

The town of Burns Flat is located within Washita County. The total labor force in Washita County was comprised of 4,759 people in 2000. Major employers include Burns Flat Public Schools, Western Technology Center, and Halliburton Services. (Oklahoma Department of Commerce, 2001) In 2001, the SWODA region had a total of 2,777 private non-farm business establishments with 27,276 paid employees. (U.S. Census Bureau, 2000) When compared to the state of Oklahoma, this is about three percent of its non-farm business establishments.

3.11.3.5 Executive Order 12898 and Environmental Justice

As described in Section 3.11.1, the EO entitled, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, mandates that Federal agencies identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of programs on minority and low-income populations.

The 2000 U.S. Census allowed people to choose between one of seven racial categories, as shown in Exhibit 3-21. Persons of Hispanic or Latino origin can be of any race, and are therefore presented separately in Exhibit 3-22. As seen in the exhibits, minority racial populations represent approximately 16.7 percent of the SWODA Region. Regardless of racial category, 9.3 percent of the population is of Hispanic or Latino origin.

Exhibit 3-21. Percentage of Total Population by Census Category, 2000

Census Category	United States	Oklahoma	Burns Flat	Washita County	SWODA Region
White	75.1%	76.2%	88.6%	92.3%	83.3%
Black or African American	12.3%	7.6%	1.3%	0.4%	5.1%
American Indian or Alaska Natives	0.9%	7.9%	3.9%	3%	3.6%
Asian	3.6%	1.4%	0.9%	0.3%	0.5%
Native Hawaiian and Other Pacific Islander	0.1%	0.1%	0.2%	0%	0.04%
Other	5.5%	2.4%	2.8%	2.2%	5.1%
Persons reporting 2 or more races	2.4%	4.5%	2.3%	1.8%	2.5%

Source: U.S. Census Bureau, 2000
Numbers may not total to 100 due to rounding.

Exhibit 3-22. Percentage of Population of Hispanic or Latino Origin (any race), 2000

Geographic Area	Percentage of Individuals of Hispanic or Latino Origin
Burns Flat	6 %
Washita County	4.5 %
SWODA Region	9.3 %
Oklahoma	5.2%
U.S.	12.5%

Source: U.S. Census Bureau, 2000

Using Census 2000 data, Exhibit 3-23 identifies the percentage of individuals living below the poverty level for Burns Flat, Washita County, the SWODA Region, Oklahoma, and the U.S.

Exhibit 3-23. Percentage of Individuals below Poverty Level in the Region

Geographic Area	Percentage of Individuals Below Poverty Level
Burns Flat	15.6 %
Washita County	15.5 %
SWODA Region	17.9 %
Oklahoma	14.7%
U.S.	12.4%

Source: U.S. Census Bureau, 2000

3.11.3.6 Executive Order 13045 and Children's Health

As described in Section 3.11.1, the EO entitled *Protection of Children from Environmental Health Risks and Safety Risks* requires that Federal agencies identify and assess environmental health and safety risks that may disproportionately affect children as a result of the implementation of Federal policies, programs, activities, and standards.

The nearest public school to the CSIA is Will Rogers Elementary School. Will Rogers is located along State Highway 44 adjacent to the housing area northeast of the CSIA. The Western Technology Center, Burns Flat Campus, is located on Sooner Drive and adjoins a portion of the eastern boundary of CSIA.

Exhibit 3-24 below summarizes the distribution of the population by age. The data show that the SWODA region has a slightly smaller percentage of children under the age of 5 and 18 years when compared to the U.S., Oklahoma, Washita County, and the town of Burns Flat.

Exhibit 3-24. Distribution of Population by Age, in percent of persons, 2000

Age Category	U.S.	Oklahoma	SWODA Region	Washita County	Burns Flat
Under 5 years	6.8%	6.8%	6.1%	6.1%	8.8%
Under 18 years	25.7%	25.9%	24.7%	26.3%	34.3%
19 to 44 years	33.1%	31.9%	29.7	26.6%	29%
45 to 64 years	22%	22.2%	22%	22.2%	19.8%
65 and older	12.4%	13.2%	17.5%	18.8%	8.1%

Source: U.S. Census Bureau, 2000

3.12 Transportation

3.12.1 Definition of Resource

Transportation as a resource can be described as the means, accessibility, and ease in which to move goods, personnel, and equipment to and from a given area. Transportation resources currently available to the CSIA include road, air, and train access.

3.12.2 Region of Influence

The ROI for transportation includes the CSIA itself as well as any other major transportation routes servicing the CSIA or the vicinity.

3.12.3 Existing Conditions

3.12.3.1 Accessibility by Road

The CSIA is located adjacent to state Highway 44 (OK-44), a two lane highway, approximately 11 kilometers (7 miles) south of Interstate 40 (I-40), a transcontinental interstate highway. Oklahoma City, Oklahoma is the nearest major city and is located approximately 167 kilometers

(102 miles) east of the CSIA and can be accessed by I-40. The City of Amarillo, Texas is located approximately 274 kilometers (170 miles) west of the CSIA and is also accessible by I-40.

There are several other major roadways in the vicinity of the CSIA that allow for easy access to and from the CSIA. Major routes include U.S. Highway 183, located approximately 16 kilometers (10 miles) east of the CSIA and U.S. Highway 283 (US-283) located approximately 42 kilometers (26 miles) west of the CSIA; both highways run north/south. Vehicular traffic uses US-283 as the major route from I-40 to Altus, Oklahoma. State Highway 152 (OK-152) is a major east/west artery and is located approximately 2.5 kilometers (1.5 miles) south of the southernmost boundary of the CSIA. According to the *Clinton-Sherman Industrial Airpark Master Plan*, the traffic volume along OK-44 is relatively low with an average daily traffic (ADT) in 1993 of 1,800 to 2,000 vehicles between I-40 and OK-152. (Benham, 1996) In comparison, the ADT for I-40 at the OK-44 interchange was 14,000 in 1993. (Benham, 1996)

The CSIA is accessible from OK-44 via Webb Street and Sooner Avenue. The current main entrance for the CSIA is located at the intersection of Sooner Drive and OK-44. This intersection is equipped with a traffic signal and signage for the CSIA. Sooner Drive also provides access to SWODA, the Western Technology Center, and the adjacent residential community. The north and south boundaries of the airpark are adjacent to section line roads, which are maintained by Washita County. The CSIA property west of the runway can be accessed from the northern section line road; however, this gate is locked and not currently utilized. The asphalt roads inside the CSIA are generally in good condition although access to the roads on the west side is restricted due to emergency vehicle operations by the OHP.

3.12.3.2 Accessibility by Air

The CSIA offers complete flight services and two north/south runways for both public and military uses and can handle all manner of aircraft. The functional runway includes approximately 4,115 meters (13,500 feet) of runway with overruns, and can accommodate any aircraft. The runway is routinely used for operations including the Lockheed C-5, the military's largest aircraft. An average of 129 aircraft operations occur at CSIA daily. Of these, 87 percent are military and 13 percent are transient general aviation. (AirNav, 2005) A control tower, emergency response unit, and an FBO lie adjacent to the flight line. Although there is abundant storage capacity, there are currently no aircraft based at the CSIA.

3.12.3.3 Accessibility by Rail

The CSIA has access to the Farmrail railroad via an 11-kilometer (7-mile) spur. Farmrail is a regional railroad operating in western Oklahoma. Based in Clinton, Oklahoma, Farmrail provides both scheduled and as-needed freight service to 29 rural communities in Oklahoma. The rail spur with service to Burns Flat is currently owned by the City of Clinton and connects to the Farmrail at the Burns Flat Junction north of Dill City. The rail line enters the CSIA near Webb Street and travels west along Webb Street terminating at 11th Street. The rail spur provides access to warehouse and manufacturing facilities, which are equipped with loading docks. Although there is no scheduled rail service to the CSIA, the spur provides the infrastructure needed to access cross-country railroads. Farmrail services connect with the major western railroads Union Pacific (UP) and Burlington Northern Santa Fe (BNSF). (Farm Rail Systems Inc, 2003)

A representative from Farmrail rates the condition of the spur between fair and poor and noted that many of the railroad ties are very old. The spur is in suitable condition for transporting light or non-hazardous loads; however, prior to any significant usage, the rail spur into the CSIA would require a full inspection and perhaps some maintenance to ensure safe operations. Farmrail currently uses approximately three kilometers (two miles) of the spur near the Burns Flat Junction for storage of rail cars. The entire rail spur was most recently used to move a CSIA tenant from the warehouses in 2002. Exhibit 3-25 shows the rail spur in the warehouse area of the CSIA.

Exhibit 3-25. Rail Spur in Warehouse Area of CSIA

3.13 Visual Resources

3.13.1 Definition of Resource

Visual resources can be described as any naturally occurring or man-made feature that contributes to the aesthetic value of an area.

Proposed changes to visual resources can be assessed in terms of 'visual dominance' and 'visual sensitivity.' Visual dominance describes noticeable physical changes within an area. The magnitude of visual dominance varies depending on the degree of change in an area. Visual sensitivity can be attributed to a particular setting and the desire to maintain the current visual resources of the viewshed. Areas such as coastlines, national parks, and recreation or wilderness areas are usually considered to have high visual sensitivity. Heavily industrialized urban areas tend to be the areas of the lowest visual sensitivity.

When evaluating visual impact the ability of the general public to view the area where the proposed action or change to the visual resource would occur must also be taken into consideration.

3.13.1.1 Visual Dominance

Proposed changes in the character of an area can be defined in terms of visual dominance. For example, if the users of the area would overlook the changes to the area's setting, then the changes would be "not noticeable." If the changes would be noticeable but would be dominated by other features in the area's setting, then the changes would be "visually subordinate." A change that would compete with the visual character of an area is "visually co-dominant." Finally, a change that would detract from the character of the setting and would demand attention is "visually dominant."

3.13.1.2 Visual Sensitivity

Visual sensitivity depends on the particular setting in which the proposed action is to occur. Areas such as coastlines, national parks, recreation areas, and wilderness areas are areas of high visual sensitivity. In these areas, viewers tend to be aware of even very small changes in the visual environment. On the other hand, in areas of low visual sensitivity, such as industrialized areas, major changes can occur without unduly annoying observers.

3.13.2 Region of Influence

The ROI for visual resources includes the CSIA as well as an area 24 kilometers (15 miles) on either side of the CSIA. This will account for seldom seen areas near the airpark as well as areas from which the CSIA will be included within the viewshed[14].

3.13.3 Existing Conditions

Agricultural areas and sparsely occurring trees compose the landscape in the general area of the CSIA. Prairie grasses proliferate in open areas not used for agriculture. The topography in the broader geographic region is mildly undulating with the occasional presence of landforms resembling small mesas, or plateaus. The landscape surrounding the town of Burns Flat and the CSIA appears relatively level. The topography in the western portion of the CSIA is also relatively level without much elevation change or visual interest. Exhibit 3-26 shows the view from the CSIA looking to the west. Exhibit 3-27 shows the view from areas to the west of the CSIA looking east towards the CSIA runway and structures.

[14] Viewshed generally refers to the area that is visible from a particular point of view.

Exhibit 3-26. View from the CSIA Looking to the West

Exhibit 3-27. View from Outside the CSIA Looking East at the Runway and Structures

Topography in the eastern portion of the CSIA exhibits slightly more variation due to the presence of several intermittent stream channels, which funnel surface water towards Base Lake. Exhibit 3-28 shows the surface drainage area east of the runway. The presence of persistent and intermittent surface water on the eastern portion of the site contributes to a more diverse plant population including larger trees and dense wetland areas.

Exhibit 3-28. Surface Drainage Area East of Runway

Many of the structures at the CSIA appear to be in good physical condition, but in need of exterior cosmetic improvements. Several structures, including two hangars and one manufacturing facility, have been recently remodeled and appear to be in excellent condition both structurally and aesthetically. The warehouse area is the area most notably in need of improvements. Vegetation is unkempt and overgrown along the rail spur, and the four large warehouse facilities appear to have dilapidated roofs and facades. Exhibit 3-29 illustrates the general appearance of the warehouse area.

Exhibit 3-29. Building 208 in Warehouse Area

Source: SWODA, 2005

3.14 Water Resources

3.14.1 Definition of Resource

Water resources include surface water features including lakes, rivers, wetlands, and floodplains, as well as ground water resources (aquifers). A description of the various water features is followed by a description of the water quality associated with the feature.

3.14.2 Region of Influence

The ROI includes the water resources located at the CSIA, as well the ground water aquifer from which the CSIA would draw its water. The ROI may also include offsite resources based on deposition of particulate emissions.

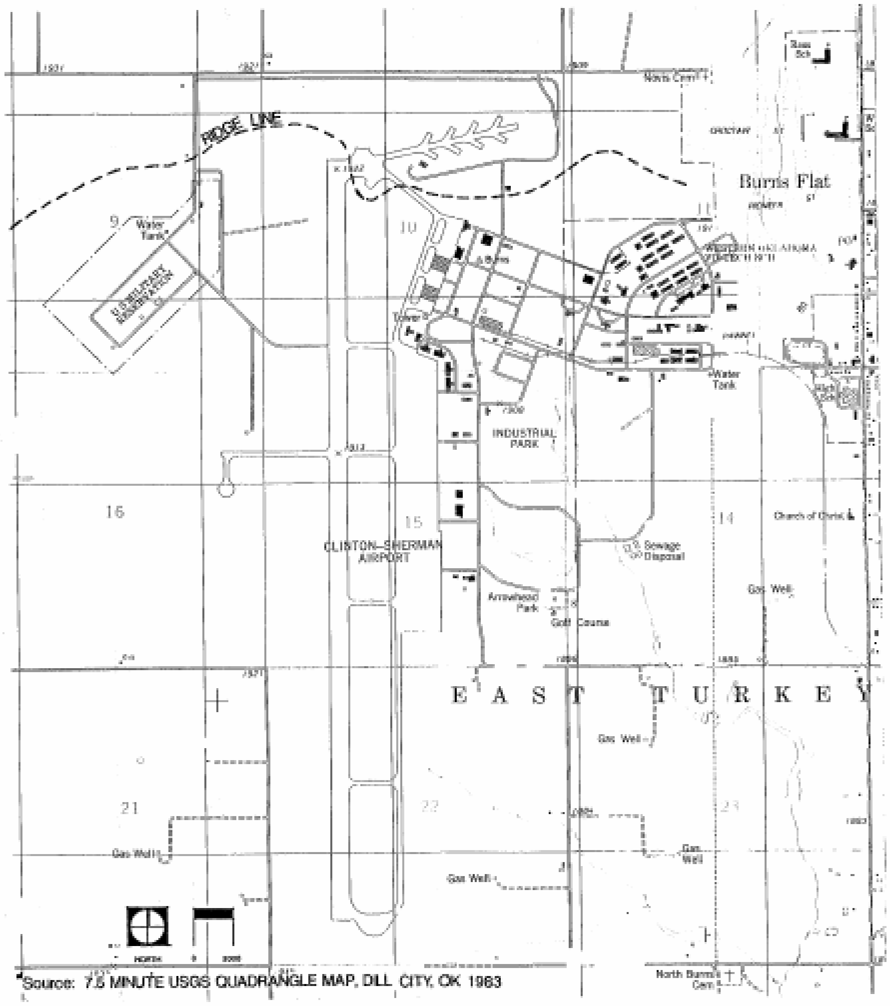
3.14.3 Existing Conditions

3.14.3.1 Surface Water

Meteorological data obtained from the Oklahoma Climatological Survey for the period from 1950 to 1995 indicate that Washita County has an average annual precipitation of 72.1 centimeters (28.4 inches). (USACE, 1999) Most precipitation never becomes surface runoff, because a large percentage of the precipitation is intercepted by evaporation and vegetation or is stored in local depressions. The average annual surface runoff at the CSIA varies from three to four centimeters (1.0 to 1.5 inches) per year. (USGS, 1976)

A ridgeline is present that traverses the northern portion of the runway in an east-west direction, and the surface waters south of the ridgeline flow in a south to southeastern direction into Base Lake or a nearby ditch (see Exhibit 3-30). Both the lake and the ditch discharge into the headwaters of Little Elk Creek. Little Elk Creek flows south-southeast into Lake Hobart also known as Rocky Lake. Lake Hobart is located in Kiowa County and is formed by a dam on Little Elk Creek. Lake Hobart empties into Little Elk Creek, which flows into Elk Creek. Elk Creek flows into the North Fork of the Red River and eventually into the Red River. (Benham Group, 1996 and USGS, 1990) The North Fork of the Red River is listed on Oklahoma's 303(d) list as a water body that does not meet its designated water quality standards. The North Fork of the Red River is impaired with metals (selenium), pathogens, turbidity, chlorides, and total dissolved solids, with no potential sources. (EPA, 2005b)

Exhibit 3-30. CSIA and Vicinity Map Showing Ridgeline



Surface waters north of the ridgeline flow toward Monument Creek, Sand Creek, and other unnamed tributaries of Turkey Creek in a north and northeasterly direction. Turkey Creek eventually flows into the Washita River. (Benham Group, 1996 and USGS, 1990) The Washita River is listed on Oklahoma's 303(d) list as a water body that does not meet its designated water quality standards. The Washita River is impaired with pathogens and turbidity, with no potential sources. (EPA, 2005b)

Little Elk Creek, North Fork Red River, and Washita River

Little Elk Creek, the North Fork Red River, and the Washita River are acceptable for use as a public and private water supply and are categorized as 'primary body contact.' Under the Fish and Wildlife Propagation category, these water bodies are subcategorized as warm water aquatic communities. (OWRB, 2002) The Red River is acceptable for use as a public, private, and emergency water supply and is categorized as primary body contact. Under the Fish and Wildlife Propagation category, the Red River is subcategorized as warm water aquatic community. (OWRB, 2002) Turkey Creek is subcategorized under the Fish and Wildlife

Propagation as a warm water aquatic community. This creek is categorized as primary body contact. (OWRB, 2002)

Base Lake

The water quality of Base Lake has been influenced by past activities at the CSIA. Sediment and surface water samples collected in 1994 detected toluene, vinyl chloride, TPH, and mercury in the sediment, and TCE and acetone in the surface water. Acetone is a common contaminant introduced by laboratories during sample analysis. Subsequent investigations detected a wider range of VOCs and metals in surface water and sediments in the Base Lake and surrounding drainage ditches.

Other Surface Water

The city of Burns Flat operates an onsite wastewater treatment plant, which includes two current treatment lagoons, with a third lagoon under construction. The wastewater treatment lagoons are 5.84 hectares (14.42 acres) in size. The current wastewater treatment plant includes rock-reed filters and aeration lagoons that treat wastewaters prior to discharge. The third treatment lagoon that is under construction is designed to increase the capacity of the wastewater treatment plant and improve treatment technology.

3.14.3.2 Floodplains

Washita County participates in the National Flood Insurance Program; the Federal Emergency Management Agency (FEMA) has not published any Flood Insurance Rate Maps (FIRMs) for CSIA or the surrounding area. However, FEMA has approved a CSIA floodplain map prepared by the Oklahoma Water Resources Board. Floodplains are located along the tributaries of Little Elk River and Base Lake.

3.14.3.3 Wetlands

The U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory Map indicates that the wetlands on the CSIA are concentrated along the tributaries of Little Elk Creek and include the Base Lake. Because the wetlands are hydraulically connected to waters of the U.S., the wetlands associated with the tributaries, Little Elk Creek, and Base Lake are jurisdictional wetlands. All of the wetlands situated on the CSIA are classified as part of the Palustrine (P) system. The wetlands associated with the tributaries and with Little Elk Creek are classified as PF01A, meaning that they are a Palustrine Forested (F) Broad-Leaved Deciduous (01) wetland that is temporarily flooded (A).

Base Lake was created by a man-made barrier designed to obstruct the inflow of surface water. Base Lake covers an area of two hectares (six acres) and has a storage capacity of 102,381 cubic meters (83 acre-feet) (*Oklahoma Water Atlas*, May 1990). Base Lake has a wetlands classification of PUBHh, or Palustrine (P), Unconsolidated Bottom (non-vegetated class) (UB), Permanently Flooded (H), and diked/impounded (h). The edges of the tributaries have a wetlands classification of PUSCH, or Palustrine (P), Unconsolidated Shore (US), Seasonally

Flooded (C), and Permanently Flooded (H). No formal wetland delineation has been performed on the wetlands on and adjacent to the CSIA.

3.14.3.4 Ground Water

The Elk City Sandstone is the major aquifer in the vicinity of the CSIA. There are three sources of ground water at the CSIA - the Elk City Sandstone, the shallow soils above the Elk City Sandstone less than 12 meters (40 feet) below ground surface, and the Doxy Shale. The ground water gradient in the Elk City Sandstone is 0.0091 ft/ft to the southeast, the ground water gradient in the shallow source is 0.0048 ft/ft to the southeast, and ground water flow in the Doxy Shale is 0.0039 ft/ft to the south. The shallow source is not used for potable water supply. (USACE, 1999)

Of the 18 water supply wells on the CSIA, six wells (10, 108, 253, 424, 460, and 462) are actively used wells. Seven wells have been capped, two wells were taken out of service due to mechanical and odor issues and three wells were removed from service because of the detection of elevated concentrations of TCE. Of the six active wells, well 424 serves as the primary source of water. Use of wells 108, 253, and 462 is limited to peak usage periods due to the presence of TCE in concentrations below the maximum contaminant level (MCL).

The depth to ground water in the wells ranges from approximately 2 to 11 meters (8 to 36 feet) below ground surface, and the average depth of the water wells is approximately 49 meters (160 feet). Wells producing from the Elk City Sandstone in the area of the CSIA yield between 227 and 757 liters per minute (60 and 200 gallons per minute).

Six additional water wells were drilled offsite to restore the supply of water lost because of the excessive TCE concentrations in some onsite wells. The additional wells are located in the City of Clinton well field northeast of the CSIA and were drilled to a depth of approximately 37 meters (120 feet) below ground surface. These wells have a combined yield of 379 to 568 liters per minute (100 to 150 gallons per minute). (USACE, 1999)

Ground Water Investigations and Remediation

Ground water contamination has occurred at the CSIA from historical military operations at the site. Solvents, metals, and organics have been identified and have resulted in the abandonment of several water wells. A summary of the nature and extent of ground water contamination identified during Phases I, II, and III of the remedial investigations conducted at the CSIA is contained in the *Final Data Evaluation Document in Support of the Remedial Investigation at the Clinton-Sherman Industrial Airpark*, ENSERCH Environmental Corporation, 1994 and the U.S. Army Corps of Engineers *Final Remedial Investigation Report Clinton-Sherman Industrial Airpark Burns Flat, Oklahoma,* ENSR Foster Wheeler Environmental Corporation, January 1999.

4 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ALTERNATIVES

This section describes the environmental consequences of the proposed alternatives on the existing natural and human environments of the CSIA and surrounding areas. This section analyzes and compares the potential environmental impacts from four alternatives including the no action alternative. The alternatives considered include the proposed action/preferred alternative, alternative 1, alternative 2, and the no action alternative.

The proposed action includes launching and landing Concept X, Y, and Z launch vehicles at the CSIA. Alternative 1 includes launching and landing only Concept X and Y launch vehicles. Alternative 2 includes launching and landing only Concept X and Z launch vehicles. The no action alternative includes no commercial launches from the CSIA and would consist of continued use of the CSIA for aviation and training-related activities and proposed future static engine testing.

4.1 Analysis methodology

4.1.1 Approach to Analysis

This analysis discusses the impacts of implementing the proposed action and alternatives as compared to the no action alternative. Impacts to each resource area are compared to the significance thresholds described in Appendix A of FAA Order 1050.1E to determine whether the applicable thresholds would be exceeded by the implementation of the proposed action or alternatives. In addition, impacts from the proposed activities are evaluated to determine whether they would prohibit or significantly hinder the continuation of current operations at the CSIA, including general aviation activities and military training activities, as well as proposed future rocket engine testing activities.

4.1.2 Proposed Action – Launching and Landing Concept X, Y, and Z Launch Vehicles at the CSIA

The CSIA is currently a fully operational general aviation airport. In addition rocket engine testing activities have been proposed for the CSIA. The CSIA would continue to operate as a general aviation airport if launch and landing activities were to be initiated. The current operations would not change appreciably as a result of launch and landing activities at the CSIA. Horizontal launch and landing activities would result in a slight increase in the number of annual flight operations at the CSIA.

During fiscal year 2003, approximately 47,000 operations were conducted at the CSIA. Of these, about 5,400 civilian aircraft operations were conducted, and there were approximately 1,090 overflights of the airport. The majority of the aircraft operations were military, with Vance AFB accounting for approximately 24,000 operations, Altus AFB 16,000 operations, and other military 1,600 operations. In addition to landings and takeoffs, the military also conducts transition training that consists of normal and emergency visual and instrument approaches and landings. The training may include missed approaches, low approaches, touch-and-gos, refused landings, and full stop landings.

Under the proposed action the maximum number of annual launches from the CSIA would be 54. The maximum number of launches for each vehicle concept is shown in Exhibit 4-1.

Exhibit 4-1. Maximum Number of Launches Under the Proposed Action from the CSIA for 2006-2010

Vehicle Concept	2006	2007	2008	2009	2010	Total
Concept X	12	12	24	48	48	144
Concept Y	2	2	2	2	2	10
Concept Z	2	2	3	4	4	15
Total	16	16	29	54	54	169

4.1.2.1 Impacts of Launches

For purposes of this analysis, launching Concept X, Y, and Z vehicles would consist of

- Transporting the vehicle, vehicle components, and propellants to the CSIA via road, rail, air, or a combination of the three methods;
- Assembling the various vehicle components;
- Conducting ground-based tests and checkout activities;
- Loading the pilot, passengers, and/or other payload;
- Fueling the launch vehicle;
- Towing or moving the launch vehicle to the proper launch or takeoff location; and
- Igniting the rocket motors.

All launches and landings would be made during daylight hours, and under VFR flight conditions. The proposed launches from the CSIA would increase from a maximum of 16 operations in 2006 to a maximum of 54 operations in 2010. As the number of launches increases over time, OSIDA may require additional coordination with various resource management agencies to ensure that applicable mitigation measures are in place.

4.1.2.2 Impacts of Landing

For purposes of this analysis, landing Concept X, Y, and Z vehicles would consist of the following activities:

- Collecting any debris from the runway prior to vehicle landing, and
- Recovering and transporting the launch vehicle from the runway after landing.

4.1.3 Alternative 1 – Launching and Landing Concept X and Y Launch Vehicles at the CSIA

Under alternative 1, only Concept X and Y launch vehicles would be launched from the CSIA. This alternative would include fewer launches than the proposed action with a maximum of 14 launches occurring in 2006 and a maximum of 50 launches occurring in 2010. The specific activities associated with launching these vehicles would be as described in Section 4.1.2.1 and the activities associated with landing these vehicles would be as described in Section 4.1.2.2. The maximum number of launches under alternative 1 is shown in Exhibit 4-2.

Exhibit 4-2. Maximum Number of Launches under Alternative 1 from the CSIA for 2006-2010

	2006	2007	2008	2009	2010	Total
Concept X	12	12	24	48	48	144
Concept Y	2	2	2	2	2	10
Total	14	14	26	50	50	154

4.1.4 Alternative 2 – Launching and Landing Concept X and Z Launch Vehicles at the CSIA

Under alternative 2, only Concept X and Z vehicles would be launched from the CSIA. This alternative would include fewer launches than the proposed action with a maximum of 14 launches occurring in 2006 and a maximum of 52 launches occurring in 2010. In addition, because both Concept X and Z launch vehicles ignite rocket engines after reaching a predetermined altitude in excess of 914 meters (3,000 feet), rocket emissions would not be expected to impact ground level air quality. The specific activities associated with launches of these vehicles would be as described in Section 4.1.2.1 and the activities associated with landing these vehicles would be as described in Section 4.1.2.2. The maximum number of launches under alternative 2 is shown in Exhibit 4-3.

Exhibit 4-3. Maximum Number of Launches under Alternative 2 from the CSIA for 2006-2010

	2006	2007	2008	2009	2010	Total
Concept X	12	12	24	48	48	144
Concept Z	2	2	3	4	4	15
Total	14	14	27	52	52	159

4.1.5 No Action Alternative

Under the no action alternative, the FAA would not issue a launch site operator license to OSIDA and there would be no launches from CSIA. OSIDA would not be able operate a launch facility at the proposed location at CSIA. The CSIA facility would continue to offer its aviation related activities and in the future may host rocket engine tests.

4.2 Air Quality

4.2.1 Approach to Analysis

This section addresses the potential impact on air quality of operating the proposed vehicle concepts at the CSIA. Impacts on air quality are assessed with respect to the potential to cause a significant deterioration in the air quality surrounding CSIA in excess of the threshold of significance described in FAA Order 1050.1E, Appendix A, Section 2. Potential air quality impacts may be caused by vehicle launches and landings at the CSIA.

The composition of exhaust emissions from launches and landings varies depending on the type of propellant and the type of propulsion systems used (i.e., jet engine and/or rocket motors). Of the chemical species that are generated by emissions during launches and landings from the vehicles proposed for use at the CSIA, the emissions of concern include PM, NO_X, SO_X, CO, CO_2, H_2O, and VOCs. Emissions of the other main exhaust products are either negligible or would not have an adverse impact on any layer of the atmosphere.

Within the proposed action and alternatives, impacts of launch emissions are assessed for each atmospheric level. Beginning at ground level, tropospheric effects are considered. Effects in the stratosphere, mesosphere, and ionosphere are also considered.

4.2.2 Proposed Action

The impacts related to the proposed action are discussed within the framework of impacts from launches and impacts from landings. Within the impacts of launches, Section 4.2.2.1, impacts to the troposphere, stratosphere, mesosphere, and ionosphere are discussed. The impacts to the troposphere include a discussion of criteria pollutants, air toxics and regional haze. Impacts within the stratosphere include global warming and ozone depletion. The impacts of landings, Section 4.2.2.2, are discussed based on concept vehicle type and heat-dissipating effects.

4.2.2.1 Impact of Launch

Troposphere

Impacts on the troposphere from the proposed launches would be a result of engine exhaust during takeoff, ascent, and landing through the troposphere. The current aircraft emissions at OSIDA, as estimated by the USAF, are found in Exhibit 4-4. As shown in Exhibit 4-5, the USAF operations are the dominant component in current annual emissions from the CSIA.

The CSIA is in attainment for all criteria pollutants under the CAA. Therefore, the air quality is generally good. At the maximum launch rate under the proposed action, an additional 54 missions per year would occur from CSIA. This is a 0.1 percent increase in operations. Assuming emissions from an RLV launch are similar to those of a general aviation or military aircraft, this would result in approximately 0.1 percent increase in air emissions. Because of the small number of vehicle launch operations relative to commercial or military aircraft as shown in Exhibit 4-5, the increase in emissions as a result of the launch operations is expected to be minimal. Despite the likelihood that emissions from the proposed launches will be quite small, emission rates of the various pollutants of potential concern were estimated for the proposed action and each alternative. Results are presented in the sections below.

Exhibit 4-4. Estimated Air Emissions for Aircraft Operations at the CSIA Based on Fiscal Year 2002 Planned Aircraft Operations

Emission Source[a]	Estimated Annual Emissions (Kilograms per year [tons per year])[b]			
	CO	VOC	NO_X	SO_2
Based Aircraft				
C-5	9,625 (10.61)	771 (0.85)	92,996 (102.51)	2,858 (3.15)
C-141	19,232 (21.20)	14,742 (16.25)	11,304 (12.46)	789 (0.87)
KC-135R	17,618 (46.43)	5,915 (6.52)	144,759 (159.57)	4,046 (4.46)
C-17	17,618 (19.42)	1,569 (1.73)	103,401 (113.98)	3,012 (3.32)
Subtotal	88,596 (97.66)	22,988 (25.34)	352,459 (388.52)	10,705 (11.80)
Total All Other Aircraft	39,453 (43.49)	3,384 (3.73)	18,806 (20.73)	1,197 (1.32)
TOTAL EMISSIONS	128,040 (141.14)	26,372 (29.07)	371,265 (409.25)	11,902 (13.12)

[a] Emissions data were not available for maintenance and fueling operations
[b] Emissions estimated using Emissions and Dispersion Modeling System (EDMS) Version 3.2
Source: Department of the Air Force, 2002

Exhibit 4-5. Operations at the CSIA for Fiscal Year 2001

Types of Aircraft	FY 2001 Operations	Percent of Total
Itinerants		
General Aviation	3,067	6.5%
Military	4,381	9.3%
Local		
General Aviation	2,786	5.9%
Military	36,977	78.3%
Total Operations	47,211	100%

Source: CSIA Tower, 2002.

Under the proposed action, any impacts on the troposphere would be a result of jet engine emissions (Concept X vehicles), carrier aircraft jet engine emissions (Concept Z vehicles), and emissions generated by the ignition of rocket motors in the troposphere (Concept Y vehicles). Other potential impacts on the troposphere could result from accidents on the launch pad or during flight.

The projected annual emissions from RLVs below 914 meters (3,000 feet) of the specific pollutants of concern from 2006 through 2010 were calculated by estimating the emissions below 914 meters (3,000 feet) per flight for each vehicle type, multiplying these emissions by the estimated annual flights for each vehicle type, and then summing across all vehicle types. Exhibit 4-6 presents the emissions below 914 meters (3,000 feet) per flight for each of the three vehicle types considered. Exhibit 4-7 presents the projected annual emissions for all proposed RLVs below 914 meters (3,000 feet). The 914-meter (3,000-feet) altitude is appropriate for evaluating impacts in the troposphere because the Federal government uses 914 meters and below to assess contributions of emissions to the ambient air quality and for the *de minimis* calculations under the CAA. (EPA, 1992) Detailed descriptions of the different vehicle types and the estimated number of annual launches of each vehicle type are provided in Section 2. The methodology used to estimate the per flight and total emissions to the troposphere is provided in Appendix A.

Exhibit 4-6. Estimated Emissions below 914 meters (3,000 feet) per RLV Flight Based on Vehicle Type, Kilograms (Tons)

Vehicle	Emission Loads per Flight, Kilograms (Tons)							
	PM	NO_X	SO_X	CO	CO_2	H_2O	VOC	H_2*
Concept X	11 (0.01)	0.5 (0.0005)	0.2 (0.0003)	38 (0.04)	-	-	4.0 (0.004)	-
Concept Y	-	-	-	-	478 (0.5)	179 (0.2)	-	2.5 (0.003)
Concept Z	11 (0.01)	0.6 (0.0007)	0.3 (0.0003)	38 (0.04)	-	-	5.2 (0.006)	-

* Hydrogen (H2)

Exhibit 4-7. Estimated Annual Emissions below 914 meters (3,000 feet) for Proposed Action, Kilograms (Tons)

Year	Emission Loads for All Proposed Action Flights, Kilograms (Tons)							
	PM	NO_X	SO_X	CO	CO_2	H_2O	VOC	H_2
2006	154 (0.2)	7 (0.008)	3 (0.003)	528 (0.6)	957 (1)	357 (0.4)	58 (0.06)	5 (0.006)
2007	154 (0.2)	7 (0.008)	3 (0.003)	528 (0.6)	957 (1)	357 (0.4)	58 (0.06)	5 (0.006)
2008	297 (0.3)	14 (0.02)	6 (0.006)	1019 (1)	957 (1)	357 (0.4)	112 (0.1)	5 (0.006)
2009	572 (0.6)	26 (0.03)	11 (0.01)	1962 (2)	957 (1)	357 (0.4)	213 (0.2)	5 (0.006)
2010	572 (0.6)	26 (0.03)	11 (0.01)	1962 (2)	957 (1)	357 (0.4)	213 (0.2)	5 (0.006)

Criteria Pollutants

EPA has set national air quality standards for six common pollutants, referred to as "criteria" pollutants. These criteria pollutants include ozone, PM, CO, NO_2, SO_2, and Pb. If the CSIA was in non-attainment for any one of these pollutants, a conformity analysis would be required if the emissions of the pollutant exceeded the applicable *de minimis* levels on an annual basis. CSIA is in attainment for all criteria pollutants; therefore these rules do not apply. However, the emissions can be compared to the *de minimis* levels to determine if the emissions have the potential to have a negative impact on air quality in the troposphere. In addition to comparison to the *de minimis* levels, the calculated annual emission rates for the proposed action (Exhibit 4-7) can be compared to emission rate increments listed in the Oklahoma air pollution control rule (Oklahoma DEQ, 2004b) as "significant" increases in emissions from major stationary sources. Comparing RLV emissions to these standards is conservative because RLVs are not stationary sources and would likely result in fewer potential impacts due to the distribution of emissions over a larger area at much lower concentrations; however, comparing the results to emissions that are considered significant by Oklahoma provides an additional measure of the potential impact of the proposed action. Both the *de minimis* levels for areas in serious non-attainment (the worst type of non-attainment status) and the significant net emission increases for stationary sources in Oklahoma are presented in Exhibit 4-8 for comparison to the RLV emissions.

Exhibit 4-8. Comparison Emission Rates, Kilograms (Tons)

Standard of Comparison	PM	NO_X[a]	NO_2	SO_X	CO	VOC[a]
Non-attainment area *de minimis* level[b]	63,640 (70)	9,072 (10)	90,910 (100)	90,910 (100)	90,718 (100)	9,072 (10)
Significant emission from major stationary source[c]	13,608 (15)	36,287 (40)	n/a	36,287 (40)	90,718 (100)	36,287 (40)

[a] NO_X and VOCs are not criteria pollutants, but are controlled under criteria pollutant standards because they lead to the formation of ozone (i.e., they are ozone precursors).
[b] Nonattainment *de minimis* levels are for serious non-attainment zones.
[c] Significant emission levels are from the Oklahoma Air Rule (Oklahoma DEQ, 2004b) and represent the level considered significant as a net emissions increase.

Overall, the calculated emissions that would result from the proposed action (Exhibit 4-7) are less than both the *de minimis* levels and the level of emission considered significant for Oklahoma stationary sources. In the years with the highest emissions under the proposed action, the total annual NO_X (26 kilograms), SO_X (11 kilograms), CO (1,962 kilograms), PM (572 kilograms), and VOC (213 kilograms) emissions from all RLVs are substantially below the *de minimis* and "significant" emission levels. Furthermore, even the maximum NO_X emissions (part of which is NO_2) under the proposed action of 26 kilograms would be substantially below the *de minimis* level of 90,910 kilograms per year for an area in non-attainment. This comparison shows that the emissions of all criteria air pollutants (and associated precursor pollutants) associated with the proposed action would not result in an impact on ambient air quality in excess of the threshold of significance described in FAA Order 1050.1E, Appendix A, Section 2.

Air Toxics

HCl and Cl are considered air toxics (i.e., HAPs) and are sometimes components of rocket engine emissions, depending on the propellant type. None of the proposed launch vehicles use propellants that would result in emissions of these pollutants; thus no HCl or Cl would be emitted to the troposphere from these launches.

Regional Haze

The regional haze rule (64 FR 35714, dated July 1, 1999) requires states to develop SIPs to address visibility at designated mandatory Class I areas, including 156 designated national parks, wilderness areas, and wildlife refuges. General features of the regional haze rule are that all states are required to prepare an emissions inventory of all haze-related pollutants (i.e., VOC, NO_X, SO_2, PM_{10}, $PM_{2.5}$, and NH_3) from all sources in all constituent counties. Most states will develop their regional haze SIP in conjunction with their $PM_{2.5}$ SIP over the next several years. The Wichita Mountains Wilderness area is the only Class I area in Oklahoma and is approximately 80 to 97 kilometers (50 to 60 miles) southeast of the CSIA. The regional haze SIP is not available yet, but the minimal emissions of the haze-related pollutants associated with the proposed action are expected to have a negligible impact on the visibility at the designated Class I area.

Stratosphere

Under the proposed action, the potential impacts to the stratosphere include global warming (from emissions of greenhouse gases) and depletion of the stratospheric ozone layer. Total emissions to the stratosphere per launch are presented in Exhibit 4-9 and are calculated as described in Appendix A. Estimated annual emissions to the stratosphere (across all vehicle types) from the proposed action are presented in Exhibit 4-10.

Exhibit 4-9. Estimated Emissions in Stratosphere by LV Launch Based on Vehicle Type, Kilograms (Tons)

Vehicle	Emission Loads per Launch/Reentry, Kilograms (Tons)							
	PM	NO_X	SO_X	CO	CO_2	H_2O	VOC	H_2
Concept X	-	-	-	648 (0.7)	1,589 (1.8)	973 (1.1)	-	13.6 (0.01)
Concept Y	-	-	-	516 (0.6)	1,264 (1.4)	774 (0.9)	-	10.8 (0.01)
Concept Z	-	-	-	305 (0.3)	46 (0.05)	335 (0.4)	-	-

Exhibit 4-10. Estimated Annual Emissions in the Stratosphere for Proposed Action, Kilograms (Tons)

Year	Emission Loads for All Proposed Action Flights, Kilograms (Tons)							
	PM	NO_X	SO_X	CO	CO_2	H_2O	VOC	H_2
2006	0	0	0	9422 (10)	21,682 (23)	13,889 (15)	0	185 (0.2)
2007	0	0	0	9422 (10)	21,682 (23)	13,889 (15)	0	185 (0.2)
2008	0	0	0	17,507 (19)	40,790 (45)	25,896 (29)	0	348 (0.4)
2009	0	0	0	33,374 (37)	78,959 (87)	49,573 (55)	0	674 (0.7)
2010	0	0	0	33,374 (37)	78,959 (87)	49,573 (55)	0	674 (0.7)

Global Warming

Under the proposed action, the potential launch emissions that may affect global warming directly as greenhouse gases are CO_2 and H_2O. The potential for these emissions to affect global warming was assessed by comparing the estimated annual launch emissions of each pollutant to the stratosphere (see Exhibit 4-9) to the annual emissions from all U.S. sources of these pollutants. Although all of the launches considered here are from one location, the stratospheric emissions are compared to nationwide emissions because the impacts of launch emissions in the stratosphere are no longer local impacts. The estimated launch emissions of CO_2 to the stratosphere for the period 2006 to 2010 would range from 23 to 87 tons annually. By comparison, the total annual CO_2 emissions from all U.S. sources for 1999 were over 6,100 million tons. (EPA, 2001) The incremental contribution of launch emissions from the proposed action would be an extremely small fraction (less than 2×10^{-6} percent) of the nationwide emissions, which would result in a negligible impact on global warming. The RLV emissions of H_2O would also have an insignificant effect on global warming due to the preponderance of other natural and anthropogenic sources of H_2O. CO, a photochemically important pollutant that can influence the creation and destruction of greenhouse gases, also would be present in horizontal RLV emissions. Contributions from launch emissions of these pollutants to the atmospheric burden, however, would be extremely small relative to U.S. annual emissions (over 100 billion kilograms of CO) for 2000. (EPA, 2004) There are no NO_X emissions into the stratosphere from the proposed action, so there can be no negative impact on greenhouse gases from its emission.

Ozone Depletion

Under the proposed action, there would be no emissions to the stratosphere of HCl, Cl, PM, or NO_X, which are the primary chemicals of concern for ozone depletion. Due to the vehicles selected for use at the CSIA, increased ozone depletion due to these emissions is not a concern.

Mesosphere

Under the proposed and alternative actions, negligible impacts on the mesosphere would occur during normal launches. The mesosphere is a relatively narrow band of the atmosphere that rockets tend to pass through fairly quickly. For launches and reentries under the proposed action, the amount of rocket emissions in this layer would be extremely small. Launches under the alternative actions would have even less potential impact. Furthermore, substantial impacts in the mesosphere associated with the compounds emitted by RLVs are not known to exist. For these reasons, emissions from the proposed action and alternatives should have no impact on the mesosphere.

Ionosphere

The vehicles selected for possible use at CSIA do not have any emissions within the ionosphere because the selected vehicles are not powered at this altitude. All three of the RLVs considered in the proposed action are expected to be coasting unpowered in the ionosphere (approximately 80 to 1,000 kilometers [50 to 621 miles] above the Earth's surface. (See Section 2.1.4 for the Flight Profiles of each vehicle.) Therefore, emissions from the proposed action and alternatives should have no impact on the ionosphere.

4.2.2.2 Impact of Landing

The potential air quality impacts from landing consist of the effects associated with heat dissipation during reentry and the ground-level impacts associated with reentry emissions. This section evaluates both of these types of impacts for the proposed action.

Heat Dissipating Effects

During landing from altitudes above 80 kilometers (50 miles), some of the launch vehicles considered propose using ablative material to protect some surfaces that would be exposed to high heat during landing operations. The ablative materials are typically a honeycomb base, consisting of oxygen, carbon, hydrogen, and nitrogen with a filler material comprised of materials such as calcium, silicon, and sodium. The carbon char and polymer binder fibers produced by the ablative material during reentry could potentially increase particulate loading in the atmosphere along the landing trajectory. However, because of the small quantity of particulates and the dispersion properties of the atmosphere, no adverse atmospheric effects are expected based on the projected level of commercial activity at the proposed site. (U.S. DOT, 1992)

Some of the launch vehicles considered propose using radiative thermal protection systems, designed to radiate heat back to the atmosphere until an equilibrium temperature is reached. They must be able to stand extremely high temperatures without melting. Radiative heat shields are self-contained and generally do not introduce substances into the atmosphere; no adverse effects have been identified from the ceramic tiles used on parts of the Space Shuttle. Thus, radiative thermal protection systems on suborbital RLVs are not expected to cause any adverse atmosphere impacts. (U.S. DOT, 1992)

Ground-level Impacts of Landing - Concept X Vehicles

Concept X vehicles use jet engines during their powered landing and thus have the potential to generate emissions that may have ground-level impacts. However, these emissions are very small and were included in the launch emission estimates presented in Section 4.2.2.1. Therefore, because no adverse impacts are expected from the launch emissions, no adverse impacts are expected from landing emissions of Concept X vehicles.

Ground-level Impacts of Landing - Concept Y Vehicles

Concept Y vehicles use an unpowered return and thus generate no emissions during landing. Therefore, there are no expected adverse impacts from Concept Y vehicles during landing.

Ground-level Impacts of Landing - Concept Z Vehicles

Concept Z vehicles consist of a carrier vehicle and a launch vehicle. The launch vehicle uses unpowered return and thus generates no emissions during landing. The carrier vehicle uses jet engines during its return and landing and has the potential to generate emissions that may have ground-level impacts. As was the case for Concept X vehicles, these emissions were included in the launch emission estimates in Section 4.2.2.1. Therefore, because there were no expected adverse impacts from the launch emissions of Concept Z vehicles, there are also no expected adverse impacts from landing emissions of Concept Z carrier vehicles.

4.2.3 Alternative 1

4.2.3.1 Troposphere

Under alternative 1, there would be no Concept Z vehicles. This would result in a reduction in emissions in the troposphere (between zero and 20 percent reduction in total emissions, on average) associated with the proposed action. Thus, the overall impacts on air quality in the troposphere from alternative 1 would be the same or less than those presented for the proposed action.

4.2.3.2 Stratosphere

Under alternative 1, the emissions of CO, CO_2, and H_2O would decrease by as much as 7 percent, and there would be no additional chemical emissions compared to the proposed action. Thus, the overall impacts on air quality in the stratosphere from alternative 1 would be the same or less than that presented for the proposed action.

4.2.4 Alternative 2

4.2.4.1 Troposphere

Under alternative 2, there would be no Concept Y vehicles. Because Concept Y is the only vehicle in the proposed action with rocket emissions in the troposphere, alternative 2 would eliminate the CO_2, H_2O, and H_2 emissions to the troposphere associated with the proposed action. However, these are not pollutants of concern in the troposphere and all other emissions to the troposphere would remain under this alternative. Thus, the overall impacts on air quality in the troposphere from alternative 2 would be the same as for the proposed action.

4.2.4.2 Stratosphere

Under alternative 2, the emissions of CO, CO_2, H_2O, and H_2 would decrease (by as much as 12 percent), and there would be no additional chemical emissions compared to the proposed action. Thus, the overall impacts on air quality in the stratosphere from alternative 2 would be the same or less than that presented for the proposed action.

4.2.5 No Action Alternative

4.2.5.1 Troposphere

Under the no action alternative, the FAA would not issue a launch site operator license to OSIDA and there would be no launches from the CSIA; therefore, there would be no additional emissions to the troposphere. Air quality in the troposphere would not be impacted by implementation of the no action alternative.

4.2.5.1 Stratosphere

Under the no action alternative, the FAA would not issue a launch site operator license to OSIDA and there would be no launches from the CSIA; therefore, there would be no addition or removal of emissions to the stratosphere. Air quality in the stratosphere would not be impacted by implementation of the no action alternative.

4.3 Airspace

4.3.1 Approach to Analysis

This airspace analysis addresses movement of aircraft and launch vehicles within the regional airspace of the CSIA. Impacts on airspace are assessed with respect to the potential to cause disruption or congestion. Impacts on air traffic are analyzed to determine whether they lead to flight operations that could not be accommodated within established operational procedures and flight patterns. The impacts are assessed to determine whether the activities associated with the CSIA degrade the FAA's ability to control air traffic near the CSIA or provide necessary safety during flight operations.

This analysis focuses on flights in Class A airspace between 5,500 and 18,300 meters (18,000 and 60,000 feet) MSL, Class E airspace between the ground level and 5,500 meters (18,000 feet), and Special Use airspace. Activities above 18,300 meters (60,000 feet) would not conflict with commercial aircraft as their typical operating altitudes are between 13,700 and 18,300 meters (45,000 and 60,000 feet). Therefore, there would be no impact on commercial flight operations as a result of proposed launch activities occurring above 18,300 meters (60,000 feet).

4.3.2 Proposed Action – Launching and Landing Concept X, Y, and Z Launch Vehicles at the CSIA

As part of the licensing process, the FAA and OSIDA would prepare an agreement (known as a Letter of Agreement [LOA]) related to airspace use. This LOA would address the responsibilities of all involved entities and would serve the purpose of mitigating potential impacts to airspace use described in Sections 4.3.2.1 and 4.3.2.2.

4.3.2.1 Impacts from Launches

The activities associated with launches of Concept X, Y, and Z vehicles are as described in Section 4.1.2.1. The impacts of these activities are described below.

Transporting the vehicle and vehicle components to the CSIA could have the potential to impact airspace if this activity were accomplished using aircraft.[15] However, because of the relatively small number of aircraft operations that would be needed to transport vehicles and vehicle components and the availability of airspace in the area, there would be no appreciable degradation of the FAA’s ability to control air traffic and provide necessary safety resulting from the transportation of vehicles or vehicle components via aircraft.

Assembly of the vehicle and vehicle components; ground-based tests (including checkout); passenger, crew, and cargo loading; fueling; and towing or moving the launch vehicle on the runway would not impact airspace.

During the years with the highest number of launches there would be a maximum of 54 launches. Currently, there are approximately 47,200 aircraft operations at the CSIA per year. An additional 54 launches per year would cause an increase of 0.1 percent in operations at the CSIA. The CSIA has the capacity to accommodate the additional operations without appreciably degrading the FAA’s ability to control air traffic in the region or air traffic flow at the CSIA, or to provide necessary safety during flight operations. In addition, launch activity would be timed to correspond with times of low aircraft activity at the CSIA. This will serve to further minimize potential impact to existing aircraft operations at the CSIA and within the region.

The remainder of this analysis focuses on potential impacts to specific types of airspace from igniting the rocket motors and the subsequent flight of the vehicles.

Low Altitude Class E Airspace

Concept X and Z vehicles would take off from the CSIA under jet power. Concept X vehicles would use jet engines on the vehicle itself and Concept Z vehicles would use a carrier aircraft operating under jet power. Because these vehicles would take off in a manner similar to or the same as other airplanes using the CSIA, they would receive clearance from the CSIA tower and follow standard operating procedures. Once outside of the control of the CSIA tower, the vehicle would be in radio contact with the relevant ARTCC and operate in the NAS as outlined in the LOA. The flight plan and proposed flight corridor would have been coordinated with the

[15] Propellants would be shipped to the CSIA via road.

respective ARTCC so that proper procedures are followed for use of the NAS. The individual flight path used during any one mission would be contained within the northwest or southwest corridors established for use by OSIDA. The launch vehicle would ascend and enter high altitude airspace at 5,500 meters (18,000 feet). Once flight missions have been specified with greater detail, OSIDA would work with the ARTCCs to determine the clearance needs of the proposed trajectories.

Concept Y vehicles would take off from the CSIA under rocket power. Because this type of activity is different than other aircraft taking off from the CSIA, special consideration needs to be given to airspace coordination. These launch vehicles may not operate as aircraft when commencing operations at the CSIA. If the flight characteristics are substantially similar to that of an aircraft, it is possible that the coordination with the appropriate ARTCC would be similar to that conducted for Concept X and Z vehicles. If the flight characteristics of Concept Y vehicles, including speed and ascent angle, are substantially different than an aircraft, additional procedures would be required by the ARTCC to ensure safe operation in the NAS. This coordination with the ARTCC would be part of the safety analysis completed by the FAA prior to issuance of a license or permit to conduct launches of Concept Y vehicles at the CSIA.

High Altitude Class A Airspace

Concept X vehicles would turn off jet engines and ignite rocket engines when the vehicle has reached a predetermined location and altitude. Concept Z vehicles would be released from their carrier aircraft and rocket engines would be ignited when the vehicles reach a predetermined location and altitude. The specific location and altitude for both of these events would be coordinated with the appropriate ARTCC. This coordination would be conducted prior to launch to ensure that no other aircraft would be operating in the vicinity of the launch vehicle operations. As described above, the launch of Concept Y vehicles would require coordination with the ARTCC to ensure that the rocket launch activities that are initiated at ground level are conducted at times and along trajectories that would not conflict with other aircraft operating in the vicinity.

The launch operations would consist of a maximum of 54 launches per year. This would require coordinating an average of 4.5 launches per month with the appropriate ARTCC to ensure that no other aircraft would interfere with proposed launch operations. The OSIDA would work closely with the ARTCC to determine how airspace corridors (as identified in Exhibits 2-5 and 2-6) should be scheduled to permit launches of the proposed launch vehicles while minimizing interference with jet routes and victor routes in the vicinity of the CSIA. Notices to Airmen (NOTAMs) would be issued to inform pilots of planned launch activities.

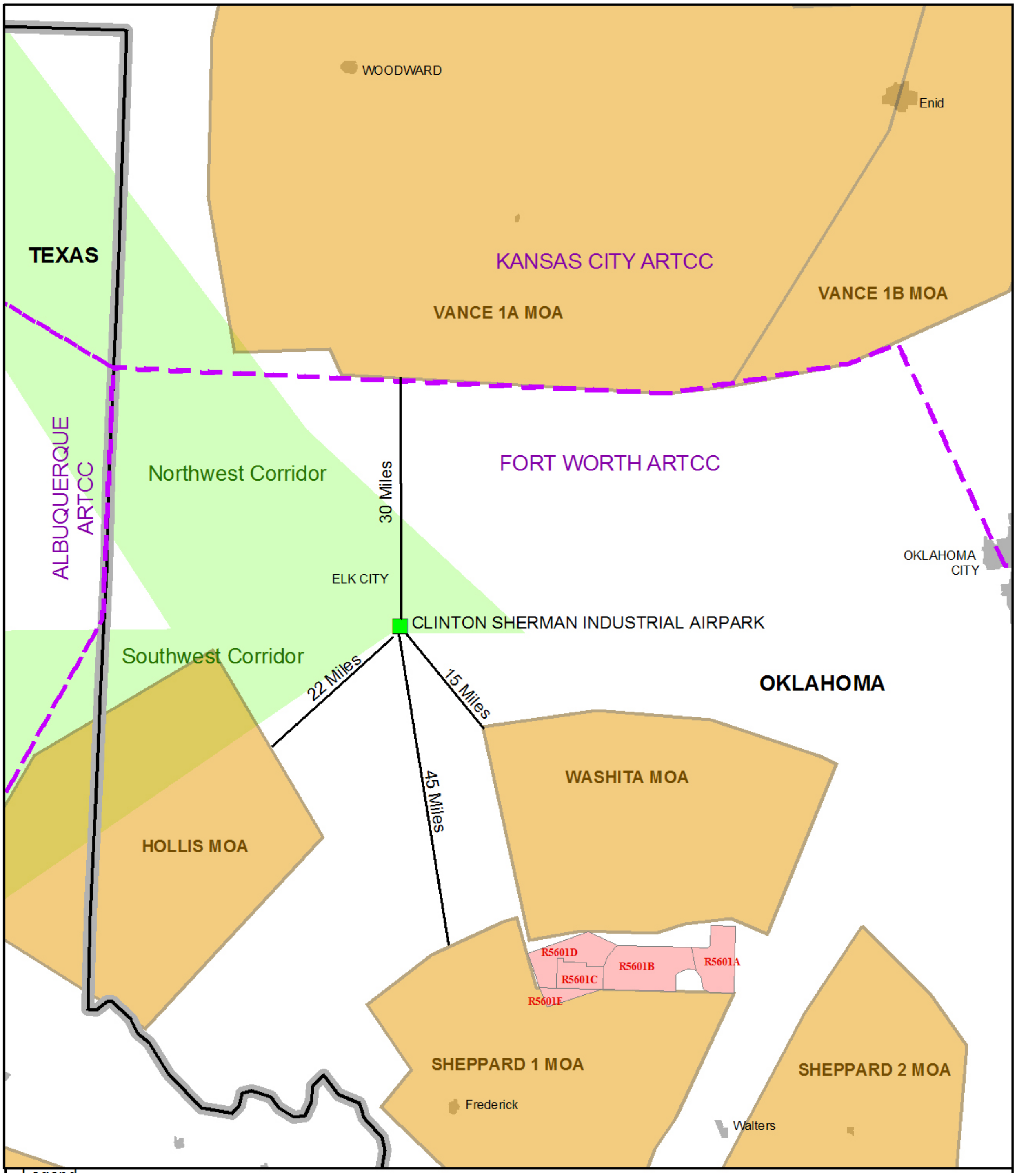
The northwest and southwest airspace corridors proposed to be used for the CSIA were chosen to minimize the number of jet routes affected while providing enough airspace for launch vehicles to have flexibility in their mission characteristics. Jet routes that cross the airspace corridors are J26, J28, J98, J8, J20, and J52. Based on proposed launch vehicle mission characteristics, commercial traffic in this area would need to fly at a designated altitude or use alternate jet routes outside of proposed launch corridors during launch operations.

Because of the relative infrequency of launch operations, and the availability of alternate routes for commercial traffic activities, proposed launches would not be expected to result in degradation of the FAA's ability to control air traffic and provide necessary safety for flight operations in high altitude airspace.

Special Use Airspace

The Special Use airspace in the vicinity of the CSIA includes three Military Operation Areas (MOAs): Vance 1A, Hollis, and Washita. Exhibit 4-11 shows the distance from the CSIA to the MOAs. The Washita MOA is located south of the CSIA and no flights are anticipated to pass through this airspace. The Vance 1A MOA is located north of CSIA and no flights are anticipated to pass through their airspace because the ceiling for the MOA is 5,500 meters (18,000 feet) and all proposed flights would travel above this ceiling. The Hollis MOA is located to the southwest of the CSIA. Launches using the southwest corridor may pass through this airspace. As part of the licensing process, the FAA would work with OSIDA to coordinate airspace and airport use with the ARTCC and with the users of the CSIA, including the USAF. Because all launches would be properly coordinated and airspace use agreements adhered to, no impacts to special use airspace are expected as a result of this proposed action. There are no anticipated impacts to special use airspace for launches from the CSIA.

Exhibit 4-11. Distance from the CSIA to MOAs



4.3.2.2 Impacts from Landing

The activities associated with landing a Concept X, Y, or Z vehicle would be as described in Section 4.1.2.2. Collecting debris from the runway after launch and recovering and transporting the vehicle after landing would not impact airspace. Therefore, this analysis focuses on the impacts of the launch vehicle after it descends to 18,300 meters (60,000 feet) and begins to operate within the FAA's controlled airspace system and adhere to the FAA's rules and regulations for operating within the NAS.

High Altitude Class A and Low Altitude Class E Airspace

Similar to the launch phase, a descending launch vehicle would pass through several designated jet routes and victor routes before landing at the CSIA. Once a launch vehicle has descended below 18,300 meters (60,000 feet) the vehicle would travel through both Class A and E airspace. The descent would be planned and coordinated with the ARTCC prior to the launch to ensure that other aircraft operating in the region would not be impacted. During descent, the lower level victor routes in the vicinity of the CSIA could be impacted. However, the planned landing trajectory would be announced in NOTAMs, to preclude conflicts with any other aircraft operating in the area, including aircraft operating under VFR.

It is anticipated that airspace closures for flight missions from the CSIA would require a maximum of 2.5 to 3 hours of airspace closure. Assuming that this represents a worst case scenario in terms of airspace closure time, this would close the airspace at the CSIA for less than 2 percent of the available time. Because of the capacity at the CSIA and efforts to conduct launches during off-peak airspace use, this would not represent a substantial impact on airspace availability at the CSIA. The specific amount of airspace closure time required for each mission would be developed in conjunction with OSIDA, ARTCC, and the launch operator to ensure flights would not appreciably impact airspace availability for the existing aircraft activities at the CSIA. Each mission trajectory would need to have specific jet route closures detailed and coordinated through the ARTCC.

For launch missions where unpowered returns are planned, the RLVs would not be able to loiter, divert, or go around. In these situations, scheduling discussions with ARTCC would need to accommodate fairly restrictive airspace closure requirements to allow sufficient time for the RLV to land at the CSIA. Alternatively, RLVs with powered aircraft type landings may be more flexible in their flight paths prior to landing at the CSIA.

Because of the infrequency of the launch operations, and the ability to reroute or provide alternative flight options, no degradation of the FAA's ability to control air traffic and provide necessary safety for flight operations in the affected airspace would be expected to result from landing Concept X, Y, or Z vehicles at the CSIA.

Special Use Airspace

The Washita MOA is located south of the CSIA and no flights are anticipated to pass through this airspace. The Vance 1A MOA is located north of the CSIA and no flights are anticipated to pass through this airspace because the ceiling for the MOA is 6,100 meters (18,000 feet) and all proposed landing activities would travel above this ceiling when crossing the MOA. The Hollis MOA is located to the southwest of the CSIA. Launches and landings using the southwest corridor may pass through this airspace. However, because all landings would be properly coordinated and airspace use agreements adhered to, no impacts to special use airspace are expected as a result of this proposed action. There would be no impacts to special use airspace from landing Concept X, Y, or Z vehicles at the CSIA.

In the case of an aborted flight or requirement to land at another airfield in an emergency, RLVs may have to descend into the MOA. Planning for this type of scenario, would be coordinated with the various DoD entities as well as the ARTCC prior to launch.

4.3.3 Alternative 1 - Launching and Landing Concept X and Y Launch Vehicles at the CSIA

The activities associated with launching and landing Concept X and Y vehicles would be the same as those described for the proposed action. However, fewer total launches would occur because there would be no launches of Concept Z vehicles.

Because launches and landings of Concept X and Y vehicles would occur under this alternative, there would be more aircraft operating in the airspace at and around the CSIA than under the no action alternative. However, the impacts of this alternative would be less than those expected for the proposed action because there would be no launches of Concept Z vehicles from the CSIA.

4.3.4 Alternative 2 – Launching and Landing Concept X and Z Launch Vehicles at the CSIA

Fewer activities would be associated with launching and landing Concept X and Z vehicles than those described for the proposed action. Because both Concept X and Z vehicles function as aircraft when taking off from the CSIA, the additional consultation with the ARTCC required for Concept Y vehicles that take off using rocket power would not be required under this alternative.

Because launches and landings of Concept X and Z vehicles would occur under this alternative, there would be more aircraft operating in the airspace at and around the CSIA than under the no action alternative. However, the impacts of this alternative would be less than those expected for the proposed action because there would be no launches of Concept Y vehicles from the CSIA.

4.3.5 No Action Alternative

Under the no action alternative, the FAA would not issue a launch site operator license to OSIDA and there would be no launches from the CSIA. The OSIDA would not be able operate a launch facility at the proposed location at the CSIA. The CSIA facility would continue to offer its aviation related activities, and there would be no change in airspace activities.

4.4 Biological Resources

4.4.1 Approach to Analysis

The FAA evaluated the severity of an impact to biological resources, by considering a variety of factors to aid in defining the severity of impact, including the following:

- Unique characteristics of the geographic area such as proximity to wetlands, wild and scenic rivers, or ecologically critical areas,
- The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973, and
- Whether the action threatens a violation of Federal, state, or local law or requirements imposed for biological resources.

4.4.2 Proposed Action– Launching and Landing Concept X, Y, and Z Launch Vehicles from the CSIA

The launch and landing of Concept X and Z vehicles would not notably impact biological resources. Concept X and Z vehicles would be jet powered vehicles during takeoff and would either glide or land under jet power, which would not represent a change over the current military, commercial, and private aviation activities that occur at CSIA.

The launch and landing of Concept Y vehicles, which would be powered by rocket engines from takeoff, would not impact biological resources. The noise associated with the takeoff and landing would be less than that associated with the daily military aircraft takeoffs and landings. The primary emissions from Concept Y vehicles would include CO_2 and H_2O (vapor) and would not impact biological resources.

Threatened and endangered species would not be impacted by the proposed action because no federally protected species occur in the region of the CSIA. (USACE, 1999) However, previous studies indicate that the endangered whooping crane may be found in or near the wetlands at CSIA during its spring and fall migration. (Department of the Air Force, 2004) Should the whooping crane be identified in or near the wetlands at CSIA, OSIDA would consult with USFWS, and implement mitigation measures to ensure that the launch and landing activities would not be likely to adversely affect the whooping crane. Potential mitigation measures may include monitoring the whooping crane during launches and landings to document the affects or scheduling launches and landings when the whooping crane is not present.

The FAA reviewed the potential impacts associated with the proposed action in light of the findings of the 2002 EIS for Proposed Airfield Repairs, Improvements, and Adjustments to Aircrew Training for Altus Air Force Base, Oklahoma, as well as the lack of suitable migration stopover habitat for the whooping crane at the CSIA. Based on this information, and the fact that no known listed or other special-status plant or wildlife species occur on or near the CSIA, the FAA has determined that issuing a launch site operator license to OSIDA and approving the transfer of ownership of the CSIA from the City of Clinton, Oklahoma to OSIDA would not affect listed or candidate species or critical habitat. The FAA determined that formal consultation under Section 7 of the Endangered Species Act was not warranted for these activities. The FAA contacted the U.S. Fish and Wildlife Service to request comments and/or concurrence on this determination. In March 2006, the USFWS notified the FAA that they concurred with their determination and no additional consultation was necessary.

4.4.2.1 Impacts from Launch

The flight of Concept X and Z vehicles may generate sonic booms. Concept Y vehicles would not exceed the speed of sound and would not generate sonic booms. Sonic booms have been found to affect both wildlife and domestic animals. (U.S. Air Force, Engineering and Services Center; and U.S. Department of the Interior, Fish and Wildlife Service, 1988) As presented in Section 4.10, Noise, the sonic booms generated by Concept X and Z vehicles would have relatively small overpressures that would have minimal impacts on wildlife and domestic animals. The first sonic booms may initiate a startle response or heighten alertness; however, studies have found that most domestic animals and wildlife tend to become accustomed to the sonic booms fairly quickly. (U.S. Air Force, Engineering and Services Center; and U.S. Department of the Interior, Fish and Wildlife Service, 1988) Because of the small number of annual launches, the relatively small overpressure, and the fact that wildlife and domestic animals tend to become accustomed to sonic booms, the impacts on wildlife and domestic animals would be small.

4.4.2.2 Impacts from Landing

The impacts from landing would be the same as those described in Section 4.4.2.

4.4.3 Alternative 1 – Launching and Landing Concept X and Y Launch Vehicles

The launch and landing of Concept X vehicles would not notably impact biological resources. Concept X vehicles would be jet powered vehicles during takeoff and would land under jet power, which would not represent a change over the current military, commercial, and private aviation activities that occur at CSIA.

The launch and landing of Concept Y vehicles would have the same impacts as those presented under the proposed action.

4.4.4 Alternative 2 – Launching and Landing Concept X and Z Launch Vehicles

The launch and landing of Concept X and Z vehicles would not notably impact biological resources. Concept X and Z vehicles would be jet powered during takeoff and would either glide or land under jet power, which would not represent a change in the current military, commercial, and private aviation activities that occur at the CSIA.

4.4.5 No Action Alternative

Under the no action alternative, there would be no additional impacts on biological resources. Commercial, military, and private aviation activities would continue at CSIA.

4.5 Cultural Resources

4.5.1 Approach to Analysis

The FAA considered the following factors when evaluating the severity of impacts from the proposed action and alternatives to cultural resources:

- Unique characteristics of the geographic area such as proximity to historic or cultural resources;
- The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources; and
- Whether the action threatens a violation of Federal, state, or local law or requirements imposed for cultural resources.

4.5.2 Proposed Action – Launching and Landing Concept X, Y, and Z Launch Vehicles from the CSIA

The FAA reviewed the proposed action in accordance with Section 106 of the National Historic Preservation Act and determined that this project would have no adverse effect on historic properties. No sites that are eligible or that are listed on the National Register of Historic Places exist within the Area of Potential Effect, and the proposed action would not affect the site that may be potentially eligible. The FAA made this determination based on the fact that no cultural resources within the Area of Potential Effect meet the criteria of 36 CFR 800.5(a)(1). The FAA requested the State Historic Preservation Officer’s comments and/or concurrence on the determination that the proposed action would not affect historic properties or other cultural resources. In October 2005 the State Historic Preservation Officer notified the FAA that they concurred with the FAA’s determination.

4.5.2.1 Impacts from Launch

The launches of Concept X, Y, and Z vehicles would not impact cultural resources. No new infrastructure would be constructed and the nearest historic site listed in the National Register is located approximately 13 kilometers (8 miles) northwest of CSIA. (National Register, 2005)

In addition, the launch of Concept X, Y, and Z vehicles would not impact any known cultural resources or traditions of the Cheyenne-Arapaho Tribe, the Chickasaw Nation, the Comanche Tribe, the Kiowa Tribe, or the Wichita Tribe.

4.5.2.2 Impacts from Landing

Landings of Concept X, Y, and Z vehicles would not impact cultural resources. No new infrastructure would be constructed and the nearest historic site listed in the National Register is located approximately 13 kilometers (8 miles) northwest of CSIA. (National Register, 2005) Although the vehicles may operate in the airspace over the historic site, their operation would not impact the site.

In addition, the landing of Concept X, Y, and Z vehicles would not impact any known cultural resources or traditions of the Cheyenne-Arapaho Tribe, the Chickasaw Nation, the Comanche Tribe, the Kiowa Tribe, or the Wichita Tribe.

4.5.3 Alternative 1 – Launching and Landing Concept X and Y Vehicles

The launch and landing of Concept X and Y vehicles would have the same impacts as those presented for the proposed action.

4.5.4 Alternative 2 – Launching and Landing Concept X and Z Vehicles

The launch and landing of Concept X and Z vehicles would have the same impacts as those presented for the proposed action.

4.5.5 No Action Alternative

Under the no action alternative, there would be no additional impacts on cultural resources. Commercial, military, and private aviation activities would continue at CSIA.

4.6 Geology and Soils

4.6.1 Approach to Analysis

Potential impacts to geological resources at the CSIA are addressed below. Operations associated with the proposed action, alternative 1, alternative 2, and the no action alternative were analyzed with regard to their potential for impacts to the geological resources and soils at the CSIA. Impacts on geology and soils were addressed to determine whether the proposed action and alternatives could result in exposure of individuals or structures to potential substantial adverse effects, including structural damage or loss and personal injury or death from strong seismic activity, or could result in substantial erosion of loss of topsoil. Historical environmental investigations of the CSIA from the USACE DERP-FUDS program were analyzed to identify and quantify areas of historical contamination and resource characteristics. Regional geological data and regional soils data were obtained from the U.S. Geological Survey (USGS) and Natural Resources Conservation Service, respectively.

The proposed action does not include any construction activities that would disturb soils. However, operations would involve the use of hazardous materials (e.g., propellants, lubricants, solvents) and generation of wastes. The risk of contamination from these hazardous materials would be properly addressed as outlined in Section 4.7 and therefore would not be expected to exceed the applicable threshold of significance.

4.6.2 Proposed Action – Launching and Landing Concept X, Y, and Z Launch Vehicles from the CSIA

4.6.2.1 Impacts from Launch

Launching vehicles from the CSIA would not affect the subsurface geology of the area, and would not result in exposure of individuals or structures to potential adverse effects from seismic activity, but has the potential to impact surface soils. These impacts would occur from deposition of exhaust emissions from vehicle launches, from deposition of residual propellant during a vehicle crash, from leaks in storage tanks or tanker trucks, or from propellant and jet fuel spills during fueling.

The deposition of exhaust emissions during vehicle launch would not result in substantial contamination, erosion or loss of topsoil. Concept X, Y, and Z vehicle launches would all use propellants that would not result in substantial contamination, erosion or loss of topsoil. Concept X and Z vehicles would use jet engines for takeoff from the CSIA and would not produce any emissions that would adversely impact surface soils. Concept Y vehicles would use liquid propellant rocket engines for launch, which would create a ground cloud with few impacts to soils.

The breakup of any of the concept vehicles during a crash and subsequent recovery activities could directly impact soils. The force associated with falling debris could create impact craters, which, depending on the force of the impact, might impact soils. In addition, any residual propellant in the damaged launch vehicle could be absorbed by soils at the impact site, affecting overall soil quality. Because the probability of a crash would be very low and the cleanup of reportable quantities of hazardous materials released is required under CERCLA, debris or residual propellant would not be expected to result in substantial contamination, erosion or loss of topsoil.

Vehicle launches of any of the three types of launch vehicles would require shipments to the CSIA of rocket propellants, temporary storage of those propellants (only enough material would be shipped to meet immediate launch needs), and transfer to the launch vehicles. There is a potential for leaks or spills during any of these operations, but the limited number of launches and the procedures in place to prevent and clean up spills would limit the likelihood of soil contamination. In addition, vehicle launches of Concept X and Z launch vehicles would require jet fuel storage, transportation of fuels from storage tanks to the launch vehicle, and fueling. During any of these three operations it would be possible for fuel to leak or spill onto the surface soils of the study area. In substantial quantities this would cause the surface soil to become contaminated. However, launch activities at the CSIA would comply with all applicable Federal and state regulations governing fuel storage and waste disposal, which would reduce the likelihood of soil contamination occurring. Therefore, the impacts to soil would not result in substantial contamination, erosion or loss of topsoil.

4.6.2.2 Impacts from Landing

The impacts to surface soils from landing vehicles at CSIA would be limited to emissions deposition and hazardous materials deposition from vehicle accidents. Concept X vehicles and the Concept Z carrier vehicle would land under the power of jet engines and thus some pollutants would be deposited onto surface soils. However, the impacts would be limited due to both the low total number of vehicle launches and the limited potential impact of emissions released from jet engines onto surface soils. Concept Y and Z launch vehicles would have no impact on soils. These vehicles would land unpowered and thus would not emit any materials that would alter surface soils.

The impacts from a crash that occurs during vehicle landing would be the same as those discussed in Section 4.6.2.1, Impacts from Launch.

4.6.3 Alternative 1 - Launching and Landing Concept X and Y Launch Vehicles at the CSIA

Under alternative 1, there would not be any impacts from the launch or landing of Concept X or Y launch vehicles. During launch and landing, Concept X vehicles would use twin turbojet engines which would not produce any emissions that would impact soils. Rocket engines utilizing LOX and kerosene as propellants would be ignited mid-flight and would not be expected produce any emissions that would impact soils. During launch, Concept Y vehicles would use rocket motors fueled by liquid propellant that would not be expected to produce any emissions that would impact soils. During landing, Concept Y vehicles would glide back to the CSIA unpowered and would not produce any potential adverse impacts to soils.

The breakup of any of the concept vehicles during a crash and subsequent recovery activities could directly impact soils. The force associated with falling debris could create impact craters, which, depending on the force of the impact, might impact soils. In addition, any residual propellant in the damaged launch vehicle could be absorbed by soils at the impact site, affecting overall soil quality. Because the probability of a crash would be very low and cleanup of reportable quantities of hazardous materials released is required under CERCLA, debris or residual propellant would not be expected to result in substantial contamination, erosion or loss of topsoil.

4.6.4 Alternative 2 – Launching and Landing Concept X and Z Launch Vehicles at the CSIA

Under alternative 2, there would not be any impacts from launching or landing Concept X or Z launch vehicles. During launch and landing, both Concept X and Z launch vehicles would use twin turbojet engines which would not produce any emissions that would impact soils. Concept X vehicles would use rocket engines with LOX and kerosene as propellants and Concept Z vehicles would use rocket engines with N_2O and HTPB. Both types of engines would be ignited mid-flight and would not be expected to produce any emissions that would impact soils.

The breakup of any of the concept vehicles during a crash and subsequent recovery activities could directly impact soils. The force associated with falling debris could create impact craters, which, depending on the force of the impact, might impact soils. In addition, any residual propellant in the damaged launch vehicle could be absorbed by soils at the impact site, affecting overall soil quality. Because the probability of a crash would be very low and cleanup of reportable quantities of hazardous materials released is required under CERCLA, debris or residual propellant would not be expected to result in substantial contamination, erosion or loss of topsoil.

4.6.5 No Action Alternative

Under the no action alternative, the FAA would not issue a launch site operator license to OSIDA and there would be no launches from the CSIA. The OSIDA would not be able operate a launch facility at the proposed location at the CSIA. The CSIA facility would continue to offer its aviation related activities, and there would be no impact to geology or soils.

4.7 Hazardous Materials and Hazardous Waste Management

4.7.1 Approach to Analysis

Through FAA Order 1050.1 E, the FAA has determined that a proposed action would have significant impacts from hazardous materials and hazardous waste if:

- The action would not meet the applicable local, state, Tribal, or Federal laws and regulations on hazardous waste management, or
- The action would involve property listed or potentially listed on the National Priorities List (NPL) established by the EPA in accordance with Comprehensive Environmental Response, Compensation, and Liability Act [42 U.S.C. 9601-9675].

If the action must involve NPL or otherwise contaminated properties, the FAA allows for mitigating impacts to levels below significance through actions such as siting on “clean” grounds within the boundary of the NPL site, or enacting procedures to minimize contaminant releases and hazardous materials exposure.

4.7.2 Proposed Action – Launching and Landing Concept X, Y, and Z Launch Vehicles at the CSIA

The proposed action involves the use of a location with historic soil and ground water contamination; however, major remediation actions have already been completed by the USACE. These actions accounted for future use of the CSIA and were performed to the extent that worker exposure to historic contaminants at the site would be negligible. Due to the remediation activities that have occurred at the site, there would be no substantial hazardous materials and waste impacts to the environment resulting from historic contamination.

All launch operators proposing to use the CSIA would be responsible for complying with applicable local, state, Tribal, or Federal laws and regulations when conducting operations involving hazardous materials and waste. Certain operations with the potential for hazardous materials and waste impacts to the environment are described in more detail in the following subsections, which discuss the launching and landing of Concept X, Y, and Z launch vehicles at the CSIA.

4.7.2.1 Impacts of Launch

The primary hazardous materials used in support of launch activities at the CSIA would be propellants. Concept X and Y rocket fuels include kerosene, and/or alcohol, which have similar hazardous characteristics to the jet fuels currently used and stored without adverse impact at the CSIA. The main oxidizer used for Concept X and Y vehicles is LOX, a non-toxic cryogenic liquid. The fuel and oxidizer for Concept Z launch vehicles are solid HTPB and liquid nitrous oxide (N_2O), respectively, which are relatively inert.

The CSIA has standard operating procedures in place to minimize the hazard associated with transporting and storing jet fuel and propellants. All propellant shipments would be escorted from the point of entry into the CSIA to the designated staging or storage area. Emergency response personnel would be on standby during these shipments. All liquid fuel and propellants would be shipped to the CSIA in bulk tanker trucks, each with a capacity of approximately 15,142 liters (4,000 gallons), which would also serve as temporary storage containers. The HTPB solid propellant would be manufactured and loaded into Concept Z rocket motors offsite and shipped to the CSIA. The solid propellant is stable and non-reactive until combined with its oxidizer and ignited. No propellants would be stored for extended periods of time; propellant shipments would be brought in to support launches as needed.

Fueling operations would occur at existing onsite fuel staging areas. Temporary dikes would be provided for containment should a spill occur, which would minimize impacts to the environment. The launch operator would be responsible for any necessary cleanup and remediation actions following a spill.

In addition to propellants, it is anticipated that minor amounts of other hazardous materials, such as paint, oils, lubricants, and solvents, would be used. No adverse impacts would be anticipated from these additional hazardous materials. The OSIDA would maintain a current inventory of all hazardous materials being stored and used within the CSIA boundaries by type, quantity, and location. All propellants and other hazardous materials would be handled, stored, and used in compliance with all applicable regulations. Hazardous materials that would be used under the proposed action are similar to materials already handled at the CSIA. The transport, use, or disposal of hazardous materials associated with CSIA operations under the proposed action would not pose a substantial hazard to the public or the environment. The CSIA is not a regulated hazardous waste generator under RCRA, but would comply with all existing and future requirements for the operation of the proposed launch facility. Overall, there would be no significant impacts anticipated from hazardous material use or hazardous waste management which would exceed the threshold of significance described in FAA Order 1050.1E, Appendix A, Section 10.

4.7.2.2 Impacts of Landing

The powered or unpowered landings of Concept X, Y, and Z vehicles under the proposed action would not result in impacts to hazardous materials or hazardous waste management in excess of the applicable threshold of significance. Concept X vehicles would make powered landings at the CSIA using turbojet engines, which is a routine occurrence at the CSIA. The unpowered landings of the Concept Y and Z vehicles would not require use of propellants or other hazardous materials and would not result in substantial impacts.

4.7.3 Alternative 1 - Launching and Landing Concept X and Y Launch Vehicles at the CSIA

Under alternative 1, the launching and landing of Concept Z vehicles would not occur and liquid N_2O and HTPB would not be handled, used or stored at the CSIA. The impacts from hazardous materials and hazardous waste management would be slightly less than that of the proposed action due to the reduced number of propellants that would be required for operations. All other impacts would be the same.

4.7.4 Alternative 2 – Launching and Landing Concept X and Z Launch Vehicles at the CSIA

Under alternative 2, the launching and landing of Concept Y vehicles would not occur, resulting in less use of kerosene and/or alcohol and LOX at the CSIA. The impacts from hazardous materials and hazardous waste management would be slightly less than that of the proposed action due to the reduced amount of propellants that would be required for operations. All other impacts would be the same.

4.7.5 No Action Alternative

Under the no action alternative, the FAA would not issue a launch site operator license to OSIDA, and there would be no launches from the CSIA. The OSIDA would not be able operate a launch facility at the proposed location at the CSIA. The CSIA facility would continue to offer its aviation related activities, and there would be no impact associated with hazardous materials and waste.

4.8 Health and Safety

4.8.1 Approach to Analysis

Public safety impacts of OSIDA's activities at the CSIA are assessed to determine if onsite workers or members of the general public are substantially endangered as a result of these activities. A hazard analysis is a necessary part of the Mission and Safety Review for the FAA licensing determination to assess the possible hazards associated with proposed launch and landing operations. Launches of Concept X, Y, and Z vehicles from the CSIA would require launch-specific licenses or permits from the FAA and each launch applicant would be required to conduct a risk analysis. Potential launch operators would estimate the casualty expectation associated with their proposed flight corridors or impact dispersion areas (if in a populated area) for all flights. The estimated casualty expectation cannot exceed 0.00003 (30×10^{-6}) to receive a launch license. The FAA is in the process of developing a regulation to address Experimental Permits, and permit applicants would be required to meet the safety standards established by the FAA. Because this will be addressed in the Mission and Safety Review it is not discussed in detail in this EA. However, analyses of the safety and health implications of launch-related operations and activities that have the potential for environmental impact are considered in this EA.

4.8.2 Proposed Action – Launching and Landing Concept X, Y, and Z Launch Vehicles at the CSIA

The proposed action could have impacts on the safety and health of onsite workers at the CSIA and the general public. The following sections describe the impacts from the various activities associated with the proposed action.

Proper compliance with the applicable laws and regulations related to the launch and landing activities outlined in Sections 4.1.2.1 and 4.1.2.2 would minimize the potential for health and safety impacts related to the proposed action. The OSIDA would implement an integrated program to manage safety and environmental protection objectives for operation of a commercial launch and landing site. This would include implementation of safety plans as necessary to protect workers during potentially hazardous activities. This would be accomplished through land use planning, range clearing (airspace closures, road closures, public evacuations), and public notifications during launch and landing.

The proposed action would not impede or adversely affect the existing contamination or clean up activities at the CSIA. All areas of contamination have been studied in the USACE work on the DERP-FUDS, and numerous maps and reports have been generated that provide the nature and extent of past contamination at the CSIA.

4.8.2.1 Impacts of Launch

Launching vehicles from the CSIA would require a number of activities that would have potential impacts on health and safety including the management of propellants and fuels required for launches of Concept X, Y, and Z vehicles. Management activities include the transport, handling, storage and potential disposal of propellants and fuels. Potential accidents during any of these activities could present impacts to health and safety including increased traffic accidents due to increased transportation activity on and off the site; occupational mechanical accidents; and exposure to propellants during transport, while being stored at the CSIA, or while being handled during fueling. There are also implications for human health and safety in the operation of all three of the launch vehicle concepts.

Propellant Management

Storing, transporting, handling, and loading propellants can lead to fire and explosion hazards. Concept X launch vehicles would use Jet-A aviation fuel to fuel their turbojet engines and a combination of LOX and kerosene RP-1 or alcohol to power their rocket engines. Concept Y launch vehicles would use a combination of LOX and kerosene, or alcohol to power their rocket engines. Concept Z launch vehicles would use Jet-A aviation fuel to power the carrier aircraft's turbojet engines and a combination of nitrous oxide and HTPB to power the launch vehicle's hybrid rocket motor.

Management of these hazardous propellants would be the responsibility of each individual launch operator. OSIDA would develop a tracking system that would handle the purchase, transport, and temporary storage of the propellants. Spills of hazardous materials would be covered by a Hazardous Materials Response Plan, which ensures that adequate and appropriate guidance, policies, and protocols regarding hazardous material incidents and associated emergency response would be available to all CSIA personnel.

All individuals or organizations at the CSIA would be responsible for complying with all applicable regulations and plans regarding hazardous waste, and applicable regulations regarding the temporary accumulation of waste at the site.

The hazards associated with each of these propellants and fuels are discussed below.

Jet-A Aviation Fuel and Kerosene

Jet-A aviation fuel and kerosene are liquid hydrocarbon fuels that are flammable and can explode if mixed with air and then ignited in a confined space. Jet-A and kerosene can also react explosively if combined with oxidizers. Toxic products can be emitted from the burning Jet-A and kerosene. Unburned vapors can irritate skin, can be moderately toxic if inhaled, and can cause severe hazards if ingested. (Canadian Centre for Occupational Health and Safety, 2006a) Approximately 37,854 liters (10,000 gallons) of jet engine fuel are stored onsite in above ground storage tanks.

The proposed Concept X and Z operations would not necessitate changes to the existing safety and health and spill prevention/response practices for Jet-A and kerosene at the CSIA. The CSIA does not have an official Spill Prevention, Control and Countermeasures (SPCC) plan; however, all appropriate state and Federal guidelines would be followed. The CSIA fire department has first response capabilities should a spill occur and the Oklahoma Department of Environmental Quality (DEQ) maintains an office onsite to facilitate follow-up response activities. In issuing specific launch licenses, the FAA would evaluate any additional safety procedures or requirements.

There would be some vapors released from fuel storage or transfer operations through evaporative losses. However, such vapors would be released in small quantities and dissipate in the air after being released. There is also the concern of spills of Jet-A and kerosene during handling and loading operations and subsequent fire or explosion. However, Jet-A fuel and kerosene have been used at the CSIA to support aircraft operations and practices and procedures for safely handling the quantities of Jet-A fuel and kerosene needed for launch operations have been established.

Liquid Oxygen

Rocket grade LOX is a light-blue transparent liquid that can be used as an oxidizer. It is stored as a cryogenic liquid (i.e., it is stored at extremely low temperatures). The LOX will not burn by itself, but will vigorously support combustion when in contact with combustible materials. When LOX is stored in a closed system and refrigeration is not maintained, vessel rupture may occur due to over-pressurization. (Canadian Centre for Occupational Health and Safety, 1997) The LOX would be stored in specially-designed tanker trucks that would meet all applicable health and safety requirements and would only be onsite temporarily. Although LOX would not pose toxic risks, it would require special handling precautions. Workers must be equipped with protective equipment designed to prevent contact with the eyes or skin, and vapors must be kept away from sources of ignition and flammable materials. The LOX also would be used at the CSIA during static rocket engine tests. All appropriate safety and handling procedures would be followed.

Nitrous Oxide (N_2O)

N_2O is a colorless, nonflammable, nontoxic gas that is chemically stable at room temperature. At elevated temperatures, it decomposes into nitrogen and oxygen and becomes a strong oxidizing agent to support combustion. It is stored and shipped as a liquefied compressed gas at atmospheric temperature (21°C [70°F]) or as a refrigerated liquid. Although non-toxic, N_2O poses danger as an asphyxiant. It can also be explosive if it comes in contact with combustible materials or if the storage cylinders are exposed to external heating. (Canadian Centre for Occupational Health and Safety, 2006b)

For Concept Z vehicle operations, N_2O would be delivered via refrigerated tanker truck to the CSIA and would be stored onsite only temporarily in the tanker trucks. Transfer of N_2O from the refrigerated tanker to the launch vehicle is potentially hazardous and could result in the release of N_2O. All the N_2O tanks would be designed to comply with applicable codes (including that of the American Society of Mechanical Engineers). The N_2O tank on Concept Z launch vehicles would be filled and vented through the tank's forward bulkhead to keep vapor away from the hot side of the tank.

Hydroxyl-terminated Polybutadiene (HTPB)

HTPB is a hydrocarbon used as the fuel (with an oxidizer such as N_2O) in a hybrid rocket motor as used in Concept Z launch vehicles. If ignited, the HTPB will continue to burn in the presence of an oxidizer. Accidental fires and explosions are possible if proper handling precautions (e.g., proper securing of ignition sources) are not taken when both the HTPB and oxidizer are loaded on the vehicle. The HTPB would be loaded in motor casings at an offsite location and would be transported in accordance with all applicable health and safety requirements. Therefore, potential impacts to health and safety would be minimized.

Traffic Accidents

The increased road traffic that would result from launches and landings of Concept X, Y, and Z vehicles would only add a few cars/trucks above existing traffic loads. There would be an increase in the trucks delivering kerosene, LOX, and N_2O to the CSIA particularly during peak launch years. However, given the small number of launches, this would likely represent only a small increase in material shipments to the CSIA. The increase in the number of shipments of hazardous materials should not materially increase the number of traffic accidents on the roadways around the CSIA.

All transport of hazardous materials would be in DOT approved packages and containers. The shipments would meet the DOT requirements including packaging design, marking, labeling, and placarding for shipment over public roadways. All hazardous materials transport would meet DOT Hazardous Materials Regulations, 49 CFR Parts 171, 172, 173, 174, 175, 176, and 177. These DOT requirements are intended to minimize potential releases, fires, and explosions.

Occupational Mechanical Accidents

Onsite work associated with the conduct of Concept X, Y, and Z launches would be similar to that associated with industrial chemical operations. Exposure impacts and mitigation of propellant/fuel hazards were discussed above. All operations at the CSIA would comply with Occupational Health and Safety Act (OSHA) standards. Exposure to mechanical accidents would not differ materially from current levels for the CSIA because the number of operations associated with the conduct of Concept X, Y, and Z launch operations would be relatively small given the number of operations CSIA-wide.

Flight/Airspace and Emergency Landing Operations

A detailed flight hazard analysis will be conducted as part of a Mission and Safety Review by the FAA before a determination is made on whether to issue a license. The potential hazards of flight/airspace and emergency landing operations include limited airspace availability, limited airport operations, and flight safety.

Emergency Landing Facilities

In the unlikely event of an emergency landing, the PIC would attempt to reach the closest potential abort site. There are numerous potential emergency landing sites along the northwest and southwest flight corridors. Potential abort sites for trajectories along the northwest corridor could include existing airports in Oklahoma and Texas such as

- Elk City, Oklahoma,
- West Woodward, Oklahoma,
- Gage, Oklahoma,
- Higgins, Texas,
- Follett, Texas,
- Canadian, Texas,
- Perryton, Texas,
- Liberal, Texas, and
- Miami, Texas.

Potential abort sites for trajectories along the southwest corridor could include existing airports in Oklahoma and Texas such as

- Elk City, Oklahoma,
- Sayre, Oklahoma,
- Mangum, Oklahoma,
- Wellington, Texas, and
- Clarendon, Texas.

However, any airport within range with a runway of at least 1,219 meters (4,000 feet) would be a candidate for an emergency landing location.

Limited Airspace Availability

Changes in airspace use can impact flight safety or limit airspace availability to other users. The FAA is charged with overall management of airspace and has established criteria and limits for use of various sectors of airspace. Section 4.3 of this document considers the potential impacts to airspace.

Flight Safety

Multiple safety precautions would be used during flights to assure safety. Safety standards for each launch vehicle would be developed as part of the FAA's required Mission and Safety Review process. All safety standards would ensure that the expected average number of casualties from falling debris generated during a worst-case scenario accident does not exceed 0.00003 (30×10^{-6}). All three vehicle concepts would have the ability to vent potentially harmful propellants in an emergency. This would minimize the risk to the pilot, crew, and surrounding public. Concept X vehicles would vent LOX through the engine nozzle during nominal and non-nominal launches. Should there be a need to vent LOX while in flight, this would most likely occur at a minimum altitude of 1,067 meters (3,500 feet). Should the need arise to vent LOX while on the ground, approximately 100 percent of the LOX would be vented through the engine nozzle at a designated point on the concrete parking ramp. There is a specific area on the extreme southernmost point of the 38-hectare (93-acre) concrete ramp designated for LOX venting if it should be required for any reason.

For Concept Y vehicles, an FSS has been developed to limit safety risks. The pilot would be responsible for activating the FSS. It would allow the pilot to turn off the engine or close propellant pre-valves, as well as vent or dump LOX in an emergency. For Concept Z vehicles, the pilot would be responsible for flight safety decisions. The pilot would be responsible for shutting down the rocket motor in an emergency. The vehicle propulsion system would contain an internal automatic shutdown mode should critical system operating parameters be exceeded. The pilot would also be responsible for venting any excess N_2O that remains in the tank during descent. This would ensure that the N_2O and residual HTPB would not mix, minimizing the likelihood of an explosion.

Catastrophic Accident Scenarios

The risk of catastrophic accidents will be discussed in detail in the Accident Investigation Plan as part of the FAA's Safety Review and Approval process. All launch vehicles would be subject to a launch evaluation to evaluate the risks of launch from the CSIA. This evaluation would analyze the consequences of failure (and corresponding probability of occurrence); the vehicle trajectory under failure modes; the vehicle casualty area and casualty expectations (given the population areas along the flight path and trajectory); and launch hazards. Generally speaking, launch hazards can be divided into meteorological hazards and system failures. Meteorological hazards consist of lightning, wind and other hazards that must be considered before launch. System failures consist of a breakdown in the flight systems on board the launch vehicle and can broadly include propulsion and guidance failures. Propulsion failures occur when the vehicle experiences a loss of thrust or a catastrophic failure of the propulsion system. Guidance failures occur when a loss of control of the vehicle occurs. For launch vehicles under the proposed action, guidance failures would be limited because all the vehicles are pilot controlled and would be flown more like airplanes than guided rockets. Any system failure could lead to a catastrophic accident during vehicle launch, ascent or descent. An overview of the accident risks associated with launching each vehicle type is discussed below.

For Concept X launch vehicles, the likelihood of a catastrophic accident would be minimal. During vehicle launch, the aircraft would take off under the power of jet engines and the probability of failure would be considered no greater than a normal plane taking off. There is an elevated likelihood of accident when the launch vehicle switches from jet engines to the rocket engine. If the rocket engine fails to ignite, the vehicle would return to jet engines and abort the flight. In the event of a catastrophic failure (e.g., an explosion), the overall risk to human health and safety would be minimized because the switch to rocket power would be at altitude and any debris would be dispersed in the atmosphere.

For Concept Y launch vehicles, there is an elevated hazard area for catastrophic accidents at the end of the runway if there is a failure of the vehicle during the rocket-powered takeoff. The vehicle may not have enough energy to make an emergency landing and therefore, the vehicle may crash off the runway. Such an accident could cause a rupture of the propellant tanks, which could result in explosion and fire. There would likely be substantial damage and heat in the immediate vicinity of the crash. There are no known populated areas in the vicinity of the takeoff area and no impacts would be expected to populated areas from an explosion. However, it would be expected that the crew could be seriously injured or killed. Emissions from the open burn of LOX and kerosene would produce similar products to those of a launch engine burn including CO, CO_2, and water (H_2O). There may be more PM (unburned hydrocarbons) forming a smoke cloud from an accident burn. None of the combustion products are considered highly toxic. Onsite and offsite emergency response capabilities would be used as necessary.

For Concept Z launch vehicles during nominal flight, there is an elevated probability of accident due to the coupling of the launch vehicle with the carrier aircraft. If the launch vehicle fails to function as intended soon after separation from the carrier aircraft, the launch vehicle would attempt a steep descent, dump its N_2O, and land at an abort site. In terms of impact, for a nominal trajectory, the ground track would be limited in terms of flight over populated areas. In a catastrophic accident, it would be likely that the crew would be seriously injured or killed. At the CSIA, the onsite fire department could respond and secure the site. It is expected that any fires resulting from a failed launch could be addressed by the fire department. Additional offsite emergency response capability could also be used if necessary.

4.8.2.2 Impacts of Landing

The hazards of landing vehicles at the CSIA would not include any additional impacts not previously discussed in the Impacts of Launch section. The main impact to human health and safety would be from a catastrophic accident. The probability of a catastrophic accident is the same as discussed in Section 4.8.2.1, Impacts of Launch; however, the potential areas on the ground that would be impacted by an accident are different based upon the projected flight paths of a vehicle returning to the CSIA along the northwest or southwest corridors.

4.8.3 Alternative 1 - Launching and Landing Concept X and Y Launch Vehicles at the CSIA

Under alternative 1, there would be minimal impacts from launching or landing Concept X or Y launch vehicles. The risks to human health and safety would be minimized through launch safety planning. All safety standards would ensure that the expected average number of casualties from falling debris generated during a worst-case scenario accident does not exceed 0.00003 (30×10^{-6}). Both vehicle types would have the ability to vent propellants in an emergency to minimize the risk to flight crews, on the ground personnel, and the general public.

Concept X vehicles would vent LOX through the engine nozzle during nominal and non-nominal launches. Should there be a need to vent LOX while in flight, it would most likely occur at a minimum altitude of 1,067 meters (3,500 feet). In the event of a need to vent LOX while on the ground, approximately 100 percent of the LOX would be vented through the engine nozzle at a designated point on the concrete parking ramp. There is a specific area on the extreme southernmost point of the 38-hectare (93-acre) concrete ramp designated for LOX venting if it should be required for any reason.

For Concept Y vehicles, an FSS has been developed to limit health and safety risks. The pilot would be responsible for activating the FSS. It would allow the pilot to turn off the engine or close propellant pre-valves, as well as vent or dump LOX in an emergency.

4.8.4 Alternative 2 – Launching and Landing Concept X and Z Launch Vehicles at the CSIA

Under alternative 2, there would be minimal impacts for the launch or landing of Concept X and Z launch vehicles. The risks to human health and safety would be minimized through launch safety planning. All safety standards would ensure that the expected average number of casualties from falling debris generated during a worst-case scenario accident does not exceed 0.00003 (30×10^{-6}). Both vehicle types would have the ability to vent propellants in the case of an emergency to minimize the risk to flight crews, on the ground personnel, and the general public.

Concept X vehicles would have the means to vent LOX through the engine nozzle during nominal and non-nominal launches. Should there be a need to vent LOX while in flight, it would most likely occur at a minimum altitude of 1,067 meters (3,500 feet). In the event of a need to vent LOX while on the ground, approximately 100 percent of the LOX would be vented through the engine nozzle at a designated point on the concrete parking ramp. There is a specific area on the extreme southernmost point of the 38-hectare (93-acre) concrete ramp designated for LOX venting if it should be required for any reason.

For Concept Z vehicles, the pilot would be responsible for flight safety decisions. The pilot would be responsible for shutting down rocket motor burns in an emergency. The vehicle propulsion system would contain an internal automatic shutdown mode should system critical operating parameters be exceeded. The pilot would also be responsible for venting any excess N_2O that remains in the tank during descent. This would ensure that the N_2O and remaining HTPB would not mix, minimizing the likelihood of a fire or explosion.

4.8.5 No Action Alternative

Under the no action alternative, the FAA would not issue a launch site operator license to OSIDA, and there would be no launches from the CSIA. The OSIDA would not be able to operate a launch facility at the proposed location at the CSIA. The CSIA facility would continue to offer its aviation related activities, and there would be no impact to health and safety from launches.

4.9 Land Use

4.9.1 Approach to Analysis

FAA Order 1050.1E requires assessment of land use impacts in terms of compatible land use and noise-sensitive areas. The compatibility of existing and planned land uses in the vicinity of an airport is usually associated with the extent of the airport's noise impacts. Actions which result in a change in the number of aircraft operations, air traffic changes, or new approaches are examples of activities that can alter aviation-related noise impacts and affect land uses subjected to those impacts. Generally, if the noise analysis concludes that there are no changes in noise exposure which exceed the applicable thresholds of significance, a similar conclusion usually may be drawn with respect to compatible land use. Individual, isolated, residential structures, like those surrounding the CSIA, may be considered compatible within the 65 DNL 65 dB noise contour where the primary use of land is agricultural and adequate noise attenuation is provided. For this analysis, land use impacts are discussed within the ROI, which includes the Spaceport Territory as defined in Section 3.9.3.1 and encompassing the CSIA, the town of Burns Flat, and other parts of Washita County. As shown in Exhibit 3-14, the ROI covers a much larger area than the DNL 65 dB noise contour. Section 4.10 contains a more detailed discussion of the noise impacts. Land use impacts are described in terms of the launch and landing activities associated with the proposed action and alternatives.

Land use impacts also are analyzed in terms of unique and sensitive properties protected under Section 4(f) of the DOT Act (recodified as 49 U.S.C. 303). The FAA's Part 150 guidelines require this consideration, and FAA Order 1050.1E states that a significant impact to Section 4(f) property exists if the proposed action either involves more than a minimal physical use of a Section 4(f) property or is deemed a "constructive use" substantially impairing the 4(f) property, and mitigation measures do not eliminate or reduce the effects of the use below the threshold of significance (e.g., by replacement of a neighborhood park).

4.9.2 Proposed Action – Launching and Landing Concept X, Y, and Z Launch Vehicles at the CSIA

Operation of a commercial launch site would not adversely impact the land use of the ROI. The existing land use of the ROI, as described in Section 3.9, is compatible with the proposed action. No major changes to land use would need to occur to accommodate the proposed action, and OSIDA does not currently have plans to alter the existing land use for the Spaceport Territory. Although OSIDA has been granted municipal authority over the Territory, an Advisory Council also would be involved in future decision-making regarding land use. The Advisory Council, consisting of elected officials of towns within the Spaceport Territory, would make recommendations to OSIDA regarding land use and development, municipal annexation, zoning, construction, safety regulations, and other matters that may be relevant to land use and development. This input from elected officials would ensure that future land use would be amenable to those living within the ROI.

OSIDA does not anticipate the need for new structures under the proposed action because several vacant facilities could be used for the proposed activities. Many of the available facilities are in good condition and could be remodeled or renovated for a variety of uses. Due to the large amount of available space, OSIDA does not plan to construct any new facilities within the next five years. However, should existing facilities not meet the needs of a potential client, a specialized facility may need to be constructed. This type of activity would be analyzed in separate environmental analyses as appropriate.

The proposed action for this EA has the potential to impact current and undefined future USAF operations at the CSIA. The USAF considered the CSIA as a site for an Assault Landing Zone for Altus AFB, which is located approximately 88 kilometers (55 miles) from the CSIA. This action was evaluated in an EA for the C-17 Program Changes at Altus AFB. The EA analyzed several possible actions, including the possible construction of an Assault Landing Zone at the CSIA. The EA resulted in a FONSI, signed on August 19, 2004, indicating that the USAF would not pursue the alternative that would entail building a new Assault Landing Zone. However, the need still exists for a new Assault Landing Zone, and the USAF continues to consider potential sites, including the CSIA. Regardless of what the Air Force decides to do in the future, the proposed action would not materially affect any decisions related to a new Assault Landing Zone.

The proposed action does not require any physical or constructive use that would impair any Section 4(f) properties. Because the activities associated with the proposed action are not expected to use or impair any Section 4(f) properties, there would be no impacts to Section 4(f) lands. The nearest known potential Section 4(f) property is the Washita National Wildlife Refuge, located on Foss Lake 19 kilometers (12 miles) to the north of the CSIA. Any impacts to the refuge would be minor and should not substantially impair the resource.

4.9.2.1 Impact of Launches

The surrounding agricultural lands to the north, west, and south of the CSIA would continue to provide a relatively open, low-density buffer for launch activities. However, the authorities granted to OSIDA by the State of Oklahoma include the ability to temporarily evacuate residents within the Spaceport Territory if launch or landing operations warrant such an action. OSIDA does not anticipate evacuations under the current plans for the CSIA; however, this right would be exercised if necessary to protect public health and safety. Although recurring evacuations are unlikely, if they occur, it could discourage commercial and residential development within the Spaceport Territory.

New infrastructure would not be needed to support the launches of the Concept X, Y, and Z vehicles. The existing infrastructure is capable of supporting all launch activities.

Noise from the launches should not result in a change in noise exposure in excess of the applicable threshold of significance within the DNL 65 dB contour (see Section 4.10). Most of this land is either part of the CSIA or agricultural land. Any residential or commercial land use is sparse.

4.9.2.2 Impact of Landing

The impacts of landing are similar to those of launches, as discussed above in Section 4.9.2.1.

4.9.3 Alternative 1 - Launching and Landing Concept X and Y Launch Vehicles at the CSIA

The impacts of alternative 1 are similar those under the proposed action. Using only Concept X and Y launch vehicles should not result in any different impacts to land use.

4.9.4 Alternative 2 – Launching and Landing Concept X and Z Launch Vehicles at the CSIA

The impacts of alternative 2 are similar those under the proposed action. Using only Concept X and Z launch vehicles should not result in any different impacts to land use.

4.9.5 No Action Alternative

Under the no action alternative, the FAA would not issue a launch site operator license to OSIDA and there would be no launches from the CSIA. The CSIA facility would continue to offer its aviation related activities, and there would be no different impact to land use.

4.10 Noise

4.10.1 Approach to Analysis

This analysis addresses potential noise impacts that might occur as a result of launching and landing Concept X, Y, and Z vehicles and the sonic booms associated with the supersonic flight of Concept X and Z vehicles. Sonic boom noise impacts are assessed with respect to the potential for causing structural damage, hearing damage, and annoyance.

4.10.1.1 Jet Engine Noise

Jet engine noise associated with military aircraft currently exists at the CSIA. As discussed in Section 4.1.2, approximately 41,300 of the 47,200 total operations conducted at the CSIA during fiscal year 2003 were military operations. Instantaneous sound pressure levels have been calculated between 86 to 122 dB at discrete receptors within the DNL 65 dB contour at the CSIA. (Department of the Air Force, 2002) Sound pressure levels from jet engines associated with launch vehicles (Concept X and Z) would be similar to this range. Jet engine noise is analyzed in this document for Concept X and Z vehicles.

4.10.1.2 Rocket Engine Noise

For this analysis, rocket engine noise was assumed to begin at one of two times. Concept X and Z vehicles are lifted to altitude using jet engines before rocket engines are ignited; therefore, rocket engine noise for these two types of vehicles begins when the vehicle is already at a considerable height above the ground. Concept Y vehicles ignite rocket engines on the ground;

therefore, the rocket engine noise associated with this type of vehicle begins while the vehicle is still on the ground. Rocket engine noise is analyzed for all vehicle concepts.

4.10.1.3 Sonic booms

When an object travels through the atmosphere faster than the speed of sound (Mach 1) a sonic boom is generated. The sonic boom is generated as the object pushes aside air molecules with great force and subsequently forms a shockwave. This shockwave propagates away from the object, and depending on various factors including the shape and trajectory of the vehicle and meteorological conditions, it can propagate and impinge on the Earth. Since sonic booms can occur during ascent and descent, the location of the sonic boom footprints on the ground would vary depending on the exact location of the vehicle relative to the ground at Mach 1 or greater. In the event that the sonic boom impinges on an observer, the observer would hear a noise comparable to a single or two closely-spaced cannon shots.

Sonic booms are typically quantified in pounds per square foot (psf) of peak overpressure. Overpressure refers to the pressure caused by the sonic boom above air pressure at ground level. Another important aspect of sonic booms is their rise time (10 to 90 percent of the peak), which is the time it takes for the sonic boom to reach its peak overpressure.

Peak overpressures for sonic booms from launch vehicles from Vandenberg AFB have been measured and ranged from approximately one to two psf (128 to 134 dB). Similar levels have been measured for sonic booms from the Space Shuttle approaching Edwards AFB. Higher peak overpressures have been measured from low altitude flights and focused sonic booms created by certain aircraft maneuvers. A nine psf sonic boom was measured for the Titan IV from Vandenberg AFB, and low altitude supersonic aircraft have generated sonic booms with peak overpressures ranging between 20 and 144 psf. None of the activities proposed for the CSIA would result in sonic booms of this magnitude. No low altitude supersonic flights are anticipated as a result of the proposed action or alternatives. Sonic booms associated with launch activities would occur at high altitudes where sonic boom noise would dissipate substantially because of distance attenuation, i.e., because of the large distance between the noise source and the observer on the ground. Further, the proposed launch vehicles are much smaller than those cited in the previous examples and sonic booms generally decrease in magnitude for smaller vehicles.

For this analysis, because only Concept X and Z vehicles reach supersonic speeds, only these two vehicle concepts have the potential to produce sonic booms. Therefore, this analysis considers the impacts from the production of sonic booms from Concept X and Z vehicles.

Structural Damage

A sonic boom can cause building damage, in terms of glass breakage and other effects, if the magnitude is great enough. However, in most cases, the potential for sonic booms to damage structures is extremely small. At one psf, the probability of a window breaking ranges from one in a billion (Sutherland, 1990) to one in a million (Hershey, 1976) depending on the composition of the glass. At 10 psf, the probability of breakage ranges from one in a hundred to one in a thousand. (Haber, 1989)

Hearing Damage

Tests conducted in 1968 at Tonapah, Nevada showed that sonic booms with overpressures from 50 to 144 psf did not create hearing loss to the exposed people. Tests on subjects exposed to simulated air bag noise at peak levels as high as 80 psf showed that temporary changes in hearing were mainly caused by high-frequency noise, not the low frequencies found in sonic booms. (Sommer, 1973)

Annoyance

Lower magnitude sonic booms may not cause damage, but can be annoying and can be evaluated by established human annoyance criteria. The DNL is the noise metric used by most Federal and state agencies to assess noise impacts and has been found to be the best noise metric for predicting human annoyance. DNL is a function of the number of noise events per day and is typically calculated on a annual average basis. For impulsive sounds such as sonic booms, it has been found that impact correlates well with C-weighted DNL (CDNL). C-weighting emphasizes low-frequency sound and excludes sound energy below 25 Hertz and above 10,000 Hertz. Exhibit 4-12 shows the relation between noise level metrics DNL, CDNL, and annoyance. (Finegold, 1994) (National Research Council, National Academy of Sciences, 1981)

Exhibit 4-12. Relation between Noise Level Metrics DNL, CDNL, and Annoyance

DNL (dBA)	CDNL (dBC)	Average Percent Population Highly Annoyed
55	52	3.3
60	57	6.5
65	61	12.3
70	65	22.1
75	69	36.5

The EPA has established an annual average DNL of 55 dB as a level that protects public health and welfare with an adequate margin of safety. (EPA, 1974) However, the FAA, as well as many other agencies, uses 65 DNL as the dividing line between acceptable and unacceptable noise levels. Therefore, 61 CDNL would be the appropriate threshold for evaluating sonic boom impact.

4.10.2 Proposed Action – Launching and Landing Concept X, Y, and Z Launch Vehicles at the CSIA

Noise produced by launches and landings at the CSIA would consist primarily of jet engine or rocket noise during the subsonic takeoff, flight, and landing; launch noise during the rocket-propelled flight of the launch vehicle; and sonic booms generated from the supersonic flight of the launch vehicle during the ascent and descent.

4.10.2.1 Impacts from Launch

Jet Engine Noise – Concept X and Z

The noise generated from the jet engines used for takeoffs and landings of Concept X and Z vehicles is similar to the noise produced by similar sized commercial or military aircraft during take-off. Currently C-5, T-1, T-37, T-38, C-130, KC-135R, F-18, and helicopter flights occur on a regular basis at the CSIA. With a maximum of 52 launches per year of Concept X and Z vehicles, the noise impacts of the jet engines from these vehicles would be minimal compared to the approximately 47,200 flight operations per year currently occurring at the CSIA. Unless the frequency of launch operations approached several thousand per year, the current noise contours at the CSIA would not change substantially.

The loudest noise for jet aircraft would consist of the carrier aircraft used for transporting Concept Z vehicles to the appropriate altitude for launch. These types of aircraft could produce noise similar to the USAF T-38, which currently takes off from the CSIA.

The area around the CSIA has been exposed to aviation noise for over 50 years as a result of the operations at the airport. The additional noise sources from proposed horizontal launches would be similar to noise generated by large military aircraft currently using the CSIA. The jet engines used would be commercially available models, and would not require any modifications that would substantially increase their noise output. As long as launch frequency is limited to a maximum of 52 launches per year of Concept X and Z vehicles, the noise generated by their jet engines would not be different enough from current noise sources to result in noise exposure in excess of applicable thresholds of significance.

Rocket Engine Noise – Concept X and Z

Concept X and Z vehicles may ignite rocket engines at altitudes as low as 6,100 meters (20,000 feet). At this altitude, using a simple rocket engine noise model and assuming 267,000 Newtons (60,000 pounds) of thrust, noise levels reaching the ground would range from 85 to 95 dB (un-weighted). A-weighted sound pressure levels are expected to be approximately 20 to 25 dB less than the un-weighted levels as rocket launch noise is primarily low frequency noise (below approximately 200 Hertz, which is attenuated by applying A-weighting). For this example, A-weighted sound pressure levels would range from 65 to 75 dBA. These instantaneous sound pressure levels are lower than those caused by military aircraft activity. As the vehicle rocket engines ignite and the vehicle climbs in altitude, noise levels reaching the ground would become quieter as the distance from the vehicle to the ground increases. The rocket engines would fire for approximately 175 to 180 seconds; however, the rocket launch noise may not be audible for that entire time because the increasing distance between the rocket and observers would diminish the launch noise.

Rocket Engine Noise – Concept Y

Concept Y vehicles would have rocket ignition at takeoff and a glide landing. These vehicles would use a LOX/kerosene rocket engine, with a thrust of 8,200 Newtons (1,800 pounds).

Concept Y vehicles would take off using their rocket engines for all their propulsion needs. At a distance of 305 meters (1,000 feet) from the vehicle as it takes off, noise levels would range from 76 to 86 dBA. While the character of the rocket engine noise would be different from existing military jet engine noise, the noise levels would be similar. Concept Y vehicles would be relatively small, and therefore the thrust and resulting noise levels would be lower than those generated by a larger rocket engine.

As the rocket engines ignite and the vehicle climbs in altitude, noise levels reaching the ground would decrease as the distance from the vehicle to the ground increases. Due to the unsubstantial noise levels at the ground level, the short duration of noise exposure and infrequent occurrence, the noise of the Concept Y vehicle and its rocket engine would not be expected to result in a change in noise exposure in excess of applicable thresholds of significance.

Sonic Booms – Concept X and Z Vehicles

Suborbital trajectories for Concept X and Z vehicles were analyzed using NASA sonic boom prediction methods (Carlson, 1978) to determine the peak amplitude of the sonic booms generated for Concept X and Z vehicles utilizing the CSIA and the surrounding airspace. These trajectories included two corridors from the CSIA, in the northwest and southwest directions. The shape and geometry of Concept X and Z vehicles are considerably different as well as the altitudes at which sonic booms would occur, so the sonic boom signatures would be different for each vehicle.

The Concept X vehicle would reach Mach 1 at 9,144 meters (30,000 feet), at which point a sonic boom would occur. The vehicle's velocity would continue to increase, and then decrease near the apogee of the trajectory. Near the apogee at 99,670 meters (327,000 feet), the vehicle would slow to a velocity less than Mach 1, and then increase in velocity during descent to exceed Mach 1. At such high altitudes a sonic boom would occur, but the atmosphere is rarefied at this altitude so there would be no substantial shock wave formed. Substantial distance attenuation would also occur at this high altitude. The vehicle would produce a sonic boom until it slowed below Mach 1, at approximately 16,459 meters (54,000) feet. This sonic boom would have a lower magnitude than the one generated during ascent because of greater distance attenuation.

The Concept Z vehicle would exceed Mach 1 at 15,545 meters (51,000 feet), continue to increase in velocity until engine shutdown, and then slow to less than Mach 1 at 97,231 meters (319,000 feet). During descent, it would then exceed Mach 1 again at 97,231 meters (319,000 feet) with no appreciable sonic boom. The vehicle's velocity would decrease to below Mach 1 at 23,774 meters (78,000 feet). Consequently, the highest magnitude sonic boom would be generated during ascent, at 15,545 meters (51,000 feet).

The sonic boom predictions were determined from modeling performed for the northwest and southwest corridors. The sonic booms' footprint size and location, and signature (waveform shape) including peak overpressures and rise times, are dependent on many factors including vehicle trajectory, maneuvering occurring during supersonic flight, and meteorological conditions during the flight.

Exhibit 4-13 shows estimated sonic boom peak overpressure and resulting CDNL, assuming 52 launches per year for Concept X and Z vehicles. These sonic booms would occur within the northwest and southwest corridors.

Exhibit 4-13. Estimated Sonic Boom Peak Overpressure and CDNL

Vehicle	Peak Overpressure (psf)	CDNL (dBC)
Concept X	1.1 to 1.9	45 to 49
Concept Z	0.5 to 0.7	38 to 41

Because these CDNL values are lower than 61 CDNL, there would be no noise impact associated with sonic booms for Concept X and Z vehicles which would exceed the applicable thresholds of significance. The areas within the northwest and southwest corridors are sparsely populated; however, sonic booms would likely be audible in certain populated areas within the ROI.

4.10.2.2 Impact from Landing

Concept X vehicles could land under jet power. Concept Y and Z vehicles would glide in for landing. Landing noise would therefore consist of Concept X jet noise, Concept Z carrier jet noise, and sonic booms (discussed in the previous section) during vehicle descent. Noise impacts due to vehicles landing would be lower than those associated with takeoff. Sonic booms during vehicle descent would occur at higher altitudes than booms occurring during ascent, and jet engine noise is much lower during landing than during takeoff, because the engines are throttled back.

Because jet and rocket noise contributions would be small compared with existing jet noise, and sonic boom impacts would be minor, there would be no noise impact associated with Concept X, Y, or Z vehicles which would exceed the applicable thresholds of significance.

Jet Engine Noise – Concept X

As discussed in Section 4.10.2.1, Concept X jet engine noise contributions would be small compared with existing military jet noise.

Glide Landing Noise – Concept Y and Z

Noise associated with gliding vehicles would be insignificant. However, the jet aircraft carrier vehicle for Concept Z would produce jet noise upon landing, which would be minor compared with existing military jet noise.

4.10.3 Alternative 1 - Launching and Landing Concept X and Y Launch Vehicles at the CSIA

The maximum number of launches would be reduced from 54 to 50 per year, which would not make a substantial difference in the projected noise impacts. Because fewer launches and landings would occur under alternative 1 than under the proposed action, the expected noise impacts from alternative 1 would be less than those for the proposed action.

4.10.4 Alternative 2 – Launching and Landing Concept X and Z Launch Vehicles at the CSIA

Under alternative 2, the rocket engine noise at takeoff would not be of concern because the Concept Y vehicle would not be used. The maximum number of launches per year would be decreased from 54 to 52, which would not make a substantial difference in the projected noise impacts. Because fewer launches and landings would occur under alternative 2, the expected noise impacts from alternative 2 would be less than those for the proposed action.

4.10.5 No Action Alternative

Under the no action alternative, the FAA would not issue a launch site operator license to OSIDA and there would be no launches from the CSIA. OSIDA would not operate a launch facility at the proposed location at the CSIA. The CSIA facility would continue to offer aviation-related and rocket engine testing activities, and there would be no change in existing noise levels.

4.11 Socioeconomics and Environmental Justice

4.11.1 Approach to Analysis

According to FAA Order 1050.1E, this analysis must consider the impacts on socioeconomics and environmental justice, as well as disproportionate impacts on children's health and safety. As previously discussed in Section 3.11.2, the ROI for this analysis includes not only the town of Burns Flat but the entire SWODA area, which encompasses a radius of about 48 to 64 kilometers (30 to 40 miles) surrounding the CSIA. Each portion of this analysis will be divided into socioeconomics, environmental justice, and children's health for the proposed action and alternatives. This analysis compares the potential impacts to the significance thresholds in FAA Order 1050.1E.

4.11.2 Proposed Action – Launching and Landing Concept X, Y, and Z Launch Vehicles at the CSIA

It has been determined that the proposed action does not have any substantial impacts to socioeconomics, as defined by FAA Order 1050.1E. This means that the proposed action does not result in any of the following:

- Extensive relocation of residents where sufficient housing is not available,
- Relocation of community businesses that would create severe economic hardship for the affected communities,
- Disruption of local traffic patterns that substantially reduce the levels of service of the roads serving the airport and its surrounding communities, or
- A substantial loss in the community tax base.

The proposed action does not create disproportionately high adverse human health or environmental effects on minority or low-income populations. Further, the proposed action does not result in disproportionate health and safety risks to children.

The remaining subsections of Section 4.11 will discuss in more detail why the proposed action and alternatives do not exceed the thresholds of significance applicable to socioeconomics, environmental justice, or children's health. In fact, the only impacts would likely be the positive impacts on socioeconomics within the ROI, as discussed below.

4.11.2.1 Impact of Launches

Socioeconomics

OSIDA has projected that approximately 50 onsite personnel would be required to staff launch and landing operations. These 50 jobs would include 45 skilled and five unskilled laborers. The skilled workers would perform engineering tasks and would include vehicle technicians. The unskilled workers would conduct maintenance, upkeep, and security tasks for the spaceport. Of these 50 new jobs, approximately 25 would be hired from within the State of Oklahoma, and 25 would be brought in from other parts of the U.S. The assumption about where the employees will originate is based on the small population living in the SWODA region (see Exhibit 3-16) and the lower levels of education in the SWODA region when compared with the State of Oklahoma and the U.S. (see Exhibit 3-17)

These 50 personnel would be in addition to the 10 current employees required for normal CSIA flight operations. Current staff includes on-call fire and rescue personnel, control tower personnel, the airpark manager, and an administrative assistant. Over time, the number of employees needed is not expected to increase or decrease. A sudden increase of the population could cause stress on the local school system or the existing town infrastructure. However, it is unlikely that 50 new employees would create a surge in the population large enough to adversely affect any parts of the ROI or surrounding areas. Any impacts related to the new employees would likely be beneficial, with an increased tax base and a small boost in sales and other services offered by local area businesses.

Economic incentives are provided for new business start-ups in 'Former Indian Lands' of Oklahoma, which includes the CSIA. According to the Post 1865 Map of Indian Lands used by the Internal Revenue Service, the CSIA and surrounding lands were formerly Cheyenne-Arapaho lands. Being located on former Indian Lands allows a business to accelerate depreciation by 40 percent on any expenditure for capital assets. This typically increases non-cash expenditures, and increases gross funds flow for a company according to the Oklahoma Department of Commerce. This tax credit is unique to Oklahoma and has recently been re-instituted through 2007. Additionally, any employer who hires a Native American or the spouse of a Native American is eligible for up to $4,500 in tax credits.

A temporary increase in population could result due to spectators who travel to the CSIA to watch launches. Because it is impossible to know exactly how many individuals will show up for each launch, the FAA assumes that a worst case scenario would be equal to the number of spectators who showed up for the launch of a commercial RLV from the Mojave airport. During a recent launch (June 2004) the community of Mojave estimated that 11,000 spectators traveled to the Mojave Airport to view the launch. (MSNBC, 2004) The Mojave numbers represent a worst case scenario because the actual spectator attendance may vary significantly based on a number of factors, including but not limited to the following:

- Mojave has a much larger population within easy driving distance (e.g., Los Angeles and surrounding communities),
- The X Prize flights were highly publicized and public attendance was actively sought, and
- There will be a great many more flights at CSIA to spread out the attendance of spectators over time.

Any temporary increase in population would impact the surrounding businesses and community. Spectators would need to use businesses such as gas stations and restaurants, and possibly hotels and surrounding public areas like parks for camping. Because the level of impact depends upon the exact number of spectators, it is impossible to know the level of impacts to the surrounding businesses and communities. However, it is unlikely that the impact would be negative. As detailed in Section 3.11, the population density in the SWODA region is very low when compared to the rest of the U.S. Although an area with low population density usually has fewer services and less ability to accommodate a large influx of visitors, the region is located along a major east-west U.S. thoroughfare, and has sufficient infrastructure and services to accommodate periodic increases in transient populations. Therefore, the region could accommodate a fairly large increase in population for a short time.

Environmental Justice

As detailed in Section 3.11, the SWODA region, Washita County, and Burns Flat all have a greater percentage of the population living below the poverty level than both the U.S. and the State of Oklahoma (see Exhibit 3-23). The SWODA region, Washita County, and Burns Flat have a lower percentage of minority racial populations than both the U.S. and Oklahoma (see Exhibit 3-21). In the SWODA region, Burns Flat, and Washita County, the percentage of Native Americans is greater than the U.S. as a whole, but is only about half of the percentage of the State of Oklahoma (see Exhibit 3-21). The percentage of persons of Hispanic or Latino origin is slightly higher in the SWODA region than in Oklahoma; however, the SWODA region’s percentage is still lower than the U.S. average (see Exhibit 3-22). Based on these Census data (detailed in Section 3.11), there is no evidence of an environmental justice population of concern living within the ROI. Furthermore, health and environmental impacts from the proposed action and alternatives are not expected to exceed applicable thresholds of significance for any impact category.

Children’s Health

Effects from the proposed action are not concentrated in areas that might contain proportionally more children, like schools. Although Burns Flat has a slightly higher percentage of children under the age of 18 as compared to the U.S., Oklahoma, and the SWODA region, the types of effects from the proposed action should not be disproportionate to the health and safety of children as compared to adults (see Exhibit 3-24). Therefore, impacts of the proposed action on children’s health and safety should not be disproportionate as defined under EO 13045.

4.11.2.2 Impact of Landing

Socioeconomics

The impacts of landing are the same as those of launches, as discussed above in Section 4.11.2.1. Therefore, no impacts associated with a temporary increase in tourist populations are expected.

Environmental Justice

The impacts of landing are similar to those of launches, as discussed above in Section 4.11.2.1.

Children's Health

The impacts of landing are similar to those of launches, as discussed above in Section 4.11.2.1.

4.11.3 Alternative 1 - Launching and Landing Concept X and Y Launch Vehicles at the CSIA

The impacts of alternative 1 are similar to those for the proposed action. Using only Concept X and Y launch vehicles should not result in any different impacts to environmental justice or children's health. For socioeconomics, the only difference would be the number of personnel required. Instead of 50 employees, the FAA assumes there would be 45 workers under alternative 1 (41 skilled and four unskilled). This would result in slightly fewer positive impacts to the tax base and sales or other services offered by local area businesses.

4.11.4 Alternative 2 – Launching and Landing Concept X and Z Launch Vehicles at the CSIA

The impacts of alternative 2 are similar to those for the proposed action. Using only Concept X and Z launch vehicles should not result in any different impacts to environmental justice or children's health. For socioeconomics, the only difference would be the number of personnel required. Instead of 50 employees, FAA assumes there will be 47 workers under alternative 1 (42 skilled and five unskilled). This would result in slightly fewer positive impacts to the tax base and sales or other services offered by local area businesses.

4.11.5 No Action Alternative

Under the no action alternative, the FAA would not issue a launch site operator license to OSIDA and there would be no launches from CSIA. The CSIA facility would continue to offer its aviation related activities, and there would be no change in airspace activities. The current number of employees (10) would not change if the proposed action is not implemented.

4.12 Transportation

4.12.1 Approach to Analysis

The analysis of transportation impacts addresses ground and air traffic within the geographic area of the CSIA. Impacts on transportation are assessed with respect to the potential to cause disruption or congestion of transportation patterns. This disruption can be in the form of deterioration of existing levels of service or a reduction in the existing level of transportation safety.

Impacts on ground transportation and capacity levels would be significant if the ratio of volume-to-capacity experienced unacceptable increases, which in turn led to congestion of the road and rail systems in and around the CSIA.

Impacts on air traffic would be significant if the proposed action leads to an increase in flight operations that could not be accommodated within established operational procedures and flight patterns. The impact would be significant if OSIDA's flight activities degrade the FAA's ability to control air traffic near the CSIA or provide necessary safety of flight services.

4.12.2 Proposed Action – Launching and Landing Concept X, Y, and Z Launch Vehicles at the CSIA

Activities associated with the proposed action that could impact rail, road, or air transportation to and from the CSIA include transporting vehicles, vehicle components, propellants, and fuel to the CSIA for launches.

There is sparse rail transportation into the CSIA, although there is an existing rail spur. Raw materials, fuels, propellants, and other vehicle components may be shipped to the CSIA via rail as a part of the proposed action; however, a large demand for incoming rail shipments is not anticipated in the reasonably foreseeable future. Depending on the nature and frequency of rail shipments, the rail spur would require varying levels of upgrade to protect public health and safety. OSIDA would consult with Farmrail about any necessary upgrades to the rail spur once specifics on the rail shipments have been confirmed.

It is anticipated that propellants would be delivered to the CSIA by truck. I-40 and OK-44 provide easy access to OSIDA and would allow propellants to be shipped to the CSIA via truck. All flight vehicle assemblies, subassemblies, support equipment, cargo, and fuel would enter the CSIA on 2nd Street on County Road E1140. All shipments of propellants and high-pressure gases will be routed via OK-44 and also enter the CSIA on 2nd Street on County Road E1140, and then travel to the assigned areas over designated non-public roadways. The high-pressure gases may be shipped in cylinders for low volume use in operating locations or by tube trailers for off-loading to a centrally located gas tube bank receiver/storage area. The CSIA will establish and maintain a high-pressure gas storage/receiver area for cylinders and tube trailers. All liquid aviation fuel and propellants would be shipped to the CSIA in bulk tanker trucks, each with a capacity of approximately 15,142 liters (4,000 gallons), which would serve as temporary storage containers.

Propellants for Concept X launch vehicles include LOX and RP-1. The amount of LOX required for launching a Concept X vehicle was estimated to be approximately 5,761 kilograms (12,700 pounds). The amount of RP-1 required for each launch was estimated to be approximately 2,404 kilograms (5,300 pounds). Each LOX delivery truck could deliver up to 15,785 kilograms (34,800 pounds) of LOX and each RP-1 delivery truck could deliver approximately 28,123 kilograms (62,000 pounds) of RP-1 to the CSIA. Therefore, in the years with the highest launch rate of Concept X vehicles, 18 trucks would be required to supply the LOX and four trucks would be required to supply the RP-1. However, these shipments would be relatively infrequent and result in an insignificant increase in the number of vehicles on local roads including OK-44 and I-40. These 22 additional delivery trucks per year would not materially impact transportation to, from, or within the CSIA.

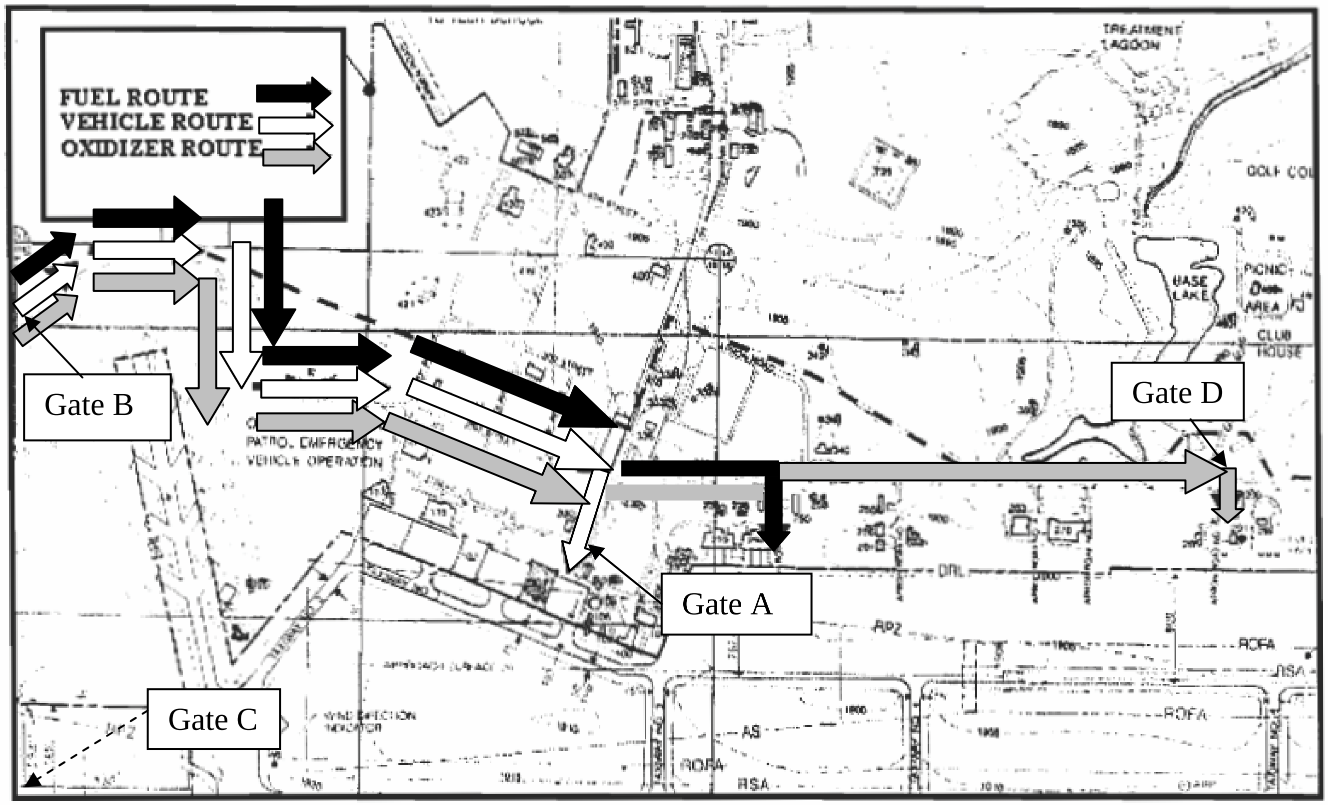
Propellants for Concept Y launch vehicles include LOX and kerosene, or alcohol. The amount of LOX required for launching a Concept Y vehicle is approximately 340 kilograms (750 pounds). The amount of kerosene required for launching a Concept Y vehicle is approximately 136 kilograms (300 pounds). Each delivery truck could deliver up to 15,785 kilograms (34,800 pounds) of LOX and each RP-1 delivery truck could deliver approximately 28,123 kilograms (62,000 pounds) of kerosene to the CSIA. Therefore, one delivery truck per year would be needed to supply the required LOX and one delivery truck per year would be needed to supply the required kerosene for Concept Y launches. These two additional delivery trucks per year would not materially impact transportation to, from, or within the CSIA.

For Concept Z vehicles, propellants would consist of N_2O and HTPB for the launch vehicle and Jet-A fuel for the carrier vehicle. The amount of N_2O required for one launch is 1,295 kilograms (2,855 pounds). Each delivery truck could deliver up to 11,340 kilograms (25,000 pounds) of N_2O. Under the proposed flight schedule, the maximum number of launches would be four per year; therefore, one delivery truck per year would supply the required N_2O. The amount of Jet-A fuel required for the carrier vehicle for one launch is 2,903 kilograms (6,400 pounds). Each delivery truck would deliver 28,123 kilograms (62,000 pounds) of Jet-A fuel; therefore, one truck per year would be needed to supply the required Jet-A fuel. One truck per launch would be needed to bring the motor containing the solid propellant, HTPB; therefore, at most four trucks per year would be needed to deliver the required HTPB.[16] A maximum of six delivery trucks per year would supply propellants for Concept Z launch vehicles, which would not materially impact transportation.

Due to the limited number of launches, propellant shipments would be infrequent and would not result in a material increase in the number of vehicles on local roads including OK-44 and I-40. Within the CSIA, shipments would travel on designated roads to the customer's location. Vehicle operations requiring crossing the main runway have been eliminated from current planning. Again, the limited number of launches would not result in a substantial increase in vehicle volume within the CSIA due to propellant, fuel, or raw material shipments. Exhibit 4-14 provides additional details on the delivery routes within the CSIA.

[16] The HTPB would be loaded into the rocket motor at an offsite location. The HTPB would be encased in the motor when it arrives at the CSIA.

Exhibit 4-14. Delivery Routes at the CSIA



Entry to the CSIA would be limited to four controlled-access gates designated for specific purposes. This traffic flow was suggested to minimize impacts to transportation to, from, and within CSIA. Gate A would be the General Access Gate located just west of 2nd Street at the main entrance. This gate would be controlled by CSIA Security personnel during normal operating hours and would provide general access for authorized personnel and vehicles. Gate B would be located at the intersection of 2nd Street and the Country Road on the north side of the CSIA. This gate would be used for delivery of fuels to the fuel staging area and would be manned by a security guard during CSIA operations. This gate would not be used for personnel or public access during CSIA operations. Gate C would be located on County Road E1140 on the northwest side of the CSIA and would be used for access to the proposed engine test area only. Gate D would be located on 2nd street and Apron Road 6 on the southeast side of the CSIA. This gate would be used for the delivery of oxidizers to the oxidizer staging area.

Activities associated with the proposed action are not anticipated to substantially increase air traffic in the reasonably foreseeable future. The potential impacts on airspace are discussed in Section 4.3 of this EA.

4.12.2.1 Impact of Launch

Operational activities associated with horizontal launch and landing could impact onsite and offsite transportation. Impacts could result from an increase in ground traffic to and from the

CSIA and from the addition of launch site personnel or tourists to the area. OK-44 is the main arterial providing access to the CSIA and is currently a two-lane road. OK-44 and the intersection at Sooner Drive could become congested at times of high traffic volume. The proposed action would result in the addition of 50 personnel commuting to and from the site on a daily basis. This amount of additional traffic should be accommodated by OK-44; however, additional traffic controls may be required at the intersection of OK-44 and Sooner Drive, where personnel would enter the site.

If the addition of launch day personnel and tourist activity significantly increases the number of people traveling to the CSIA, an additional entrance to the CSIA could be opened to employees or employees and the general public. As described in Section 4.11, it was expected that up to a maximum of 11,000 spectators could attend each launch. (MSNBC, 2004) Assuming four people per passenger vehicle, this would be a total of 2,750 passenger vehicles per launch. However, these numbers would be expected to rapidly decline and taper to approximately less than 100 spectators per launch as launches become more routine occurrences. According to the Clinton-Sherman Industrial Airpark Master Plan, traffic volume averaged 1,800 to 2,000 vehicles on OK-44 between I-40 and OK-152 in 1993 and averaged 14,000 vehicles daily on I-40 at the OK-44 interchange. (Benham, 1996) Depending on the exact number of spectators and how rapidly this number declines with each launch, there could be substantial temporary traffic congestion on routes to the CSIA for launches occurring early in the operating period. However, given the limited number of launches, and the existing capacity of the existing roads in the area, no major or lasting impacts would be expected.

Onsite transportation could increase during launches due to towing or moving the launch vehicle to the proper launch or takeoff location. However, the maximum number of launches (54) per year would not be expected to create any substantial impacts to transportation onsite.
A substantial increase in air traffic from launch activity is not anticipated in the reasonably foreseeable future.

4.12.2.2 Impact of Landing

Impacts from landing should be similar to those for launch. Again, if substantial temporary traffic congestion occurs at the intersection of OK-44 and Sooner Drive, an additional entrance to the CSIA could be opened.

Onsite transportation could increase during landings due to recovering and transporting the launch vehicle from the runway after landing. However, the maximum number of launches (54) per year would not be expected to create substantial impacts to transportation onsite.

A substantial increase in air traffic from landing activity is not anticipated in the reasonably foreseeable future.

4.12.3 Alternative 1 - Launching and Landing Concept X and Y Launch Vehicles at the CSIA

Launching and landing Concept X and Y vehicles at the CSIA would have the same impacts on transportation as the proposed action. Launching only Concept X and Y vehicles would not impact the transportation of additional employees or materials to the site. See Section 4.12.2 for potential impacts associated with transportation under the proposed action. Because alternative 1 would result in fewer employees commuting to and from the CSIA than the proposed action (45 instead of 50) and because there would be fewer launches and landings each year, the impact on transportation would be slightly less.

4.12.4 Alternative 2 – Launching and Landing Concept X and Z Launch Vehicles at the CSIA

Launching and landing Concept X and Y Launch Vehicles at the CSIA would have the same impacts on transportation as the proposed action. Launching only Concept X and Y vehicles would not impact the transportation of additional employees or materials, such as propellant or manufacturing equipment to the site. See Section 4.12.2 for potential impacts associated with transportation under the proposed action. Because alternative 2 would result in fewer employees than the proposed action (47 instead of 50) and because there would be fewer launches and landings each year, the impact on transportation would be slightly less. As compared to alternative 1, alternative 2 would result in a slightly higher number of employees commuting to and from the CSIA and a slightly higher number of annual launches and landings. Therefore, the impacts associated with alternative 2 would be slightly higher than those associated with alternative 1.

4.12.5 No Action Alternative

Under the no action alternative, the FAA would not issue a launch site operator license to OSIDA and there would be no launches from the CSIA. The OSIDA would not be able operate a launch facility at the proposed location at CSIA. The CSIA facility would continue to offer its aviation related activities, and there would be no additional impacts to transportation.

4.13 Visual Resources

4.13.1 Approach to Analysis

As directed by FAA Order 1050.1E, the FAA must consider potential impacts from light emissions and visual impacts from the proposed action. As part of light emissions, the FAA considers the extent to which any lighting would create an annoyance or interfere with normal activities. Visual or aesthetic impacts are more difficult to determine because of the subjectivity involved. Impacts to visual and aesthetic resources would be considered significant if the proposed action and alternatives resulted in a substantial adverse effect on a scenic vista; damaged scenic resources, such as trees, rock outcroppings, or historic buildings within a state scenic highway; or degraded the existing visual character or quality of the site and its surroundings.

In general, impacts to visual resources would result if a significant change occurred in the natural or man-made features contributing to the aesthetic value of the CSIA. The proposed action can be analyzed with respect to intensity and context. Intensity is measured by the estimation of visual dominance, and context is determined by the degree of visual sensitivity. Exhibit 4-15 graphically displays the concepts of intensity and context.

Exhibit 4-15. Determination of Impact Based on Visual Dominance and Visual Sensitivity

Intensity Visual Dominance	Context Visual Sensitivity		
	High	***Moderate***	***Low***
Would generally be overlooked " Not Noticeable"	○	○	○
Noticeable, but not detract from the exisitng dominant landscape features " Visually Subordinate"	○	○	○
Changes compete for attention with other viewshed features " Visually co-dominant"	◑	◔	◔
Changes demand attention " Visually dominant"	●	◑	◔

Impact Determination

○	◔	◑	●
Not Significant	Adverse, but not significant	Significant, but mitigable	Significant and unavoidable

The setting of the CSIA is characteristic of the smooth uplands within the Central Rolling Red Plains physiographic area. These upland areas are typically dominated by level plains and generally do not include areas of substantial visual sensitivity.

4.13.2 Proposed Action – Launching and Landing Concept X, Y, and Z Launch Vehicles at the CSIA

4.13.2.1 Impact of Launch

The visual impact of most horizontal launches would be "visually co-dominant." There were approximately 47,000 aircraft operations at the CSIA in 2003 and the general public in the area of the CSIA is accustomed to seeing various military aircrafts performing training maneuvers at the CSIA. Therefore, the visual presence of horizontal launches would not be new to the area. The majority of current aircraft operations at CSIA involve jet powered aircraft. While Concept X and Z vehicles would be launched by jet powered carrier vehicles, Concept Y vehicles would be launched under rocket power. Rocket-powered launches would be a new sight in the area of the CSIA and might attract and dominate the attention of a viewer in this area. In these few cases the launch itself might be "visually dominant"; however, the limited number of Concept Y launches (a maximum of two per year) would mitigate any resulting impacts. Jet powered takeoffs, however, are more common to the area and would be "visually co-dominant." In addition, because the CSIA is a "low" visual sensitivity area, the resulting impact rating for both "visually dominant" and "visually co-dominant" intensity ratings would be adverse, but not substantial.

Launches would not create any impacts unless they occur during nighttime hours. If a launch occurs during nighttime hours, the launch itself would be visually dominant for all vehicle concepts. In such a case, mitigation measures might be required to shield viewers in the area from light generated as a result of the launch. At this time all launches are anticipated to occur during daytime hours. If night launches were proposed in the future they would need to be analyzed in separate environmental analyses.

4.13.2.2 Impact of Landing

Horizontal landing activities would result in a "visually subordinate" classification, due to the large number of existing touch and go operations performed by various sizes of military aircraft on a daily basis. Both powered and unpowered landings should appear similar to current landing activities as CSIA.

4.13.3 Alternative 1 - Launching and Landing Concept X and Y Launch Vehicles at the CSIA

Impacts to visual resources resulting from alternative 1 would be the same as impacts to visual resources associated with the proposed action, as discussed in Section 4.13.2.

4.13.4 Alternative 2 – Launching and Landing Concept X and Z Launch Vehicles at the CSIA

Impacts to visual resources from alternative 2 would be less than the impacts associated with the proposed action. The elimination of Concept Y vehicles means that no launches would occur from ground level at the CSIA under this alternative. See Section 4.13.2 for a description of the impacts to visual resources from the proposed action.

4.13.5 No Action Alternative

Under the no action alternative, the FAA would not issue a launch site operator license to OSIDA and there would be no launches from the CSIA. The OSIDA would not be able operate a launch facility at the proposed location at the CSIA. The CSIA facility would continue to offer its aviation-related activities, and there would be no change in visual impacts.

4.14 Water Resources

4.14.1 Approach to Analysis

The FAA considered the following factors to aid in defining the severity of impact from the proposed action and alternatives to water resources:

- The degree to which the action may adversely affect wetlands, wild and scenic rivers, or ecologically critical areas; and
- Whether the action threatens a violation of Federal, state, or local law or requirements imposed for water resources.

4.14.2 Proposed Action – Launching and Landing Concept X, Y, and Z Launch Vehicles

The following sections present the impacts associated with the proposed action, alternative 1, alternative 2, and the no action alternative. Implementation of any alternative, including the proposed action, would have no impact on the ongoing ground water investigation and remediation efforts at CSIA. Wetlands and floodplains would not be impacted as no new infrastructure would be constructed and no new discharges would be released into the wetlands.

4.14.2.1 Impact of Launch

The vehicle preparation activities (i.e., fueling and assembly) associated with Concept X, Y, and Z vehicles may result in inadvertent spills or releases of fuel or materials that may impact surface water and ground water. OSIDA or the launch operator would clean up any spills and excavate and remove any contaminated soil associated with an incidental spill or release, resulting in a small impact.

4.14.2.2 Impact of Landing

The impacts associated with landing would be the same as described in Section 4.14.2.1.

4.14.3 Alternative 1 – Launching and Landing Concept X and Y Launch Vehicles

The launch and landing of Concept X and Y vehicles would have slightly fewer impacts than those presented for the proposed action, because with one less concept vehicle, there would be fewer vehicle preparations and fewer chances for accidental spills or releases.

4.14.4 Alternative 2 – Launching and Landing Concept X and Z Launch Vehicles

The launch and landing of Concept X and Z vehicles would have slightly fewer impacts than those presented under the proposed action, because with one less concept vehicle, there would be fewer vehicle preparations and fewer chances for accidental spills or releases.

4.14.5 No Action Alternative

Under the no action alternative, there would be no additional impacts on water resources. Commercial, military, and private aviation activities would continue at CSIA.

5 POTENTIAL CUMULATIVE IMPACTS OF THE PROPOSED ALTERNATIVES

A cumulative impact is "the incremental impact of the actions when added to other past, present, and reasonably foreseeable future action regardless of what agency (Federal or non-Federal) or person undertakes such other actions." (40 CFR 1508.7) This cumulative impact analysis only analyzes those resource areas that have the potential for cumulative impacts. The proposed action has been evaluated for cumulative impacts on air quality, airspace, biological resources, hazardous materials, health and safety, noise, socioeconomic impacts, transportation, visual resources, and water resources.

5.1 Analysis Methodology

In researching cumulative projects, OSIDA and the USAF were contacted. The following were identified based on information from these contacts:

- Impacts occurring as a result of the proposed action over the five-year term of the launch site operator license,
- Proposed future use of the CSIA as a location to test rocket engines using a mobile trailer, and
- Continued use of the CSIA as a training facility for military and general aviation aircraft.

For purposes of this analysis, activities associated with testing rocket engines include

- Transporting the mobile test trailer to the test location near Building 33,
- Securing the trailer to the existing tie down pins,
- Securing the rocket engine to the test stand,
- Fueling the rocket engine,
- Igniting the rocket engine,
- Removing the engine and any debris following the test, and
- Transporting the trailer to the appropriate storage location.

Although other actions have been previously proposed that would have contributed to cumulative impacts, they are not currently considered "reasonably foreseeable" future actions within the timeframe of this analysis. This includes the proposed use of the CSIA as a location to build an Assault Landing Zone to support C-17 aircraft training (as discussed in Section 4.9 Land Use) and the proposed use of the CSIA for conducting manufacturing and testing activities for experimental aircraft.

The USAF prepared an EA of the C-17 Program Changes at Altus AFB and the 97th Airlift Wing Commander signed a FONSI on August 19, 2004. The EA considered several possible actions including the possible construction of an Assault Landing Zone at the CSIA. The FONSI indicated that the USAF would pursue the proposed action (which was to accommodate the expanded C-17 training program without building a new Assault Landing Zone). Due to the lack of funding and authority to buy or lease land and build the Assault Landing Zone and the urgent need to produce more trained aircrews, the Commander opted for the proposed action. While the USAF has stated that the need still exists for a new Assault Landing Zone and the USAF continues to consider potential sites, including the CSIA, there is currently no reasonably foreseeable plan to locate such a facility at the CSIA.

In the past, one aviation-related firm had expressed an interest in conducting operations at the CSIA, which would possibly include manufacturing, research and development, test flights and general flights from CSIA. These proposed activities would have included development of industrial space for manufacturing and testing adjacent to or accessible to the runways at the CSIA. However, these plans were determined not to be reasonably foreseeable within the timeframe of this analysis and therefore, are not considered as part of the cumulative impacts analysis.

The cumulative impacts analysis for this EA focuses on those past, present, and reasonably foreseeable future actions that have the potential to contribute to cumulative impacts. These actions include the cumulative effect of the proposed action/preferred alternative as it would occur over the five-year term of the launch site operator license, the continued use of the CSIA as a training facility for military and general aviation aircraft, and the reasonably foreseeable future use of the CSIA as a location for testing rocket engines. The impacts of the proposed action are presented in Section 4 of this EA and the impacts of using the CSIA for military and general aviation aircraft activities have been analyzed in previous environmental documentation including those listed in Section 1.6. The impacts associated with rocket engine testing at the CSIA have not been analyzed in previous environmental documentation; therefore, the impacts of rocket engine testing are briefly described as part of this cumulative impacts analysis.

The cumulative impacts were analyzed for the resource areas with potential impacts. The following sections discuss the potential cumulative impacts for this project.

5.2 Air Quality

5.2.1 Impacts of Testing Rocket Engines

40 CFR Part 63, *National Emission Standards for Hazardous Air Pollutants for Source Categories,* Subpart PPPPP, *National Emission Standards for Hazardous Air Pollutants for Engine Test Cells/Stands*, establishes national emission standards for hazardous air pollutants (NESHAP) for engine test cells/stands located at major sources of HAP emissions. Subpart PPPPP establishes requirements to demonstrate initial and continuous compliance with the emission restrictions contained in this NESHAP. Subpart PPPPP defines engine test cells/stands to mean any apparatus used for testing uninstalled stationary or uninstalled mobile (motive) engines. This includes rocket engines that are not installed in, or an integrated part of, the final product (i.e., launch vehicle). The owner/operator of an engine test cell/stand must determine applicability of the requirements as described in 40 CFR § 63.1 and follow notification instructions as applicable in 40 CFR § 63.9. The full text of the rule is available at the following Internet link http://www.tnrcc.state.tx.us/permitting/airperm/opd/63/63hmpg.htm.
The air emissions from the use of a rocket engine test cell to fire an engine are similar to the air emissions from launching the vehicle. The testing program for an engine typically requires frequent firings of the engine for short intervals, with a few longer firing intervals for the anticipated full duration of the rocket engine firing. The shorter firing intervals produce smaller amounts of air emissions; therefore, this analysis focuses on the full burn test scenario.

For the full burn test of a rocket engine, all rocket engine emissions are generated in a localized area, in contrast to a launch where the emissions would be spread over a larger area due to the motion of the vehicle. Worst-case emissions were estimated for 16 tests per year of a LOX/kerosene-powered rocket engine with a maximum thrust of approximately 222,400 Newtons (50,000 pounds force) and total fuel usage of approximately 8,100 kilograms (9 tons) per test. The emissions calculations are presented in Appendix A. The estimated annual emissions between 2006 and 2010 are presented in Exhibit 5-1.

Exhibit 5-1. Estimated Annual Emissions to the Troposphere from Rocket Engine Testing

Year	Emission Loads for All Proposed Action Rocket Engine Tests Kilograms (Pounds)			
	CO_2	CO	H_2	H_2O
2006	63,783 (140,617)	26,034 (57,395)	547 (1,206)	39,051 (86,093)
2007	63,783 (140,617)	26,034 (57,395)	547 (1,206)	39,051 (86,093)
2008	63,783 (140,617)	26,034 (57,395)	547 (1,206)	39,051 (86,093)
2009	63,783 (140,617)	26,034 (57,395)	547 (1,206)	39,051 (86,093)
2010	63,783 (140,617)	26,034 (57,395)	547 (1,206)	39,051 (86,093)

The calculated emissions from rocket engine testing that would occur at the CSIA were compared to both the *de minimis* level and the level of emissions considered significant for Oklahoma stationary sources (both levels are 90,718 kilograms [100 tons]). The only pollutant emitted from these tests with either a *de minimis* level or significant Oklahoma emission level is CO, and the worst-case CO emissions from these tests are less than one-third of these levels. Any potential short-term impacts of these emissions could be mitigated through proper choice of weather conditions and/or burn times. To ensure air emissions do not move off the CSIA property in hazardous or dangerous concentrations, strict requirements exist for testing of rocket engines. These may include air monitoring, weather monitoring, limiting use of rocket engine firing to specific atmospheric conditions, limiting duration and or frequency of test, or imposing additional mitigation procedures dependent on the specific test condition.

5.2.2 Cumulative Impacts

The CSIA is in attainment for all criteria pollutants under the CAA. Therefore, the air quality is generally good. Under the proposed action, there is the potential for additional emissions from launch vehicles and other launch-related sources (specifically, fuel delivery trucks and spectator vehicles). Exhibit 5-2 summarizes the total estimated emissions likely to impact the local area[17]

[17] All emissions below 914 meters (3,000 feet) were assumed to have the potential to impact the local area surrounding the facility. This altitude is appropriate for evaluating impacts in the local area because the Federal government uses 914 meters (3,000 feet) and below to assess contributions of emissions to the ambient air quality and for the *de minimis* calculations under the CAA. (EPA, 1992)

Exhibit 5-2. Comparison of Baseline Aircraft and Proposed Static Engine Test Emissions with Projected Emissions Associated with the Proposed Action

	Estimated Annual Emissions, Metrics Tons (Tons)			
	CO	VOC	NO_X	SO_2
Baseline Aircraft and Proposed Static Engine Test Emissions				
Existing aircraft operations	128 (141)	26 (29)	371 (409)	12 (13)
Static engine tests	26 (29)	-	-	-
Total Non-proposed Action Emissions	**154 (170)**	**26 (29)**	**371 (409)**	**12 (13)**
Proposed Action				
Concept X, Y, and Z vehicle emissions	2 (2)	1 (1)	< 1 (< 1)	< 1 (< 1)
Fuel delivery truck emissions	< 1 (< 1)	< 1 (< 1)	< 1 (< 1)	-
Spectator vehicle emissions	7 (8)	1 (1)	5 (6)	-
Total Proposed Action Emissions	**9 (10)**	**2 (2)**	**6 (6)**	**< 1 (< 1)**
Cumulative Emissions	**163 (180)**	**28 (31)**	**377 (416)**	**12 (13)**

for current CSIA activities and activities associated with the proposed action. The baseline emissions and emissions associated with the proposed action were estimated as described in Section 4.2. For the purposes of the cumulative impacts assessment, it was conservatively assumed that the annual emissions for each type of activity are equivalent to those for the year between 2006 and 2010 with highest emissions (i.e., 2010 for launch vehicle emissions and fuel delivery truck emissions, and the year with the highest expected spectator vehicle emissions).

The activities associated with the proposed action are conservatively estimated to result in a six percent increase in CO emissions, an eight percent increase in VOC emissions, a two percent increase in NOX emissions, and a negligible (less than one percent) increase in SO2 emissions. Given that (1) CSIA is currently in attainment for all criteria pollutants, (2) the emissions associated with the proposed action were estimated using worst-case assumptions, and (3) the increase in emissions associated with the proposed action is relatively small, there are unlikely to be any cumulative air quality impacts associated with the proposed action. Furthermore, none of the alternatives to the proposed action would result in higher emissions than the proposed action, and thus no cumulative air quality impacts are expected under any of these alternatives.

5.3 Airspace

5.3.1 Impacts of Testing Rocket Engines

The proposed placement of the mobile trailer near Building 44 during static rocket engine tests would not result in impacts to airspace. Rocket engine tests would last no longer than 100 seconds (less than 2 minutes) and would be located such that no impacts to aircraft or launch vehicles taking off or landing at the CSIA would be expected. In addition, a maximum of 16 tests would occur per year, therefore, even if aircraft traffic needed to be stopped during engine tests this would constitute a disruption in traffic patterns at the CSIA for no more than 1,600 seconds (27 minutes) per year.

5.3.2 Cumulative Impacts

Once coordination and scheduling procedures have been developed with the ARTCC and the military users, the long-term cumulative impacts associated with existing aircraft operations, continuation of static rocket engine testing, and launches and landings of Concept X, Y, and Z vehicles at the CSIA would not result in degradation of the FAA's ability to control air traffic and provide necessary safety for flight operations.

5.4 Biological Resources

5.4.1 Impacts of Testing Rocket Engines

The increased noise and emissions associated with testing rocket engines could have a negative impact on biological resources. Previous studies indicated that the endangered whooping crane may be found in or near the wetlands at the CSIA during its spring and fall migration. (Department of the Air Force, 2004) If the whooping crane could be negatively impacted by the rocket engine testing at the CSIA, OSIDA would consult with USFWS, and implement mitigation measures to ensure that the rocket engine testing activities would not be likely to adversely affect the whooping crane. Potential mitigation measures may include monitoring the whooping crane during rocket engine tests to document the impacts, or scheduling tests when the whooping crane is not present.

5.4.2 Cumulative Impacts

The cumulative increase in noise and emissions would result in an adverse impact on biological resources. The cumulative noise and emissions would result from ongoing commercial, military, and private aviation activities, future rocket engine testing, as well as from the proposed action. The biological resources affected would be those that have been able to tolerate the existing noise and emissions associated with an active airfield, therefore, the cumulative impacts on biological resources are expected to be minor.

5.5 Hazardous Materials and Hazardous Waste

5.5.1 Impacts of Testing Rocket Engines

The primary hazardous materials associated with the testing of rocket engines are RP-1 and LOX. The use of LOX would have the same impacts as those described in Section 4.7.1.1. RP-1 is a highly flammable hydrocarbon fuel similar to the commercial jet fuel currently used and stored without adverse impact at the CSIA. RP-1 is handled according to the same safety and spill prevention procedures as jet fuel and would not resulted in material impacts to the environment.

5.5.2 Cumulative Impacts

Cumulative impacts from hazardous materials and hazardous waste management could occur on the portions of the CSIA with historic soil and ground water contamination. However, substantial cumulative impacts are not anticipated due to the extensive remediation activities that have been completed at the site.

5.6 Health and Safety

5.6.1 Impacts of Testing Rocket Engines

The potential impacts of testing rocket engines on the ground at the CSIA include the risk of exposure to toxic emissions produced from burning propellants and the risk of a rocket engine exploding during a test. Because workers and the general public would be excluded from the blast danger area around the mobile test cell during testing, no impacts to health and safety would be expected to occur. All workers would be required to stay out of this area during testing. Overall, the risk to human health and safety from rocket engine testing would be small and limited by adherence to safety precautions.

5.6.2 Cumulative Impacts

No cumulative health and safety impacts are expected from the proposed operations at the CSIA. The extent of the impacts on public health and safety would be addressed in the required FAA Safety Review prior to issuance of a launch site operator license.

5.7 Noise

5.7.1 Impacts of Testing Rocket Engines

The noise level from testing rocket engines would be substantially higher than rocket launch noise because the thrust of the engines proposed to be tested at the CSIA is substantially greater than the thrust of the Concept Y vehicle engines for which data was presented in Section 4.10. The Concept Y vehicle is the only vehicle proposed to be launched from the CSIA that would rely on rocket engine power for takeoff. The maximum thrust of rocket engines proposed to be tested at the CSIA is up to 224,190 Newtons (50,400 pounds force), whereas the thrust of the Concept Y vehicle would be 8,007 Newtons (1,800 pounds force).

The rocket engines would be tested up to 16 times per year for durations of up to 100 seconds per test. Based on a thrust of 224,190 Newtons (50,400 pounds force), Exhibit 5-3 shows the estimated noise levels as a function of distance from the rocket engine test stand. These noise levels are expressed in terms of instantaneous sound pressure level and cannot be directly compared with the existing CSIA airport noise contours, which are expressed in terms of annual DNL. However, because of the short duration of these tests and small number of tests per year, the noise impact would be small compared with existing military aircraft noise.

Exhibit 5-3. Estimated Rocket Engine Test Noise Levels

Distance from Test Engine kilometers (miles)	Unweighted Sound Pressure Level (dB)	Sound Pressure Level (dBA)
1.6 (1)	96	76
3.2 (2)	90	70
4.8 (3)	86	66
6.4 (4)	84	64
8.0 (5)	82	62

5.7.2 Cumulative Impacts

Background noise at the CSIA would increase with the increased level of activity from the addition of launches and landings. During launches, rocket engine tests, and aircraft operations, the noise levels could potentially be very high, but because of the relative infrequency of these events, the overall impacts would be relatively small. The impacts of rocket launches would be relatively small when compared to the existing airport-generated noise and rocket engine testing noise. Sonic booms from supersonic vehicles at high altitudes would create minor impacts because of their relatively low magnitude, relatively infrequent occurrence, and occurrence over sparsely populated areas. Consequently, cumulative noise impacts due to the proposed action would not exceed thresholds of significance applicable to noise.

5.8 Socioeconomics and Environmental Justice

5.8.1 Impacts of Testing Rocket Engines

The rocket test cell would not require personnel in addition to the 50 new employees described in Section 4.11. Instead, between five and seven of those 50 employees would conduct the operations of the rocket engine testing. Therefore, the rocket engine testing would cause no additional or cumulative impacts on socioeconomics.

No environmental justice impacts would occur as a result of the engine test cell. All impacts would be confined to the immediate area in the CSIA, where there are no residential populations or low-income or minority communities.

No disproportionate impacts from the engine test cell would be placed on children’s health and safety. All impacts have been confined to the immediate area in the CSIA, and no children are expected to be on or near the site.

5.8.2 Cumulative Impacts

Contributions of the proposed action to cumulative socioeconomic impacts would be additive. Given the proposed action's small relative size to the workforce in the surrounding counties, the impacts would be minimal from a population and residential living standpoint. The impacts for the local economy in Burns Flat, Oklahoma could be considered as starting a beneficial economic "chain reaction." With more activity and better capabilities at the CSIA, additional firms may be attracted to operating at the CSIA. The beneficial cumulative socioeconomic impact could be greater than the direct impact of the proposed action.

No disproportionate negative impacts are anticipated on socioeconomics, environmental justice, or children's health.

5.9 Transportation Impacts

5.9.1 Impacts of Testing Rocket Engines

Onsite transportation would increase during rocket engine testing due to transporting the mobile test trailer to the test location near Building 33, and transporting the trailer to the appropriate storage location after the test is complete. However, with a maximum of 16 annual engine tests, no material impacts to onsite transportation would occur as a result of rocket engine testing.

Additional offsite road closures are not anticipated for continued rocket engine testing activities.

Rocket engines tested at the CSIA would consist of Rocketdyne 88 engines that use LOX and RP-1 as propellants. At most, each test could require up to approximately 5,761 kilograms (12,700 pounds) of LOX and 2,404 kilograms (5,300 pounds) of RP-1. Assuming that a maximum of 16 engine tests occur per year, 91,716 kilograms (202,200 pounds) of LOX and 38,465 kilograms (84,800 pounds) of RP-1 would need to be delivered to the CSIA for rocket engine testing. If they are delivered in 15,142-liter (4,000-gallon) tanks as planned, six trucks per year would be needed to deliver the LOX, and four trucks per year would be needed to deliver the RP-1. Due to the limited number of engine tests, shipments would be infrequent and would result in an immaterial increase in the number of vehicles on local roads including OK-44 and I-40. This combined with the proposed action and current aircraft operations at the CSIA would not result in substantial impacts to transportation.

5.9.2 Cumulative Impacts

Cumulative impacts to transportation systems would be possible as a result of the proposed action over the five-year term of the launch site operator license, the continued use of the CSIA as a training facility for military and general aviation aircraft, and use of the CSIA for testing rocket engines. The main entrance to the CSIA is accessible from Highway 44 (OK-44) which runs parallel to and is easily accessed from I-40. Over OSIDA's five-year operating period, the number of launches would rise from 16 in 2006 to 54 in 2010. However, the existing capacity on the surrounding roads would be able to accommodate the proposed action and the existing traffic flow.

5.10 Visual Resources

5.10.1 Impacts of Testing Rocket Engines

The mobile rocket engine test cell would be located in an area that is not easily or commonly viewed from public vantage points. In addition, the trailer would only be located in the test location for the duration of the test activities, when not in use it would be stored in the storage area and would not impact visual resources. Thus, the visual intensity of testing rocket engines falls into the "not noticeable" category. This combined with the proposed action and current aircraft operations at the CSIA would not result in impacts from light emissions or substantial adverse effects to visual or aesthetic resources. As is the case at other test locations, rocket engine firings would only occur when meteorological conditions support the dispersal of exhaust emissions. Therefore, the exhaust plume would not be expected to be sustained for long periods of time. No impacts to visual resources or to visibility would be expected as a result of rocket engine testing.

5.10.2 Cumulative Impacts

The proposed action would not entail any changes to the built environment at the CSIA. A maximum of 54 launches per year would be added to the current flight schedule. Because there is currently an average of 47,000 aircraft operations conducted at the CSIA per year, the proposed action would only increase these operations by 0.1 percent. Casual observers within viewing range of launches at the CSIA may not be able to distinguish Concept X and Z vehicles, which are launched by jet powered carrier vehicles, from the current aircraft operations at the CSIA that involve jet powered aircraft. Concept Y vehicles would be launched using rocket power, which has not been used before at the CSIA. However, the maximum of two Concept Y launches per year combined with existing aircraft operations would not result in substantial cumulative impacts on visual resources.

5.11 Water Resources

5.11.1 Impacts of Testing Rocket Engines

The impacts associated with testing rocket engines would result from accidental spills and releases of propellants during fueling procedures. These spills or releases may impact surface or ground water at the CSIA. As presented in Section 4.14, Impacts on Water Resources, OSIDA or the launch proponent would be required to clean up any spills or releases and excavate and remove any contaminated soil. All applicable requirements regarding spill prevention would be used when conducting fueling activities prior to engine testing.

5.11.2 Cumulative Impacts

Cumulative impacts on water resources may result from incidental spills and releases associated with aircraft preparation, rocket engine test preparation, and launch vehicle preparation. Such spills or releases may impact surface water and ground water. As presented in Section 4.14, Impacts on Water Resources, OSIDA or the proponent of the activity would clean up any spills or releases and excavate and remove any contaminated soil associated with an incidental spill or release; resulting in a small cumulative impact.

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6 MITIGATION MEASURES

The following mitigation measures may be implemented as directed by any license, permit or related documentation issued by the FAA for this proposed action.

6.1 Air Quality

- Minimization of unnecessary traffic to, from, and within the CSIA.
- Use of personal protection equipment and implementing appropriate procedures.

6.2 Airspace

- Surveying the potentially affected airspace prior to launches to ensure there are no potential conflicts.
- Compliance with the procedures outlined in the LOA.

6.3 Biological Resources

- Should the whooping crane be identified in or near the wetlands at CSIA, OSIDA would consult with USFWS, and implement mitigation measures to ensure that the activities at the CSIA would not be likely to adversely affect the whooping crane. Potential mitigation measures may include monitoring the whooping crane during launch and landing or rocket engine testing activities to document the impacts, or scheduling launches and landings when the whooping crane is not present.

6.4 Hazardous Materials

- Spill prevention, containment, and control measures would be used while transporting equipment and materials.
- Impermeable ground cover and spill containment berms would be used when conducting fueling operations.
- Bulk hazardous materials (e.g., 210 liter [55 gallon] drums of anti-freeze, hydraulic fluid, compressed welding gases) would be stored in approved containers that meet National Fire Protection Association industrial fire protection codes and required containment systems.
- Spill response materials (e.g., sorbents, drain covers, mops, brooms, shovels, drum repair materials and tools, warning signs and tapes, and personal protective equipment) would be readily available for use in the event of an unplanned release.
- Storage of hazardous materials would be in protected and controlled areas designed to comply with site-specific spill prevention, control, and countermeasures plans.
- Hazardous materials would be inspected before accepting a shipment (e.g., to validate container integrity and expiration date).
- Hazardous materials would be purchased in appropriately sized containers (e.g., if the material is used by the can, it would be purchased by the can rather than in bulk sized containers).
- Purchasing excess hazardous materials would be avoided.
- Hazardous material containers would be appropriately labeled.

6.5 Waste Management

- Waste would be containerization to prevent discharges.
- Litter would be prevented.
- Access to waste by wildlife would be controlled.

6.6 Health and Safety

- Access would be prevented to hazardous operations areas by non-essential personnel.

6.7 Transportation

- Shipping and delivery of vehicles, vehicle components, and propellant would be conducted under routine procedures in accordance with applicable FAA and DOT safety standards to minimize possible impacts to transportation.

7 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM MAINTENANCE AND ENHANCEMENT OF THE ENVIRONMENT

Short-term uses of the environment are considered those that occur over a period of less than the life of the proposed action. Conversely, long-term uses of the environment include those impacts that would persist for a period of five years or the life of the proposed action.

Short-term commitments of the proposed action would include labor, capital, and fossil fuels that result directly from renovation of facilities to accommodate potential tenants and vehicle assembly prior to launch at the proposed Oklahoma Spaceport.

From the long-term perspective, the increased utilization of the CSIA would enhance the local and regional economies through new business development. Economic growth in Southwestern Oklahoma is an important vision for OSIDA. Increased activity would also provide increased revenue for improving and maintaining the aging infrastructure of the CSIA.

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8 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that use of these resources may have on future generations. The use or destruction of specific resources (e.g., energy and minerals) that cannot be replaced within a reasonable time frame is termed an irreversible resource commitment of that resource.

The proposed action would not be expected to result in the loss of threatened or endangered species or cultural resources such as archaeological or historic sites.

The proposed action would result in an increased use of aviation fuel and other propellants required by the RLVs, and miscellaneous fuels required by supporting ground vehicles such as tanker trucks. Additionally, raw materials may be required for the assembly of vehicles or vehicle components, or the renovation of facilities at the CSIA. Energy would also be irreversibly and irretrievably committed to the proposed action. Facilities would utilize natural gas or electricity in support of operations.

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9 ADVERSE ENVIRONMENTAL EFFECTS THAT CANNOT BE AVOIDED

In general, most known adverse effects resulting from implementation of the proposed action would be mitigated through project planning and design measures, consultation with appropriate agencies, and the use of Best Management Practices. As a result, most potential adverse effects would be avoided and those that cannot be avoided would not be expected to result in an impact to the environment which would exceed applicable thresholds of significance.

Adverse environmental impacts that cannot be avoided include short-term noises that may startle and otherwise impact wildlife; the release of small amounts of pollutants to the atmosphere; and minor increased generation of hazardous waste at the CSIA. Consultation with appropriate agencies and implementation of appropriate mitigation measures would help to minimize potential impacts.

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10 SECONDARY OR INDUCED IMPACTS

The CEQ defines secondary impacts as "those that are caused by an action and are later in time and farther removed in distance but still foreseeable." Some development projects pose the potential for induced or secondary impacts on the surrounding areas. A secondary or induced impact would exist when a proposed project causes a shift in population growth, public service requirements, or changes in local or regional economic activity that are influenced by the changes produced by implementing the proposed action.

Issuing a launch site operator license to OSIDA for the operation of a launch and landing site at the CSIA would not result in substantial induced impacts. Although the proposed action would support and facilitate limited growth, it would not induce growth. Additionally, there are no known specific future development activities that would be dependent on the proposed action. Therefore, no secondary impacts are expected to result from the proposed action or alternatives analyzed in this EA. The use of the CSIA by launch operators conducting launches and landings of Concept X, Y, and Z vehicles would not result in substantial induced impacts.

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12 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.
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.
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.
cryogenic liquid	Liquefied gases kept at extremely low temperatures.
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).
endangered species	A plant or animal that is in danger of extinction throughout all or a significant portion of its range.
energy management area	A designated zone downrange from a landing area where concept vehicles may conduct a series of maneuvers to expend excess energy before landing.
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 (FSS)	Flight safety system means the system that provides 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.
gypsum	An evaporite (class of sedimentary minerals and sedimentary rocks that form by precipitation from evaporating aqueous fluid) deposit composed of hydrous calcium sulfate.
impacts	An assessment of the meaning of changes in all attributes being studies for a given resource, an aggregation of all of the adverse effects, usually measured using a qualitative and nominally subjective technique.
instantaneous impact point (IIP)	An impact point that follows thrust termination of a launch *point* vehicle. IIP may be calculated with or without atmospheric drag effects.
instrument flight rule	Rules that govern the procedures for conducting flights *(IFR)* under Instrument Meteorological Conditions. "Less than 1000 ft per 3 statute miles."
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 about 70 or 80 kilometers and it extends to an indefinite height.
jet routes (J-Routes)	High-altitude routes designated to indicate frequently used routes, from 18,000 ft MSL to FL 450.
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 who will conduct the launch of a launch vehicle and any payload.
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 Secretary issues or transfers under this chapter) and necessary facilities at that location.
launch site operator license	A license granted by the FAA to OSIDA that would authorize OSIDA to conduct launches from CSIA, 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 FAA review and licensing
launch vehicle	A vehicle built to operate in, or place a payload in, outer space or a suborbital rocket.
loam	A soil consisting of a friable mixture of varying proportions of clay, silt, and sand.
mesosphere	The atmospheric shell between about 45-55 kilometers and 80-85 kilometers, extending from the top of the stratosphere to the mesopause; characterized by a temperature that generally decreases with altitude.
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 license or the expiration date stated in the reentry license, whichever occurs first.
National Airspace System (NAS)	The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas.

nominal	In reference to launch vehicle performance, trajectory, or stage impact point, a launch vehicle flight where all launch vehicle aerodynamic parameters are as expected, all vehicle internal and external systems perform as planned, and there are no external perturbing influences (e.g., winds) other than atmospheric drag and gravity.
operation of a launch site	The conduct of approved safety operations at a permanent site to support the launching of vehicles and payloads.
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.
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.
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, and includes those people and 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 or 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 for the return of a suborbital vehicle to CSIA is “land.”

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.
rhyolite	A light-colored, very fine-grained or glassy volcanic rock similar chemically to granite, often containing small quartz and feldspar crystals dispersed in a glassy white, green, or pink groundmass.
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.
stratosphere	The layer of the Earth's atmosphere 20 to 50 kilometers (12 to 31 miles) above the surface; where ozone forms.
suborbital flight	A flight involving less than one orbit of the Earth.
sonic boom	Sound, resembling an explosion, produced when a shock wave formed the noise of an aircraft or launch vehicle traveling at supersonic speed reaches the ground.
threatened species	Plant and wildlife species likely to become endangered in the foreseeable future.
touch and go	An operation by an aircraft that lands and departs on a runway without stopping or exiting the runway.
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.
very high frequency (VHF)	Radio transmissions that occur in the 30 - 300 MHz band and are commonly used for air-to-ground communication.
victor routes (V-routes)	Network of low-altitude airways serving commercial aircraft operations up to 18,000 ft MSL, from 1200 ft AGL to 17,999 ft MSL.
viewshed	The area visible from a particular point of view.

visual flight rules (VFR) “See and Avoid.” Rules governing the procedures for conducting flights under Visual Meteorological Conditions. “Equal to or greater than” 1000 ft ceiling per 3 statute miles.

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APPENDIX A

EMISSIONS ASSOCIATED WITH THE PROPOSED ACTION AND ALTERNATIVES

This appendix identifies the emissions/afterburning products from various propellants used in launch and landing activities associated with the proposed action and alternatives. Section A.1 discusses the methodology used to determine per launch emission loads in the various atmospheric layers and provides the estimated per launch emissions. The methodology used to estimate cumulative emission loads associated with launches, as well as the estimates themselves, are provided in Section A.2. Section A.3 describes the methodology used to estimate emission loads from proposed rocket engine tests and provides the estimated emissions for these tests.

A.1 Methodology for Determining Per Launch/Reentry Emissions Loads in Various Atmospheric Layers

The four principal layers in the Earth's atmosphere are the troposphere, stratosphere, mesosphere, and ionosphere. They are generally defined by temperature, structure, density, composition, and degree of ionization. (DOT, 1992) The approximate altitude of these layers is provided in Exhibit A-1. The troposphere is the turbulent weather region containing 75 percent of the total mass of the Earth's atmosphere. The troposphere is critical because any rocket emission can potentially increase ambient pollution in the air or can deposit to Earth. The stratosphere contains a critical ozone layer that protects the Earth's surface from UV radiation. Both the stratosphere and the troposphere are of most concern when considering greenhouse gases and global warming. This analysis is also interested in the portion of the troposphere below 914 meters (3,000 feet) because this is the altitude range to which ambient air quality standards apply.

Exhibit A-1. Altitude Range for Various Atmospheric Layers

	Troposphere	Stratosphere	Mesosphere	Ionosphere
Altitude Range In Kilometers (Miles)	Surface to 10 (6.2)	10 to 50 (6.2 to 31)	50 to 80 (31 to 50)	80 to 1,000 (50 to 621)

Launch vehicles used to transport payloads or passengers into space will be propelled through several layers of the atmosphere including the troposphere, stratosphere, mesosphere, and ionosphere. The load of the emissions in each of these atmospheric layers depends on the stage firing, the engine type, type of fuel, burn rate of fuel, and residence time in the atmospheric layer. This methodology focuses on the tropospheric and the stratospheric layers that are generally viewed with greater environmental concern.

Total emissions associated with the proposed action and alternatives were estimated by completing the following steps:

- Estimating the emissions per launch into each layer of the atmosphere for each type of vehicle,
- Estimating the total annual launches for each type of vehicle, and
- Multiplying the number of launches by the appropriate emissions per launch.

The following sections describe the methodologies used to complete these steps for both the proposed action and alternatives.

A.1.1 Proposed Action and Alternative Activity Emissions

This EA considers three types (or concepts) of horizontally launched launch vehicles. Concept X vehicles would take off from a runway under jet power and would ignite rocket engines at a specified altitude. Concept Y vehicles would take off from a runway under rocket power. Concept Z vehicles would take off from a runway while mated to a jet-powered assist aircraft and would ignite rocket engines at a specified altitude after being released from the assist aircraft. For Concept X and Concept Z vehicles, the emissions generated by jet engines were calculated separately from rocket emissions, as described below.

The characteristics of these vehicles were developed from launch data provided on the X-Prize website (http://www.xprize.com) and from other publicly available data on LV characteristics. A brief overview of each of these vehicles is provided in Exhibit A-2.

Jet Engine Launch Emissions

To estimate jet engine emissions per launch for each vehicle, emission factors (e.g., amount of releases per take off/landing cycle) were selected based on the type and number of engines being used. Exhibit A-3 provides the total emissions below 914 meters (3,000 feet) per take off/landing cycle[18] for each vehicle type. Emissions from jet engines would also occur above 914 meters (3,000 feet). However, jet engine emissions above 914 meters (3,000 feet) from the fairly limited number of Concept X and Concept Z flights and jet-powered reentries would be very small relative to the number of annual jet aircraft flights in the U.S., and therefore these emissions are not included in the overall emission estimates. Exhibit A-7 provides the total emissions per launch, including both jet engine and rocket emissions, to each layer of the atmosphere for each vehicle type included in this analysis.

[18] The take off/landing cycle includes idle, take off, climb out to 914 meters (3,000 feet), descent starting at 914 meters (3,000 feet), approach, and landing.

Exhibit A-2. Overview of Launch Vehicle Types

Vehicle	Rocket Propellant Type	Notes
Concept X	LOX/Kerosene	Jet engine ignited for lift off; rocket engine ignited at approximately 6,096 meters (20,000 feet); jet engines stop at 24,384 meters (80,000 feet) and rocket engines stop at 45,720 meters (150,000 feet); reentry powered by reigniting jet engines
Concept Y	LOX/Kerosene	Rocket engine ignited for lift off; no jet engine; rocket engines stop at 60,960 meters (200,000 feet); un-powered reentry
Concept Z	N_2O/HTPB	Jet-powered carrier vehicle; rocket ignited at 15,240 meters (50,000 feet) and burns approximately one minute; un-powered reentry

Exhibit A-3. Jet Engine Emissions per Take Off/Landing Cycle (below 914 meters [3,000 feet])

Vehicle	Emissions, kilograms (pounds)					Source
	CO	NO_X	VOC	SO_X	PM	
Concept X	38 (83)	0.48 (1.1)	4.0 (8.8)	0.17 (0.37)	11 (24)	a
Concept Z	38 (83)	0.55 (1.2)	5.2 (12)	0.28 (0.62)	11 (24)	b

[a] CO, NO_X, VOC, SO_X for Learjet 25c (EDMS, 2004); no PM emissions were specified for Learjet 25c so it was assumed that the particulates were similar to F-14 Tomcat (EPA, 1980).
[b] CO, NO_X, VOC, SO_X for T-38 Tiger (EPA, 1980); no PM emissions were specified for T-38 Tiger so it was assumed that the particulates were similar to F-14 Tomcat (EPA, 1980).

Rocket Launch Emissions

To estimate rocket emissions per launch for each vehicle, the propellant consumed in each atmospheric layer was estimated and then multiplied by fuel-specific emission weight fractions for each pollutant. The propellant consumed in each atmospheric layer for each vehicle type was estimated using available data on the total fuel used by that vehicle type and the percentage of time spent in each layer. When vehicle-specific data were not available, data for a similar vehicle were used. The propellant type and estimated propellant consumption in each atmospheric layer for each vehicle type are provided in Exhibit A-4. Exhibits A-5 and A-6 present the emission weight fractions for the three rocket propellant types used in the LVs being evaluated in this EA. The estimated emissions per launch (from both rockets and jet engines) for each vehicle are presented in Exhibit A-7.

Exhibit A-4. Estimated Propellant Consumption by Atmospheric Layer

Vehicle	Rocket Propellantl Type	Rocket Propellant Consumption, kilograms (pounds)				
		< 914 meters (3,000 feet)	Tropo-sphere	Strato-sphere	Meso-sphere	Iono-sphere
Concept X	LOX/ Kerosene	-	432 (952)	3,242 (7,147)	-	-
Concept Y	LOX/ Kerosene	595 (1,312)	1,191 (2,626)	2,580 (5,688)	992 (2,187)	-
Concept Z	N_2O/HTPB	-	-	1,523 (3,358)	-	-

Exhibit A-5. Emission Weight Fractions for LOX/Kerosene Rocket Propellant Emissions

CO_2	CO	H_2	H_2O
0.49	0.20	0.0042	0.30

Source: U.S. DOT, 2002

Exhibit A-6. Emission Weight Fractions for N_2O/HTPB Rocket Propellant Emissions

CO_2	CO	N_2	H_2O
0.03	0.20	0.54	0.22

Source: U.S. DOT, 2001

Exhibit A-7. Total Emission Loads per Launch or Reentry for Proposed Action and Alternatives, by Vehicle

Vehicle	Emission Loads per Launch/Reentry (kilograms [pounds])							
	PM	NO_X	SO_X	CO	CO_2	H_2O	VOC	H_2
Below 914 meters (3,000 feet)								
Concept X	11 (24.2)	1 (2.2)	0.2 (0.44)	38 (83.8)	-	-	4 (8.8)	-
Concept Y	-	-	-	-[a]	478 (1.054)	179 (394.6)	-	3 (6.6)
Concept Z	11 (24.2)	1 (2.2)	0.3 (0.66)	38 (83.8)	-	-	5 (11)	-
Troposphere								
Concept X	11 (24.2)	1 (2.2)	0.2 (0.44)	124 (273.4)	212 (467.4)	130 (286.6)	4 (8.8)	2 (4.4)
Concept Y	-	-	-	-[a]	958 (2,112)	357 (787)	-	5 (11)
Concept Z	11 (24.2)	1 (2.2)	0.3 (0.33)	38 (83.8)	-	-	5 (11)	-

Vehicle	Emission Loads per Launch/Reentry (kilograms [pounds])							
	PM	NO_X	SO_X	CO	CO_2	H_2O	VOC	H_2
Stratosphere								
Concept X	-	-	-	648 (1,428.6)	1,589 (3,503)	973 (2,145)	-	14 (30.9)
Concept Y	-	-	-	516 (1,137.6)	1,264 (2,786.6)	774 (1,706)	-	11 (24.3)
Concept Z	-	-	-	305 (672)	46 (101.4)	335 (738.5)	-	-
Mesosphere								
Concept X	-	-	-	-	-	-	-	-
Concept Y	-	-	-	199 (438.7)	486 (1,071.5)	298 (657)	-	4 (8.8)
Concept Z	-	-	-	-	-	-	-	-
Ionosphere								
Concept X	-	-	-	-	-	-	-	-
Concept Y	-	-	-	-	-	-	-	-
Concept Z	-	-	-	-	-	-	-	-

[a] It is assumed that all CO emissions into the troposphere are instantaneously converted to CO_2.

A.2 Methodology for Calculating Cumulative Emissions Loads in Various Atmospheric Layers

To calculate the cumulative emission loads to each atmospheric layer, the per launch emissions estimates for launches associated with the proposed action and alternatives were multiplied by the launch estimates for each type of vehicle. The estimated numbers of launches are provided in Exhibit A-8.

For the proposed action, the estimated annual emission loads for each vehicle type and pollutant of interest were calculated for 2006 to 2010. Emission loads below 914 meters (3,000 feet) are presented in Exhibits A-9 through A-16; emission loads to the troposphere are presented in Exhibits A-17 through A-24; emission loads to the stratosphere are presented in Exhibits A-25 through A-28; and emission loads to the mesosphere are presented in Exhibits A-29 through A-32.

Exhibit A-8. Vehicle Launches Associated with the Proposed Action and Alternatives, 2006-2010

Vehicle	2006	2007	2008	2009	2010
Concept X	12	12	24	48	48
Concept Y	2	2	2	2	2
Concept Z	2	2	3	4	4

A.2.1 Estimated Annual Emission Loads below 914 meters (3,000 feet)

Exhibit A-9. Estimated Annual PM Emission Loads below 914 meters (3,000 feet)

Vehicle	PM Emission Loads (kilograms [pounds])				
	2006	**2007**	**2008**	**2009**	**2010**
Concept X	132 (291)	132 (291)	264 (582)	528 (1,164)	528 (1,164)
Concept Y	-	-	-	-	-
Concept Z	22 (48.5)	22 (48.5)	33 (72.7)	44 (97)	44 (97)

Exhibit A-10. Estimated Annual NO_X Emission Loads below 914 meters (3,000 feet)

Vehicle	NO_X Emission Loads (kilograms)				
	2006	**2007**	**2008**	**2009**	**2010**
Concept X	6 (13.2)	6 (13.2)	12 (26.4)	24 (52.9)	24 (52.9)
Concept Y	-	-	-	-	-
Concept Z	1 (2.2)	1 (2.2)	2 (4.4)	2 (4.4)	2 (4.4)

Exhibit A-11. Estimated Annual SO_X Emission Loads below 914 meters (3,000 feet)

Vehicle	SO_X Emission Loads (kilograms [pounds])				
	2006	**2007**	**2008**	**2009**	**2010**
Concept X	2 (4.4)	2 (4.4)	5 (11)	10 (22)	10 (22)
Concept Y	-	-	-	-	-
Concept Z	1 (2.2)	1 (2.2)	1 (2.2)	1 (2.2)	1 (2.2)

Exhibit A-12. Estimated Annual CO Emission Loads below 914 meters (3,000 feet)

Vehicle	CO Emission Loads (kilograms [pounds])				
	2006	**2007**	**2008**	**2009**	**2010**
Concept X	452 (996.5)	452 (996.5)	905 (1,995)	1,810 (3,990)	1,810 (3,990)
Concept Y	-	-	-	-	-
Concept Z	76 (167.5)	76 (167.5)	114 (251)	152 (335)	152 (335)

Exhibit A-13. Estimated Annual CO_2 Emission Loads below 914 meters (3,000 feet)

Vehicle	CO_2 Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	-	-	-	-	-
Concept Y	957 (2,110)	957 (2,110)	957 (2,110)	957 (2,110)	957 (2,110)
Concept Z	-	-	-	-	-

Exhibit A-14. Estimated Annual H_2O Emission Loads below 914 meters (3,000 feet)

Vehicle	H_2O Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	-	-	-	-	-
Concept Y	357 (787)	357 (787)	357 (787)	357 (787)	357 (787)
Concept Z	-	-	-	-	-

Exhibit A-15. Estimated Annual VOC Emission Loads below 914 meters (3,000 feet)

Vehicle	VOC Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	48 (105.8)	48 (105.8)	96 (211.6)	192 (423.3)	192 (423.3)
Concept Y	-	-	-	-	-
Concept Z	10 (22)	10 (22)	16 (35.3)	21 (46.3)	21 (46.3)

Exhibit A-16. Estimated Annual H_2 Emission Loads below 914 meters (3,000 feet)

Vehicle	H_2 Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	-	-	-	-	-
Concept Y	5 (11)	5 (11)	5 (11)	5 (11)	5 (11)
Concept Z	-	-	-	-	-

A.2.2 Estimated Annual Emission Loads to the Troposphere

Exhibit A-17. Estimated Annual PM Emission Loads to the Troposphere

Vehicle	PM Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	132 (291)	132 (291)	264 (582)	528 (1,164)	528 (1,164)
Concept Y	-	-	-	-	-
Concept Z	22 (48.5)	22 (48.5)	33 (72.8)	44 (97)	44 (97)

Exhibit A-18. Estimated Annual NO_X Emission Loads to the Troposphere

Vehicle	NO_X Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	6 (13.2)	6 (13.2)	12 (26.4)	24 (52.9)	24 (52.9)
Concept Y	-	-	-	-	-
Concept Z	1 (2.2)	1 (2.2)	2 (4.4)	2 (4.4)	2 (4.4)

Exhibit A-19. Estimated Annual SO_X Emission Loads to the Troposphere

Vehicle	SO_X Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	2 (4.4)	2 (2.2)	5 (11)	10 (22)	10 (22)
Concept Y	-	-	-	-	-
Concept Z	1 (2.2)	1 (2.2)	1 (2.2)	1 (2.2)	1 (2.2)

Exhibit A-20. Estimated Annual CO Emission Loads to the Troposphere

Vehicle	CO Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	1,489 (675.4)	1,489 (675.4)	2,978 (6,565)	5,956 (13,130)	5,956 (13,130)
Concept Y	-	-	-	-	-
Concept Z	76 (167.6)	76 (167.6)	114 251.3)	152 (335)	152 (335)

Exhibit A-21. Estimated Annual CO_2 Emission Loads to the Troposphere

Vehicle	CO_2 Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	2,542 (5,604)	2,542 (5,604)	5,083 (11,206)	10,166 (22,412)	10,166 (22,412)
Concept Y	1,915 (4,221.8)	1,915 (4,221.8)	1,915 (4,221.8)	1,915 (4,221.8)	1,915 (4,221.8)
Concept Z	-	-	-	-	-

Exhibit A-22. Estimated Annual H_2O Emission Loads to the Troposphere

Vehicle	H_2O Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	1,556 (3,430)	1,556 (3,430)	3,113 (6,863)	6,226 (13,726)	6,226 (13,726)
Concept Y	714 (1,574)	714 (1,574)	714 (1,574)	714 (1,574)	714 (1,574)
Concept Z	-	-	-	-	-

Exhibit A-23. Estimated Annual VOC Emission Loads to the Troposphere

Vehicle	VOC Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	48 (105.8)	48 (105.8)	96 (211.6)	192 (423.3)	192 (423.3)
Concept Y	-	-	-	-	-
Concept Z	10 (22)	10 (22)	16 (35.3)	21 (46.3)	21 (46.3)

Exhibit A-24. Estimated Annual H_2 Emission Loads to the Troposphere

Vehicle	H_2 Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	22 (48.5)	22 (48.5)	43 (94.8)	86 (189.6)	86 (189.6)
Concept Y	10 (22)	10 (22)	10 (22)	10 (22)	10 (22)
Concept Z	-	-	-	-	-

A.2.3 Estimated Annual Emission Loads to the Stratosphere

Exhibits of emission loads for the following compounds are not included in this section because under the proposed action, the vehicles' emissions will not affect the stratosphere.

- PM
- NO_X
- SO_X
- VOC

Exhibit A-25. Estimated Annual CO Emission Loads to the Stratosphere

Vehicle	CO Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	7,781 (17,154)	7,781 (17,154)	15,561 (34,306)	31,123 (68,614.5)	31,123 (68,614.5)
Concept Y	1,032 (2,275)	1,032 (2,275)	1,032 (2,275)	1,032 (2,275)	1,032 (2,275)
Concept Z	609 (1,342.6)	609 (1,342.6)	914 (2,015)	1,218 2,685)	1,218 (2,685)

Exhibit A-26. Estimated Annual CO_2 Emission Loads to the Stratosphere

Vehicle	CO_2 Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	19,062 (42,025)	19,062 (42,025)	38,124 (84,049)	76,248 (168,098)	76,248 (168,098)
Concept Y	2,528 (5,573)	2,528 (5,573)	2,528 (5,573)	2,528 (5,573)	2,528 (5,573)
Concept Z	91 (200.6)	91 (200.6)	137 (302)	183 (403.5)	183 (403.5)

Exhibit A-27. Estimated Annual H_2O Emission Loads to the Stratosphere

Vehicle	H_2O Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	11,671 (25,730)	11,671 (25,730)	23,342 (51,460)	46,685 (102,923)	46,685 (102,923)
Concept Y	1,548 (3,413)	1,548 (3,413)	1,548 (3,413)	1,548 (3,413)	1,548 (3,413)
Concept Z	670 ((1,477)	670 (1,477)	1,005 (2,216)	1,340 (2,954)	1,340 (2,954)

Exhibit A-28. Estimated Annual H_2 Emission Loads to the Stratosphere

Vehicle	H_2 Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	163 (359)	163 (359)	326 (718.7)	653 (1,439.6)	653 (1,439.6)
Concept Y	22 (48.5)	22 (48.5)	22 (48.5)	22 (48.5)	22 (48.5)
Concept Z	-	-	-	-	-

A.2.4 Estimated Annual Emission Loads to the Mesosphere

Exhibits of emission loads for the following compounds are not included in this section because under the proposed action, the vehicles' emissions will not affect the mesosphere.

- PM
- NO_X
- SO_X
- VOC

Exhibit A-29. Estimated Annual CO Emission Loads to the Mesosphere

Vehicle	CO Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	-	-	-	-	-
Concept Y	397 (875)	397 (875)	397 (875)	397 (875)	397 (875)
Concept Z	-	-	-	-	-

Exhibit A-30. Estimated Annual CO_2 Emission Loads to the Mesosphere

Vehicle	CO_2 Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	-	-	-	-	-
Concept Y	972 (2,143)	972 (2,143)	972 (2,143)	972 (2,143)	972 (2,143)
Concept Z	-	-	-	-	-

Exhibit A-31. Estimated Annual H_2O Emission Loads to the Mesosphere

Vehicle	H_2O Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	-	-	-	-	-
Concept Y	595 (1,312)	595 (1,312)	595 (1,312)	595 (1,312)	595 (1,312)
Concept Z	-	-	-	-	-

Exhibit A-32. Estimated Annual H_2 Emission Loads to the Mesosphere

Vehicle	H_2 Emission Loads (kilograms [pounds])				
	2006	2007	2008	2009	2010
Concept X	-	-	-	-	-
Concept Y	8 (17.6)	8 (17.6)	8 (17.6)	8 (17.6)	8 (17.6)
Concept Z	-	-	-	-	-

A.2.5 Estimated Annual Emission Loads to the Ionosphere

Under the proposed action, none of the vehicles' emissions will affect the ionosphere. Thus, no exhibits of emission loads for all compounds studied are included.

A.3 Methodology for Calculating Emissions Loads from Rocket Engine Tests

The emission loads associated with rocket engine tests were calculated by first estimating the amount of propellant used for each test. Then, these propellant amounts were multiplied by the appropriate propellant-specific emission weight fraction to estimate the per test emissions. Finally, the per test emissions estimate was multiplied by the estimated number of annual launches to calculate the annual emissions associated with rocket engine tests.

The rocket engine tests were assumed to be performed using a LOX/kerosene engine with a maximum thrust of 224,190 Newtons (50,400 pounds force). The worst-case (i.e., highest emission) rocket engine test was assumed to consume approximately 8,136 kilograms (17,936 pounds) of LOX/RP-1. Using the LOX/kerosene emission weight fractions from Exhibit A-5, the worst-case, per test emissions were calculated (see Exhibit A-33).

Exhibit A-33. Total Emissions Per Rocket Engine Test

	Emission Loads (kilograms [pounds])			
	CO_2	CO	H_2	H_2O
Worst-case Emissions per Test	3,986 (8,787.6)	1,627 (3,587)	34 (75)	2,441 (5,381.5)

It was assumed that 16 of these tests would be performed annually. The resulting emission loads from rocket engine tests from 2006 through 2010 are presented in Exhibit A-34.

Exhibit A-34. Estimated Annual Emissions to the Troposphere from Rocket Engine Testing

Year	Emission Loads for All Proposed Rocket Engine Tests (kilograms [pounds])			
	CO_2	CO	H_2	H_2O
2006	63,783 (140,617)	26,034 (57,395)	547 (1,206)	39,051 (86,093)
2007	63,783 (140,617)	26,034 (57,395)	547 (1,206)	39,051 (86,093)
2008	63,783 (140,617)	26,034 (57,395)	547 (1,206)	39,051 (86,093)
2009	63,783 (140,617)	26,034 (57,395)	547 (1,206)	39,051 (86,093)
2010	63,783 (140,617)	26,034 (57,395)	547 (1,206)	39,051 (86,093)

APPENDIX A References

U.S. Department of Transportation (DOT), 1992. *Environmental Impact Statement for Commercial Reentry Vehicles.* Washington. May.

U.S. DOT, 2002. *Final Environmental Assessment for the Site, Launch, Reentry, and Recovery Operations at the Kistler Launch Facility*, Nevada Test Site. April.

APPENDIX B

POTENTIAL ACCIDENT SCENARIOS

This appendix presents various accident scenarios and their associated impacts resulting from the activities considered in this EA. The appendix discusses methods and regulations, including safety criteria used by the FAA in licensing decisions for preventing and mitigating threats to public health, public safety, property, and the environment. The discussion of these topics serves as a roadmap for the additional, mission-specific analyses a licensee applicant must carry out before receiving a license from the FAA to conduct a launch or reentry.

B.1 Accidents During Ignition

Accidents during launch usually occur after the ignition of the launch vehicle's propulsion system. For the activities considered in this EA the ignition of a launch vehicle's propulsion system may take place in the air, on the ground or from an air-based launch platform (e.g., released from support aircraft). An explosion immediately after ignition of the launch vehicle propulsion system potentially represents the worst type of accident scenario because the launch vehicle contains the maximum amount of propellant it would carry throughout its mission, culminating in the greatest explosion possible. Debris and fragments from the explosion may be blown a significant distance from the ignition area. The distance this debris and fragments travel would depend on the amount and type of propellant aboard and the atmospheric conditions (e.g., wind speed, humidity levels, temperature, etc.) at the location of the explosion. A large smoke plume would rise (or fall depending on the altitude at which the accident occurred) and drift in a downwind direction, along with particulates, potentially affecting surrounding areas. Although air quality would be the environmental resource predominantly affected, the extent of the impact depends upon atmospheric conditions and the surrounding areas. See Section 4.2 for a discussion of impacts on the atmosphere from the proposed action.

To protect public health and safety, launch site personnel are sheltered at a safe distance from the launch area and are therefore protected from an explosion. The exact distance is determined by FAA regulation 14 CFR § 420.21 and Range Safety personnel. FAA regulation 14 CFR § 420.21 governs the licensing of commercial launch vehicles and requires licensees to calculate the debris dispersion radius from within the flight corridor given particular accident scenarios. OSIDA, pursuant to regulation 14 CFR § 415.35, must demonstrate that for each launch the expected average number of casualties from falling debris generated during a worst-case scenario accident does not exceed 0.00003 (30×10^{-6}). The process requires a probability and consequence assessment of all reasonably foreseeable hazardous events (e.g., inclement weather) and systems failures. These probabilities are incorporated into the flight corridor selection process, which helps minimize the risk to public health, safety, and property by ensuring flight paths intersect minimally populated areas.

For an air-based launch platform, an accident occurring in the initial 10 seconds after release from the carrier aircraft could likely expose the carrier aircraft to fragments, potentially causing an emergency landing, crash, or subsequent explosion. An air explosion of one or both the launch vehicle and carrier aircraft would send emissions into the ambient air similar to a ground-based launch accident. However, an explosion would disperse debris and fragments over a far greater area than a ground-based explosion. As stated, FAA regulations require a licensee to define a flight corridor for horizontal launch that minimizes the risk of falling debris to public health and/or property.

B.2 Accident During Vehicle Ascent or Descent

Vehicle ascent is defined as the period after the initial rocket engine is ignited when a launch vehicle is under power and rising through the atmosphere. Vehicle descent occurs after a launch vehicle reenters the atmosphere and is moving downward through the atmosphere in either a powered or unpowered landing approach. Accidents that may occur during vehicle ascent or descent include mechanical, electrical, or computer failures; fuel releases; or mid-air explosions, defined as an explosion during ascent or descent. FAA regulation 14 CFR § 431.45 requires launch vehicle licensees to prepare a comprehensive emergency response plan, part of which includes a method for notifying local officials as far in advance as possible in the event of an offsite or unplanned landing.

B.2.1 Mechanical, Electrical, or Computer Failure

Although redundant engineering of key electrical and mechanical systems aid in preventing a midair computer or mechanical failure, licensees, under FAA guidance, must present methods of mitigating the impacts of a system failure during ascent or descent. In the event of a mechanical or systems failure, an emergency landing at an alternate or unforeseen landing site may be necessary. Alternate landing sites should be chosen before launch during the development of the flight corridor. Real-time tracking and monitoring of the launch vehicle’s location using Global Positioning Systems (GPS), along with communication with FAA air traffic controllers, enables the determination of an IIP (the point at which the launch vehicle or pieces of it would land in the event of a failure).

Launch vehicles retain the capability of terminating engines and aborting mission objectives in the event that a problem arises. In case of engine failure, a launch vehicle may be equipped with a variety of safety mechanisms that allow an operator to guide the vehicle without engine power to an alternate landing site to prevent the launch vehicle and its payload from reaching any populated or protected areas. Launch vehicles may also be equipped with safety devices such as parachutes that provide a soft landing in the event of an emergency.

Should all safety mechanisms fail to prevent an uncontrolled landing, remaining fuels may ignite, resulting in a cascading fuel explosion on the ground. During ascent, spacecrafts contain greater amounts of fuels than they hold during descent. Therefore, failures that occur during ascent that result in uncontrolled landings will create larger explosions than crashes that occur during descent.

B.2.2 Midair Explosion

FAA regulation 14 CFR § 420.23 requires commercial launch licensees to design a flight corridor for the launch vehicle that minimizes risk to public health, safety, and property. Risk is minimized by ensuring the flight corridor traverses only sparsely populated areas and, in the event of a midair explosion, the debris dispersion radius falls within the flight corridor. Before a flight corridor is approved by FAA, calculated risk estimates for public endangerment from falling debris and associated impacts must meet risk tolerance criteria for public endangerment pursuant to FAA regulations 14 CFR § 417.227 and 14 CFR § 420.25. If the risk level exceeds a certain threshold value, the launch is not authorized.

The extent of a mid-air explosion would depend on the amount of fuel the launch vehicle is carrying at the time of explosion, a factor relative to the amount of time that had elapsed after initial launch. An explosion can potentially emit large amounts of emissions, debris, and fragments into the air which would disperse within the flight corridor.

B.2.3 Accident during Landing

FAA regulations require operators and mission control personnel to monitor and verify the status of safety-critical systems before enabling reentry flights to assure the vehicle can reenter safely to Earth. Should an anomaly cause an explosion during landing, the ramifications would depend on the assembly methods of the vehicle. Falling debris would likely remain within the flight corridor, thereby minimizing impacts to public safety, health, property, or the environment. Propellants would be incinerated during reentry.

Launch vehicles retain the capability of terminating engines and aborting mission objectives in the event that a problem arises. In case of engine failure, a launch vehicle may be equipped with a variety of safety mechanisms that allow an operator to guide the vehicle without engine power to an alternate landing site to prevent the launch vehicle and its payload from reaching any populated or protected area. Launch vehicles may also be equipped with safety devices such as parachutes that provide a soft landing in the event of an emergency.

B.3 Accidental Release of Propellant or Hazardous Substances

Accidental spills must be reported to the National Response Center within 24 hours if propellants/fuels, oxidizers, and associated materials or other hazardous materials as defined in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) § 101(14) (42 U.S.C. 9601.101(14)) are present on-board the launch vehicle and are spilled in volumes greater than the Reportable Quantities established by EPA under CERCLA. Spill cleanup shall then be performed in accordance with the procedures defined in the National Contingency Plan (outlined in regulation 40 CFR § 300).

In the event that the launch vehicle releases any extremely hazardous substances (listed in 40 CFR Part 355), it may also be necessary to notify the State Emergency Response Commission and the Local Emergency Planning Committee established under the Emergency Planning and Community Right-to-Know Act. (EPCRA, 40 CFR §355)

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APPENDIX C

RESPONSE TO COMMENTS

In accordance with NEPA and the implementing regulations of CEQ (40 CFR 1500-1508) the FAA initiated a public review and comment period for the Draft EA for the Oklahoma Spaceport. Twelve comment documents were received during the Draft EA comment period. Comment documents received from cooperating agencies and from other lines of business within the FAA are not included in this appendix, but were addressed in the Final EA where appropriate.

Several of the comment documents contained more than one comment. Therefore, in this appendix the FAA has reproduced the full text of each comment document as provided by the commenter. No changes were made to the comment document to correct for grammatical or spelling errors. Where appropriate, specific comments within the comment document have been identified and reproduced to allow for a specific response by the FAA.

Exhibit C-1 below provides a summary of the comment documents received during the comment period for the Draft EA. The FAA's responses to these comments appear in the order the comment documents are listed in this exhibit. Individual comments are denoted by a dash and the comment number, i.e., M004-1 is the first comment within comment document M004.

Exhibit C-1. Summary of the Comments on the Draft Environmental Assessment

Name	Organization	Comment Method	Date Authored	Comment Number
Ms. Cindy Schneberger	Private Citizen	E-mail	2/12/2006	E001
Ms. Cindy Schneberger	Private Citizen	E-mail	2/19/2006	E002
Mr. Robert Brooks	Oklahoma Archaeological Survey, The University of Oklahoma	Mail	2/7/2006	M001
Mr. Fred Nahwooksy	Comanche Tribe	Mail	2/21/2006	M002
Ms. Stephanie Krouter	Oklahoma Conservation Commission	Mail	2/13/2006	M003
Ms. Heidi Williams	Aircraft Owners and Pilots Association (AOPA)	Mail	3/8/2006	M004
Mr. Gary Morgan	Private Citizen	Written comment received at public hearing	3/9/2006	PHW001

Name	Organization	Comment Method	Date Authored	Comment Number
Ms. Cindy Schneberger	Private Citizen	Oral comment received at public hearing	3/9/2006	PHO001
Senator Gilmer Capps	Oklahoma State Senate	Oral comment received at public hearing	3/9/2006	PHO002
Mr. Bill Khourie	Oklahoma Space Industry Development Authority (OSIDA)	Oral comment received at public hearing	3/9/2006	PHO003
Mr. Ken McGill	OSIDA	Oral comment received at public hearing	3/9/2006	PHO004
Mr. John Herrington	Rocketplane	Oral comment received at public hearing	3/9/2006	PHO005

C.1 Ms. Cindy Schneberger, Private Citizen

C.1.1 Comment Document E001

Mr. Graham, My name is Cindy Schneberger, about a week ago my husband Chris and I received a copy of your Environmental Assessment Draft. We were curious as to why only a few people in our area received these books. Some of our neighbors did however receive a disc. Could you tell me why only a selected few people have received any type of information about your plans on the studies you conducted. Thank you, Cindy Schneberger

FAA Response to Comment Document E001: The FAA placed an announcement that the Draft EA was available for public review and comment in the Federal Register on February 3, 2006. More than 150 copies of the Draft EA were produced and distributed. Copies were sent to Federal, state, and local agencies who have an interest in this proposed project. In addition, copies were sent to those individuals who had indicated that they wanted to receive a copy. The FAA received requests for the document starting in 2002, when the scoping period began and scoping meetings were held in Burns Flat and Oklahoma City. It is likely that you and some of your neighbors requested to receive a copy of the document during one of these meetings. To allow for everyone in the region to view the document, copies were sent to local public libraries. In addition, the Draft EA is available on the project website (www.okspaceporteis.com) and the FAA website (http://ast.faa.gov/lrra/comp_coop.htm). The FAA's public involvement efforts are detailed in Section 1.5 of this document.

C.1.2 Comment Document E002

Could you please tell me why only a very few people like myself received a copy of the Environmental Assessment Draft? Thank You Cindy Schneberger

FAA Response to Comment Document E002: See FAA Response to Comment Document E001 above.

C.2 Mr. Robert Brooks, Oklahoma Archeological Survey

Oklahoma Archeological Survey

THE UNIVERSITY OF OKLAHOMA

February 7, 2006

Doug Graham
FAA Environmental Specialist
FAA Oklahoma Spaceport EA
ICF Consulting
9300 Lee Highway
Fairfax, VA 22031

Re: *Draft Environmental Assessment for the Oklahoma Spaceport, 2006*

Dear Mr. Graham:

I have examined the above referenced proposed action for its potential affect on Oklahoma's archaeological and historic resources. The designation and use of the current Clinton-Sherman Industrial Airpark as the Oklahoma Spaceport will not require new construction or land alteration. I concur with the assessment that this action will not bring about an affect to cultural resources and no treatment measures for nearby archaeological and Historic properties nearby are warranted at this time.

This review has been conducted in cooperation with the State Historic Preservation Office, Oklahoma Historical Society.

Sincerely,

Robert L. Brooks
State Archaeologist

Cc: SHPO

C.2.1 Comment M001-1

I concur with the assessment that this action will not bring about an effect to cultural resources and no treatment measures for nearby archeological and Historic properties nearby are warranted at this time.

FAA Response to Comment M001-1: Thank you for your comment.

C.3 Mr. Fred Nahwooksy, Comanche Tribe

COMANCHE TRIBE
NAGPRA

February 21, 2006

Doug Graham, FAA Environmental Specialist
FAA Oklahoma Spaceport EA
C/O ICF Consulting
9300 Lee Highway
Fairfax, VA 22031

Re: Draft Environmental Assessment for the Oklahoma Spaceport for the FAA to issue a launch site operator license to the Oklahoma Space Industry Development Authority to operate a launch facility at the Clinto Sherman Industrial Airpark located adjacent to the town of Burns Flat, OK

Dear Mr. Graham:

Thank you for your letter of January 27th regarding the draft Environmental Assessment as referenced above.

At this time, the Comanche Nation has no immediate concerns or issues regarding the project; however, please keep us informed of the project progress. We also would like to receive any archaeological reports and findings for the project.

We look forward to your reports on the findings and the original project activities.

Sincerely,

Fred Nahwooksy, NAGPRA Coordinator

cc: Herbert Bachner, Manager Space Systems Development Division

P.O. Box 908 • Lawton, Oklahoma 73502 • (580) 492-3754 • (580) 492-3733 FAX

C.3.1 Comment M002-1

At this time, the Comanche Nation has no immediate concerns or issues regarding the project; however, please keep us informed of the project progress. We also would like to receive any archeological reports and findings for the project.

FAA Response to Comment M002-1: The FAA has included your organization in the mailing of the Final EA and will include you in any future mailings if they occur. The FAA also will forward you any archeological reports or findings if they become available.

C.4 Ms. Stephanie Krouter, Oklahoma Conservation Commission

BRAD HENRY
GOVERNOR

MARY FALLIN
LIEUTENANT GOVERNOR

STATE OF OKLAHOMA
OKLAHOMA CONSERVATION COMMISSION

MIKE THRALLS
EXECUTIVE DIRECTOR

BEN POLLARD
ASSISTANT DIRECTOR

February 13, 2003

Mr. Doug Graham
FAA Environmental Specialist
c/o ICF Consulting
9300 Lee Highway
Fairfax, VA 22031

RE: Draft Environmental Assessment for the Oklahoma Spaceport

Dear Mr. Graham,

The Draft Environmental Assessment for the Oklahoma Spaceport has been reviewed. The Oklahoma Conservation Commission (OCC) has concerns with the 'spills or releases of fuel or materials that may impact surface water and ground water.' OCC supports mitigation activities to account for this. OCC recommends that special preventative measures be taken when preparing aircrafts, testing rocket engines, and preparing launch vehicles so incidental spills and releases will not occur. If a spill or release occurs, immediate clean up will need to take place.

If you have any questions or concerns, I can be contacted at 405/522-0221 or stephanie.kroutter@okcc.state.ok.us.

Sincerely,

Stephanie Kroutter

Stephanie Kroutter
Technical Writer
P.O. Box 53134
2401 N. Lincoln Blvd., Rm. 224
Will Rogers Building
Oklahoma City, OK 73105

C.4.1 Comment M003-1

The Oklahoma Conservation Commission (OCC) has concerns with the 'spills or releases of fuel or materials that may impact surface water and ground water.' OCC supports mitigation activities to account for this. OCC recommends that special preventative measures be taken when preparing aircrafts, testing rocket engines, and preparing launch vehicles so incidental spills and releases will not occur. If a spill or release occurs, immediate clean up will need to take place.

FAA Response to Comment M003-1: The FAA understands that spills and releases at the CSIA would need to be cleaned up immediately. OSIDA or the launch operator would be responsible for cleaning up spills, this may include the excavation, removal, and proper disposal of any contaminated soil associated with an incidental spill or release. As stated in Section 3.7.3.1 of the EA, "The CSIA fire department has developed a set of *Tactical Guidelines for Fuel Spill Procedures*, which establishes responsibility, outlines personnel duties, and provides resources and guidelines for use in the control, clean-up, and emergency response for spills or releases." Section 4.7.2.1 of the EA describes some of the measures that would be used to contain spills including the use of temporary dikes when fueling the vehicles. Finally, Section 6.4 and Exhibit ES-2 of the EA discuss mitigation measures that would be used for spill prevention, containment, and control.

C.5 Ms. Heidi Williams, Aircraft Owners and Pilots Association (AOPA)

AOPA
AIRCRAFT OWNERS AND PILOTS ASSOCIATION
421 Aviation Way • Frederick, MD 21701-4798
Telephone (301) 695-2000 • Fax (301) 695-2375
www.aopa.org

March 8, 2006

Mr. Doug Graham
FAA Environmental Specialist
FAA Oklahoma Spaceport EA
c/o ICF Consulting
9300 Lee Highway
Fairfax, VA 22031

Dear Mr. Graham,

The Aircraft Owners and Pilots Association (AOPA), on behalf of more than 406,000 members nationwide, submits the following comments regarding the environmental assessment (EA) for the proposed Oklahoma Spaceport, to be located at Clinton-Sherman Municipal Airport (CSM) in Burns Flat, Oklahoma. While AOPA supports the advancement of the commercial space industry, full consideration must be given to the impact commercial space operations will have on general aviation operations within the National Airspace System (NAS). In addition, AOPA contends that the establishment of commercial spaceports and subsequent commercial space launches must not require temporary or permanent flight restrictions for any portion of their operation.

Commercial space launches in the National Airspace System

Safety is paramount and must be the primary consideration with regard to integration of commercial space operations into the NAS. AOPA recognizes the Federal Aviation Administration (FAA) has a congressional mandate to ensure that commercial space launches provide a sufficient level of safety for all users of the NAS. However, this mandate does not justify or require temporary or permanent flight restrictions.

AOPA encourages the FAA to form a working group to examine ways in which commercial space transportation can occur seamlessly within the NAS. Considering a majority of the proposed launch vehicles will simply be altered versions of certified aircraft, the FAA should reasonably be able to provide standard separation services for non-participating aircraft.

The Oklahoma Spaceport EA

AOPA is very concerned the draft EA for the Oklahoma Spaceport does not adequately assess the impacts that commercial space launches from Burns Flat will have on general aviation flight operations. While a number of potential impacts are identified in the draft EA, the study does not reveal how those impacts will affect general aviation flight

Member of International Council of Aircraft Owner and Pilot Associations

Mr. Doug Grahem
Page 2
March 8, 2006

operations at CSM or within the State of Oklahoma. For example, page 4-13 says "transporting the vehicle and vehicle components to the CSTA could have the potential to impact airspace if this activity were accomplished using aircraft." The draft EA provides no subsequent explanation on how often this operation is expected to occur, what impacts this will have on the NAS and airspace users or how the FAA will mitigate the impacts. In addition, the draft EA mentions temporary flight restrictions may be implemented during launches and recoveries from the Oklahoma Spaceport, but does not address the impacts associated with those restrictions.

According to the draft EA, the launch corridors have been designed around jet routes, but there is no analysis of the impacts to Victor Airways or popular Visual Flight Rules (VFR) transition routes associated with the launch. The northwest and southwest corridors that have been proposed for the commercial space launches have the potential to impact over 16 Victor Airways and restrict all east-west transitions through the State of Oklahoma when coupled with the surrounding special-use airspace. These corridors are by de facto, large airspace restrictions that potentially prohibit access to the rest of the NAS for aircraft based in and around the proposed Oklahoma Spaceport. A complete assessment of the impacts on all airspace routes, both VFR and Instrument Flight Rules (IFR) routes, must be incorporated in the final EA before full consideration is given to the establishment of the commercial spaceport at CSM.

AOPA contends that the large amount of ambiguity that exists in the draft EA must be eliminated, and the FAA must fully examine the impacts of the proposed spaceport establishment on general aviation operations. In the draft EA, the FAA does not assume to even know the anticipated flight mission at the Oklahoma Spaceport (described on page 4-14). The full impact to the NAS cannot be analyzed without detailed knowledge and an explanation of the anticipated launch mission.

AOPA appreciates the opportunity to provide comments on the draft EA for the Oklahoma Spaceport. Prior to the establishment of the Oklahoma or any other commercial spaceport, we strongly encourage the FAA to fully examine all of the associated impacts of commercial space launches on general aviation operations and describe and analyze those impacts in the final EA.

Sincerely,

Heidi Williams
Director
Air Traffic Services

C.5.1 Comment M004-1

AOPA recognizes the Federal Aviation Administration (FAA) has a congressional mandate to ensure that commercial space launches provide a sufficient level of safety for all users of the NAS. However, this mandate does not justify or require temporary or permanent flight restrictions.

FAA Response to Comment M004-1: As stated by the commenter the FAA has a congressional mandate to ensure protection of the public, property, and the national security and foreign policy interests of the U.S. during a commercial launch or re-entry activity and to encourage, facilitate, and promote U.S. commercial space transportation.

To fulfill this mission, the FAA determines what actions are necessary during commercial launches to ensure an adequate margin of safety. These actions may include temporary or in some instances permanent flight restrictions. As stated in the EA, the FAA anticipates that this proposed action and the limited number of launches associated with it would only require temporary flight restrictions.

C.5.2 Comment M004-2

AOPA encourages the FAA to form a working group to examine ways in which commercial space transportation can occur seamlessly within the NAS. Considering a majority of the proposed launch vehicles will simply be altered versions of certified aircraft, the FAA should reasonably be able to provide standard separation services for non-participating aircraft.

FAA Response M004-2: All launch activities occurring at the CSIA would need to be conducted in accordance with established airspace agreements and in coordination with the ATRCC. Therefore, the FAA will be able to effectively ensure that commercial space transportation can occur within the NAS without the need to establish a workgroup. The FAA has staff dedicated to addressing all airspace issues of commercial space launches as well as general aviation. The FAA plans to provide separation services for non-participating aircraft under their control. For aircraft not under the direct control of Air Traffic Control, appropriate Notices to Airmen (NOTAMs) will be issued to advise them of any potential hazardous operations.

C.5.3 Comment M004-3

AOPA is very concerned the draft EA for the Oklahoma Spaceport does not adequately assess the impacts that commercial space launches from Burns Flat will have on general aviation flight operations. While a number of potential impacts are identified in the draft EA, the study does not reveal how those impacts will affect general aviation flight operations at CSM or within the State of Oklahoma. For example, page 4-13 says “transporting the vehicle and vehicle components to the CSIA could have the potential to impact airspace if this activity were accomplished using aircraft.” The draft EA provides no subsequent explanation on how often this operation is expected to occur, what impacts this will have on the NAS and airspace users or how the FAA will mitigate the impacts.

FAA Response to Comment M004-3: The remainder of the paragraph on page 4-13 states “However, because of the relatively small number of aircraft operations that would be needed to transport vehicles and vehicle components and the availability of airspace in the area, there would be no appreciable degradation of the FAA’s ability to control air traffic and provide necessary safety resulting from the transportation of vehicles or vehicle components via aircraft.” This infrequent type of aircraft operations should not be any different from that of a military cargo aircraft that lands at the CSIA. As stated in the EA, the FAA will work to mitigate impacts to airspace by coordinating flight and landing times so that they do not interfere with general aviation or other airport operations at the CSIA.

C.5.4 Comment M004-4

In addition, the draft EA mentions temporary flight restrictions may be implemented during launches and recoveries from the Oklahoma Spaceport, but does not address the impacts associated with those restrictions.

> ***FAA Response to Comment M004-4:*** The EA states that it is anticipated that airspace closures for flight missions from the CSIA would require a maximum of 2.5 to 3 hours of airspace closure. Assuming that this represents a worst case scenario in terms of airspace closure time, this would close the airspace at the CSIA for less than 2 percent of the available time. Because of the capacity at the CSIA and efforts to conduct launches during off-peak airspace use, this would not represent a substantial impact on airspace availability at the CSIA. The specific amount of airspace closure time required for each mission would be developed in conjunction with OSIDA, ARTCC, and the launch operator to ensure flights would not appreciably impact airspace availability for the existing aircraft activities at the CSIA. Each mission trajectory would need to have specific jet route closures detailed and coordinated through the ARTCC. The FAA would implement these temporary airspace closures to ensure the safety of the uninvolved public.

C.5.5 Comment M004-5

According to the draft EA, the launch corridors have been designed around jet routes, but there is no analysis of the impacts to Victor Airways or popular Visual Flight Rules (VFR) transition routes associated with the launch. The northwest and southwest corridors that have been proposed for the commercial space launches have the potential to impact over 16 Victor Airways and restrict all east-west transitions through the State of Oklahoma when coupled with the surrounding special-use airspace. These corridors are by de facto, large airspace restrictions that potentially prohibit access to the rest of the NAS for aircraft based in and around the proposed Oklahoma Spaceport. A complete assessment of the impacts on all airspace routes, both VFR and Instrument Flight Rules (IFR) routes, must be incorporated in the final EA before full consideration is given to the establishment of the commercial spaceport at CSM.

> ***FAA Response to Comment M004-5:*** The EA states that "The descent [of a launch vehicle] would be planned and coordinated with the ARTCC prior to the launch to ensure that other aircraft operating in the region would not be impacted. During descent, the lower level victor routes in the vicinity of the CSIA could be impacted. However, the planned landing trajectory would be announced in NOTAMs, to preclude conflicts with any other aircraft operating in the area, including aircraft operating under VFR. In addition, as stated above, the temporary closures would, at a maximum, affect the airspace for no more than two percent of the available time. The EA also notes that efforts would be made to schedule the up to 54 annual launches at times when the airspace is not heavily used to further mitigate possible impacts to other users. As required, the EA provides an analysis that is commensurate with the potential for impact resulting from the proposed action and reasonable alternatives.

C.5.6 Comment M004-6

AOPA contends that the large amount of ambiguity that exists in the draft EA must be eliminated, and the FAA must fully examine the impacts of the proposed spaceport establishment on general aviation operations. In the draft EA, the FAA does not assume to even know the anticipated flight mission at the Oklahoma Spaceport (described on page 4-14). The full impact to the NAS cannot be analyzed without detailed knowledge and an explanation of the anticipated launch mission.

> ***FAA Response to Comment M004-6:*** The purpose of this document is to analyze the environmental impacts of issuing a launch site operator license to OSIDA for the CSIA. Flight mission details for specific flights are not required for issuing a launch site operator license. The proposed flights at the CSIA would fall within the scope of Concept X, Y and Z launch vehicles as outlined in Section 2.1.4 in the EA. In addition, the FAA has determined a maximum number of launches that would be allowed to occur from the facility in any given year. These up to 54 annual launches would require temporary closures of the airspace representing less than two percent of the available time. The FAA would further mitigate the impact of launch activities on other airspace users by coordinating and scheduling launch activities during times of off-peak airspace use.

C.6 Mr. Gary Morgan

C.6.1 Comment PHW001

COMMENT FORM

Federal Aviation Administration
Draft Environmental Assessment for the
Proposed Oklahoma Spaceport

Please include your name and contact information so that we can add you to our mailing list if you would like to receive subsequent information on the project. Thank you for taking the time to provide us with your comments.

Name: [illegible]

Address: [illegible]

Organization: ____

E-mail Address: ____

Add to Mailing List? Yes ✓ No ____

If yes: Paper copy of the Final Executive Summary ___
CD ROM of the Final Environmental Assessment

Deadline to Submit Comments on the Draft Environmental Assessment: March 13, 2006

What comments do you have on the Draft Environmental Assessment? (Please be as specific as possible)

[illegible]

FAA Response to Comment PHW001: Thank you for your comment.

C.7 Ms. Cindy Schneberger

C.7.1 Comment PHO001-1

You know, a lot of people have a lot of questions that they don't ever get answered. And the one thing that concerned me is like the territory called the Spaceport Territory. And of course, my home's in that. And a lot of them wonder what you can do for that?

Now, is this Spaceport Territory, is that the land, the air, or what is that?

FAA Response to Comment PHO0001-1: The Spaceport Territory is a geographic land area designed to provide a launch pad and area contiguous to a spaceport. This geographic area would be used to protect the surrounding area from health and safety hazards as a result of the operation of the spaceport. The OSIDA Board of Directors was given the authority to regulate development within the Spaceport Territory. The Board may increase or decrease the geographical limits of the Spaceport Territory upon written consent of the simple majority of all land owners included within the existing territory, or by vote of a majority of landowners in the area to be annexed or excluded. The proposed action being considered in this EA did not consider the need for a launch pad or an area contiguous to a spaceport because only horizontal launches were anticipated to occur from the proposed location.

C.7.2 Comment PHO0001-2

And then, also like the statistics of how much the value of our homes and minerals and things listed in the book, that concerns me because I paid a lot more for my home that what's listed. And I know that you put this up and you can always say, well, now, when I come in there I can just take it for nothing.

But that's just concerns that I'm saying for the people that live in this area. And, you know, I would just like to have some of those questions answered about, you know, the territory and where you got your statistics for the value of land and property and homes?

FAA Response to Comment PHO001-2: Determining the property values of private land within the Spaceport Territory is outside of the scope of this EA. As noted in the EA, the Spaceport Territory was designated by the Oklahoma State legislature, not the FAA. The EA states that "This Spaceport Territory was designated to provide a launch pad and a geographic area contiguous to a launch facility that would be used to protect the surrounding areas from health and safety hazards as a result of the operation of the launch facility. In addition to establishing the Territory, the Legislature also established a Spaceport Territory Advisory Council made up of a member of the Washita County Commissioners and the Mayors of Burns Flat and Canute. Their authority includes setting zoning, collecting fees, ownership of utilities and roads, and the power to condemn up to 10 hectares (25 acres) of land in the territory. Section 3.9.3.1 provides more detail on the Spaceport Territory."

The purchase of private land within the Spaceport Territory was not considered necessary as a result of this proposed action. The types of activities proposed to be conducted at the CSIA would not warrant the creation of a larger safety barrier than already exists at the CSIA. If the scope of the proposed action changes to includes different types of activities at the CSIA in the future, the FAA would evaluate the potential environmental impacts of those actions. However, details specific to the purchase price of land in the future or the property value of that land would be outside the scope of the FAA's purview.

C.8 Senator Gilmer Capps

C.8.1 Comment PHO002

I didn't know I was going to be first.

Well, first of all, I'm State Senator Gilmer Capps, and I've been in the Senate for 36 – this is my 36th year and I've been in Clinton-Sherman Industrial Park in my district here since I've been in office. In fact, I was elected about two or three years after the base went out.

But I am very excited about this project. We have tried to get industry to come in to the Clinton-Sherman for a number of years. We've had some that have come in but not many of them that would relate to the air travel or the Aerospace Industry for sure.

As most of you know, we became involved when it looked like the Federal Building and the Lockheed-Martin and Boeing and the rest of them was working on a deal which would be the new space vehicle which was called Victory Star [sic.] I went out on that a couple of times and we looked at Victory Star [sic.] and we have some slides to look at and they wanted it to be a site and we qualified there.

They wanted it to be in a sparsely populated area. We don't like it that we are but we are in a sparsely populated area. An within, you know, my 36 years, I've feel like this is the only industry we can get to take advantage of those things I just mentioned. And our whole purpose is to teach young people and work with them and make sure they're home and in Oklahoma.

Now, you people we have an outstanding company. In fact, I have had two or three companies – 14 companies looked at Clinton-Sherman. We've had about three companies in Oklahoma. Optic Planes is probably the leading one. And I went up to Guthrie at the airport today. Of course, they are working on their vehicle. And we are leading the other states. And I had the chance to be in New Mexico recently and they was fearful that we would be giving them competition. And our statement to them was, well, we want to work with you because we are going to need Spaceports in New Mexico and Oklahoma so we can go back and forth and John can fly the vehicle from one Spaceport to the other. It's just very existing bit it's real.

A lot of people have had trouble saying, it's not going to happen. But let me tell you what, I have traveled this United States probably at the expense of you taxpayers, but let me tell you what, I have met a lot of interesting people in the space industry and they love Oklahoma. You have to get out of the state or almost out of the United States to find out what Oklahoma has.

Japan has found out about us, they love us. And I tell you what, it's just one of the best things I've seen in my 36 years.

Mr. Graham, I appreciate you working with us. I was in the FAA office with Patricia Graysmith [sic.] on 9-11, remember that day? That's where I was when the plane hit the Pentagon in D.C.

It looks good and we appreciate all of the help that the FAA has given us and, people, let's just make it happen. Thank you.

FAA Response to Comment PHO002: Thank you for your comment.

C.9 Mr. Bill Khourie

C.9.1 Comment PHO003

Good evening and thank you all for being here this evening. We've waited a long time for this meeting to happen. We've been working several years to make this come to this point and time, not only to help Oklahoma prosper, Western Oklahoma, our young people, the Aerospace Industry, we are bringing attention to Oklahoma at a point in time where it's not only national but it's global.

I'm excited about this and on many different occasions I've have people ask me is this really going to happen? Yes, it's really going to happen. It's going to happen with your assistance. We're excited about it. We've got a group of board members and a chairman that have worked extremely hard and have gone way above and beyond the call of duty to make sure that we stayed focused on our mission and that we are able to obtain the goals that we are setting out to attain. Over to your left, our Chairman Ken McGill, next to him Don Rodolf, Mr. Joe King, Mr. Sims from Hobart, Phil Clever, Todd Russ.

They've worked very diligently on behalf of this agency and the State of Oklahoma and for you so that hopefully we can bring high-tech industry to Oklahoma and provide opportunities for our young people.

FAA Response to Comment PHO003: Thank you for your comment.

C.10 Mr. Ken McGill

C.10.1 Comment PHO004

A transcript copy of this statement was not available. Mr. McGill expressed support of the proposed spaceport on behalf of OSIDA and gave an update on OSIDA's vision and proposed schedule for the spaceport.

FAA Response to Comment PHO004: Thank you for your comment.

C.11 Mr. John Herrington

C.11.1 Comment PHO005

A transcript copy of this statement was not available. Mr. Herrington expressed support of the proposed spaceport on behalf of Rocketplane and gave a statement on his professional experience and Rocketplane's proposed operations at the CSIA.

FAA Response to Comment PHO005: Thank you for your comment.