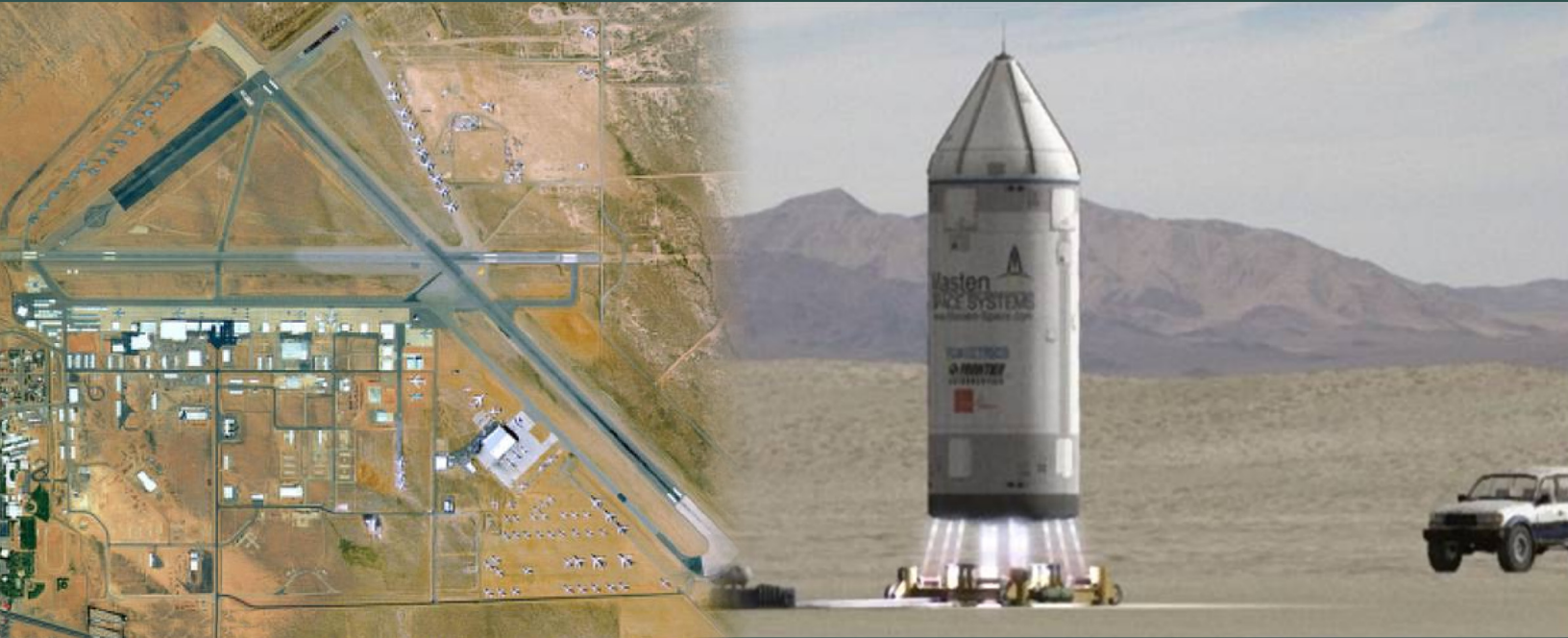




FAA
Commercial Space
Transportation



Masten Space Systems Environmental Assessment

August 2006

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AGENCY: Federal Aviation Administration (FAA)

ABSTRACT: In accordance with NEPA regulations, the FAA is announcing the availability of the Masten Space Systems Environmental Assessment (EA) and Finding of No Significant Impact (FONSI). Under the proposed action, the FAA would issue experimental permits to Masten Space Systems for test flights of its XA0.1, XA0.2, and XL0.1 reusable suborbital rockets. The FAA would issue a separate experimental permit for each suborbital rocket design. This EA evaluates the impacts of launching and landing the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets at the Mojave Airport in Mojave, California.

Potential impacts of the proposed action and alternatives were analyzed in the EA. Potential environmental impacts that were considered 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 EA.

CONTACT INFORMATION: The notice of availability of the EA and FONSI was published in local papers in August 2006. Both documents can be downloaded from the FAA website at <http://ast.faa.gov/files/>. Questions or additional information on the EA and FONSI can be requested from: Ms. Stacey M. Zee, Federal Aviation Administration, Office of Commercial Space Transportation, 800 Independence Ave SW, Suite 331, Washington, DC 20591; fax (202) 267-5463. All requests should reference "Masten Space Systems EA."

This EA 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 FAA would issue experimental permits to Masten Space Systems for test flights of its XA0.1, XA0.2, and XL0.1 reusable suborbital rockets. The FAA would issue a separate experimental permit for each suborbital rocket design. The decision to issue experimental permits for launch and reentries of reusable suborbital rockets by the FAA is considered a major Federal action; consequently, the FAA is responsible for analyzing the environmental impacts associated with permitting proposed launches and reentries as required by NEPA.

For the purposes of this EA, the FAA examined the environmental impacts associated with the launch activities of the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets to make an informed decision on whether to issue experimental permits to Masten Space Systems. If in the future Masten Space Systems develops plans to conduct launch activities in a manner not authorized by the experimental permit(s), it would have to apply to the FAA for modification of the permit. Application for modification to the experimental permit also would be mandatory if any representation contained in the permit application that is material to public health and safety or the safety of property, is no longer accurate or complete.

Purpose and Need

The purpose of the proposed action is for Masten Space Systems to test its XA0.1, XA0.2, and XL0.1 reusable suborbital rockets. The company's intent is to use the initial tests of the XA0.1 and XA0.2 rockets to further refine the construction, propulsion, and flight control software/hardware technology of the XL0.1 rocket in preparation for the X Prize Cup competition and NASA's Lunar Lander Challenge competition. The XL0.1 rocket would be used to demonstrate reusable vertical takeoff and vertical landing technologies for a lunar lander.

This action is necessary for Masten Space Systems to test its reusable suborbital rockets and the associated technologies in preparation for the X Prize Cup competition, which is scheduled for October 2006 at the Las Cruces International Airport in Las Cruces, New Mexico.

Description of the Proposed Action/Preferred Alternative

The proposed action is for the FAA to issue experimental permits to Masten Space Systems for test flights of its XA0.1, XA0.2, and XL0.1 reusable suborbital rockets at the Mojave Airport in Mojave, California. The FAA would issue a separate permit for each suborbital rocket design. The permits would cover launch and landing activities at the primary site shown in Exhibit 2-1. The proposed action includes the construction of two concrete launch pads at the primary site that measure 3 meters by 3 meters (10 feet by 10 feet) each.

Pre-flight activities would consist of suborbital rocket positioning, flight control diagnostics checks, and propellant loading. Flight tests would consist of vertical launch, lateral travel, and vertical landing. Tests conducted at the Mojave Airport would not rise above 152 meters

(500 feet). The longest of these tests would last approximately 107 seconds at 100 percent throttle or 179 seconds at 60 percent throttle. The powered duration of the flight would be no more than 150 seconds; most tests would occur for no more than 60 seconds. Landing activities would include shut down of flight control systems and purges of remaining pressurants and propellants.

An experimental permit authorizes an unlimited number of launches and landings for a particular reusable suborbital rocket design within a one-year period; however, Masten Space Systems has indicated that it would conduct the majority of its operations during a two-month period culminating in the X Prize Cup competition scheduled for October 2006. Therefore, this EA analyzes a maximum number of 50 test flights occurring during a proposed two-month period of operations.

Description of Alternatives and No Action

The FAA specifically identified two alternatives to the proposed action, which are considered in this EA. Under alternative 1, concrete launch/landing pad construction and flight test operations would occur at the secondary pad location site as shown in Exhibit 2-1. The same activities would occur as described for the proposed action. This EA conservatively assumes that all 50 flight tests would be conducted using the largest of the three suborbital rockets (see Section 2.1.2), thus the FAA did not specifically analyze alternatives and impacts associated with issuing a subset of experimental permits for a mix of rockets (e.g., permit one or two, but not all, of the reusable suborbital rockets types) because the impacts would be within the range analyzed and expected to produce fewer impacts. However, the FAA may decide to issue experimental permits to only a subset of Masten's proposed reusable suborbital rockets.

Under the no action alternative, the FAA would not issue experimental permits to Masten Space Systems, and there would be no flight tests of its XA0.1, XA0.2, and XL0.1 suborbital rockets at the proposed site. The Mojave Airport would continue its current services as a general aviation airport and commercial launch site. Masten Space Systems would not be able to test the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets and the associated technologies in preparation for the X Prize Cup competition from this location.

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 focus 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. The Region of Influence (ROI), which describes a region that comprises the area that could be affected by the proposed action or alternatives, was also considered. The environmental consequences associated with the proposed action, alternative 1, and the no action alternative, were analyzed within the ROI.

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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	No Action Alternative
Air Resources	Launch operations would result in carbon monoxide (CO) emissions, and ground support operations would result in CO, nitrogen oxides, volatile organic compounds, and particulate matter emissions. Eastern Kern County is in non-attainment for ozone for NAAQS standards; however, air analyses show that there would be no exceedances of the NAAQS from the proposed action and a NAAQS assessment would not be required to evaluate the potential for significant air quality impacts under NEPA. Emissions would not be regionally significant (i.e., would not equal or exceed 10 percent of regional emissions inventory for the air quality control area for any criteria pollutant) and would not require a Federal conformity analysis.	Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on air quality would be the same as those discussed for the proposed action.	Under the no action alternative, the FAA would not issue experimental permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impacts on air quality.
Airspace	Masten would need to coordinate with the Mojave Air Traffic Control Tower for their proposed operations. Tests conducted at the Mojave Airport would not reach heights above 152 meters (500 feet) and would occur entirely within Class E airspace. The increase in low altitude flights would not exceed the capabilities of the Mojave Air Traffic Control Tower and would not result in a significantly higher probability of in-flight mishaps. No military training routes, en route airways, jet routes or surrounding airport airspaces intersect the Mojave Airport airspace. Therefore, the proposed action would not significantly impact airspace activities.	Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on airspace would be the same as those discussed for the proposed action.	Under the no action alternative, the FAA would not issue experimental permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no change in existing airspace activities.

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Resource Area	Proposed Action	Alternative 1	No Action Alternative
Biological Resources	<p>No federally protected wetlands, riparian habitat, or other ecologically critical areas are located at the Mojave Airport; therefore no adverse effects on these areas would occur. The habitat that would be lost due to launch/landing pad construction is similar to other habitat in the area and the wildlife species that would be displaced by the activities would be able to relocate to these areas. A maximum of 50 test flights would result in infrequent short-term increases in emissions and noise as compared to existing flight operations in the region; thus impacts on biological resources would not be significant. Two state/federally protected threatened species, the Mohave ground squirrel and desert tortoise, have limited potential to occur at the Mojave Airport. If observed on the airport property, personnel would follow appropriate U.S. Fish and Wildlife Service (USFWS) and California Department of Fish and Game (CDFG) protocol. The FAA has an agreement with USFWS to conduct visual surveys of launch and landing areas prior to test flight activities as a protective measure for desert tortoises that may be within the Mojave Airport fence.</p>	<p>Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on biological resources would be the same as those discussed for the proposed action.</p>	<p>Under the no action alternative, the FAA would not issue experimental permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impact on biological resources.</p>
Cultural Resources	<p>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 (National Register) exist within the Mojave Airport property, and the proposed action would not affect any sites that may be potentially eligible. No sites on the California list of State Historical Landmarks occur within the Mojave Airport, thus the proposed action would have no adverse impact on state historical resources. Because no notable Tribal cultural resources are located at the airport, adverse effects on Tribal cultural resources would not be anticipated.</p>	<p>Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on cultural resources would be the same as those discussed for the proposed action.</p>	<p>Under the no action alternative, the FAA would not issue experimental permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impact on cultural resources.</p>

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Resource Area	Proposed Action	Alternative 1	No Action Alternative
<p>Geology and Soils</p>	<p>Impacts to geology and surface soils could occur from launch pad construction, deposition of exhaust emissions from vehicle launches, deposition of residual propellant during a vehicle crash, or from spills during propellant loading. Construction would disturb 18.6 square meters (200 square feet) of ground, but the small size of the disturbance and the use of best management practices would mitigate any substantial erosion or loss of topsoil. The limited number of launches and the airport’s spill response plan would limit the likelihood of soil contamination or impacts on geology. Therefore, the proposed tests would not result in substantial contamination, erosion or loss of topsoil nor cause impacts on geology.</p>	<p>Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on geology and soils would be the same as those discussed for the proposed action.</p>	<p>Under the no action alternative, the FAA would not issue experimental permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impact on geology and soils.</p>
<p>Hazardous Materials and Waste</p>	<p>Propellants would be shipped to the Mojave Airport on an as-needed basis and would not be stored at the site for extended periods of time. Propellant loading operations would occur at a designated staging area. If a spill occurs, Masten would conform to the Mojave Airport’s spill prevention control plan, which would minimize impacts to the environment. All propellants and other hazardous materials would be handled, stored, and used in compliance with all applicable regulations. Hazardous materials that would be used for the proposed action are similar to materials already handled at the Mojave Airport. The transport, use, or disposal of hazardous materials associated with operations under the proposed action would not pose a substantial hazard to the public or the environment. On site waste management capacity at the Mojave Airport is adequate to manage the quantity of hazardous waste generated by the proposed action. Masten Space Systems would adhere to standard hazardous waste management procedures that would serve to minimize releases and ensure treatment and disposal in accordance with Resource Conservation and Recovery Act (RCRA) regulations and other applicable regulations.</p>	<p>Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts of hazardous materials and hazardous waste management would be the same as those discussed for the proposed action.</p>	<p>Under the no action alternative, the FAA would not issue experimental permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impacts associated with hazardous materials or hazardous waste management.</p>

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Resource Area	Proposed Action	Alternative 1	No Action Alternative
Health and Safety	<p>Trained ground crew personnel would follow established standard operating procedures during propellant loading in accordance with all applicable safety regulations. Additional propellant deliveries should not materially increase the number of traffic accidents on the roadways in and around the Mojave Airport. All hazardous materials transportation would meet applicable Department of Transportation Hazardous Materials Regulations to minimize potential releases, fires, and explosions. During launch operations, Masten Space Systems would verify that all ground crew personnel and members of the public are outside of the designated safety clear zone before and during each launch. Potential health and safety impacts could occur in the unlikely event of a failure during the takeoff, mid-flight, or landing phase; however, the XA0.1, XA0.2, and XL0.1 are unmanned reusable suborbital rockets and no flight personnel would be onboard the rocket. Because of these established safety mitigation measures, no significant health and safety impacts are expected.</p>	<p>Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on health and safety would be the same as those discussed for the proposed action.</p>	<p>Under the no action alternative, the FAA would not issue experimental permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impacts on health and safety.</p>

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Resource Area	Proposed Action	Alternative 1	No Action Alternative
Land Use	<p>The proposed suborbital rocket testing would take place in land use zone B1, and the proposed action meets acceptable use criteria for that zone. Although vertical launches and landings are not currently conducted at Mojave Airport, the suborbital rockets are smaller, less powerful, and are expected to produce less noise than the horizontally launched vehicles that have been previously analyzed and launched from the airport. Runway 22 may need to be closed during suborbital rocket testing, but the airport would not be shut down. Therefore, there would not be a significant change in airport activities under the proposed action. All land uses and building restrictions in the primary compatibility criteria zones on the Mojave Airport would be maintained as defined in the Kern County Airport Land Use Compatibility Plan (ALUCP). No farmlands or agricultural use lands are located on the Mojave Airport. No prime farmland, unique farmland, farmland of state importance, or general farmland would be converted to a non-agricultural use as a result of the proposed action. No parks, recreational facilities, or Section 4(f) resources are located within the Mojave Airport property, and thus no impacts on these land uses and resources would be expected.</p>	<p>Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on land use would be the same as those discussed for the proposed action.</p>	<p>Under the no action alternative, the FAA would not issue experimental permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur, and land use at the Mojave Airport would not be impacted.</p>

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Resource Area	Proposed Action	Alternative 1	No Action Alternative
Noise	<p>It is anticipated that the noise levels produced by the launch of the XL0.1 vehicle would be lower than the noise levels produced by aircraft already in use at the Mojave Airport. Because the Mojave Airport currently experiences high intensity noise levels due to military jet flights and stationary rocket engine testing, and because the additional noise level would be much lower than existing noises, impacts on noise levels during launches at the Mojave Airport would be insignificant. The proposed action would not expose persons to or generate noise levels in excess of standards established by the California State Building Code, the California Land Use Compatibility for Community Noise Environments guidelines, the Kern County General Plan, the Mojave Specific Plan, or the Kern County ALUCP. The proposed action would not result in a significant permanent or temporary increase in ambient noise at or near the Mojave Airport.</p>	<p>Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on ambient noise levels would be the same as those discussed for the proposed action.</p>	<p>Under the no action alternative, the FAA would not issue experimental permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no change in existing noise levels.</p>
Socioeconomics and Environmental Justice	<p>Because no new development would be required to support the proposed action and existing personnel would be used to conduct suborbital rocket testing, it would not induce significant population growth in the Mojave census-designated place. Because the proposed action would occur entirely on airport property, no disruption to local businesses would be expected. No jobs would be created or eliminated as a result of the proposed action; therefore no impacts to employment or housing demand would be expected. Short-term noise impacts associated with the proposed action would not have an impact on the health or environment of minority or low-income populations located at or near the airport. Effects from the proposed action are not concentrated in an area that might contain proportionally more children; thus the impacts of the proposed action on children's health and safety should not be disproportionate as defined under Executive Order 13045.</p>	<p>Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on socioeconomics, environmental justice, and children's health would be the same as those discussed for the proposed action</p>	<p>Under the no action alternative, the FAA would not issue experimental permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur, and there would be no change in current activities at the Mojave Airport. Therefore, there would be no impacts on socioeconomics, environmental justice, or children's health.</p>

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Resource Area	Proposed Action	Alternative 1	No Action Alternative
Transportation	<p>The increased road traffic that would result from transporting propellants, equipment and personnel to and from the proposed launch site would only add a few vehicles to existing traffic loads on Business SR-58. Currently, the Mojave Airport receives approximately 264 deliveries annually. (FAA, 2004) Activities under the proposed action would increase the number of deliveries by only a few shipments. The small number of additional passenger vehicles and delivery trucks anticipated as part of the proposed action would not materially increase the number of traffic accidents, increase traffic congestion, or cause a decline in the level of service of local roadways.</p>	<p>Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on transportation would be the same as those discussed for the proposed action.</p>	<p>Under the no action alternative, the FAA would not issue experimental permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impacts on transportation.</p>
Visual Resources	<p>The construction of two concrete pads under the proposed action would be similar to existing airport infrastructure and would not significantly alter the current visual landscape. Vertically oriented rocket-powered flight tests might attract and dominate the attention of a viewer in this area when compared to the horizontally launched rockets and aircraft currently in operation at the airport. In these few cases the launch itself might be “visually dominant”; however, the relatively small number of flight tests (a maximum of 50 over a two-month period) and the temporary nature of the visual change (a maximum flight time of three minutes per test) would mitigate any resulting impacts. In addition, the Mojave Airport, as an active airport and industrial site, is a low visual sensitivity area; thus the resulting impact rating for “visually dominant” intensity ratings would be adverse but not significant. Masten Space Systems has not proposed any nighttime operations at this time.</p>	<p>Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on visual resources would be the same as those discussed for the proposed action.</p>	<p>Under the no action alternative, the FAA would not issue experimental permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impacts on visual resources.</p>

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Resource Area	Proposed Action	Alternative 1	No Action Alternative
Water Resources	<p>Surface water bodies, wetlands, and wild and scenic rivers are not present at the Mojave Airport; therefore these resources would not be adversely impacted by proposed test flight operations. No significant impacts to ground water quality would be expected from accidental releases of propellants into the environment because they are non-toxic and rapidly biodegradable. The proposed action would not substantially deplete ground water supplies or result in any contaminant releases that would cause violations of local, state, or Federal water quality requirements. The existing storm water system and permit would be adequate for the proposed action. The Mojave Airport is not located within the 100-year flood plain or California’s coastal zone as defined in the state Coastal Zone Management Plan. The proposed action is not required to conform to the California Coastal Zone Management Plan.</p>	<p>Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on water resources would be the same as those discussed for the proposed action.</p>	<p>Under the no action alternative, the FAA would not issue experimental permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impacts on water resources.</p>

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 actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions.” (40 Code of Federal Regulations [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

- Ongoing commercial, military, and private aviation activities at the Mojave Airport,
- Activities described as part of the proposed action, and
- A series of up to 65 tethered flight tests of the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets. Tethered flight tests would involve the use of equipment to prevent the vehicle from rising above 2.1 meters (7 feet) and rocket engine firings of up to 3 minutes. These types of tests would not require a license or permit from the FAA.

The proposed action has been evaluated for cumulative impacts on air quality, airspace, biological resources, hazardous materials, health and safety, noise, transportation, visual resources, and water resources. The results of this evaluation are summarized below.

- **Air Quality** - The launch of up to 50 vertically launched suborbital vehicles in 2006 in conjunction with other aircraft operations and tethered tests at the Mojave Airport, would not result in emissions considered regionally significant or in excess of specific *de minimis* levels for criteria pollutants under the General Conformity Regulations (40 CFR 150 et seq.) for areas that are in non-attainment for Federal ambient air quality standards. Analyses of emissions from past, present, and reasonably foreseeable future actions show that there would be no exceedances of the NAAQS for all criteria pollutants. Therefore, a NAAQS assessment would not be required to evaluate the potential for significant air quality impacts under NEPA. In addition, the cumulative impact on global warming from launches account for only a fraction of total U.S. CO₂ emissions and would be insignificant when compared to emissions from other industrial sources.
- **Airspace** - Cumulative airspace impacts associated with the proposed action are not anticipated given that coordination and scheduling procedures would be developed with the Mojave Airport Air Traffic Control Tower. In addition, the increase in flight activity at the Mojave Airport would be less than one percent, with all activities occurring below 152 meters (500 feet).
- **Biological Resources** - The cumulative noise and emissions resulting from ongoing commercial, military, and private aviation activities; a series of up to 65 tethered flight tests; and the proposed action could adversely impact biological resources. However, there are limited biological resources found in the ROI and those that would be affected have been able to tolerate the existing noise and emissions associated with an active airport. The loss of 18.6 square meters (200 square feet) of potential wildlife habitat from the construction of two concrete pads would not be significant because the area supports minimal plant and wildlife species and is very similar to the surrounding area. Protective mitigation measures are in

place for the federally-listed, threatened desert tortoise (*Gopherus agassizii*); therefore, significant cumulative impacts on threatened and endangered species are not anticipated.

- **Hazardous Materials and Hazardous Wastes** - Cumulative impacts from hazardous materials and hazardous waste management could occur as a result of increased quantities of propellants and hazardous materials necessary to support ongoing commercial, military, and private aviation activities, a series of up to 65 tethered flight tests, and the proposed action. Propellants and other hazardous materials would be handled, stored, and used in compliance with all applicable regulations, which would minimize releases and associated environmental impacts. The activities considered in the cumulative impacts analysis would increase the amount of hazardous waste generated on site; however, on site waste management capacity is adequate to manage this amount of waste and Masten Space Systems would not exceed the regulatory limit of a conditionally exempt small quantity generator. No significant cumulative impacts would result from the use of hazardous materials and hazardous waste management.
- **Health and Safety** - Cumulative impacts on health and safety could occur as a result of the increase in the quantity of propellants handled and in the number of both tethered flight tests and permitted launches conducted at the Mojave Airport. Because all operations would follow established safety procedures, no significant cumulative impacts on health and safety are expected.
- **Noise** - Background noise at the Mojave Airport would increase with the increased level of activity from the tethered flight tests and permitted launches of the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets. During flight tests, the noise levels could potentially be very high, but because these test flights would occur over a two-month period and would be of short duration (a maximum burn time of 3 minutes), the overall impacts would be relatively small. The impacts of flight tests would be relatively small when compared to the existing high intensity noise levels due to military jet flights and stationary rocket engine testing at the Mojave Airport. There are no noise sensitive receptors or areas within the ROI at the Mojave Airport. Therefore no significant cumulative noise impacts are expected.
- **Transportation** - Cumulative impacts on transportation could occur as a result of the increase in road traffic that would result from transporting equipment and personnel in support of ongoing aviation activities, the proposed action, and the tethered flight tests. The combined increase resulting from these activities would only add a few vehicles to the existing traffic load on Business SR-58. No more than two additional passenger vehicles and eight delivery trucks would be anticipated as part of the proposed action and tethered flight tests. This small number of vehicles would not materially increase the number of traffic accidents, increase traffic congestion, or cause a decline in the level of service of local roadways; therefore no significant cumulative impacts are expected.
- **Visual resources** - The construction of two concrete pads under the proposed action would be similar to existing airport infrastructure and would not significantly alter the current visual landscape. Tethered flight tests and permitted launches may attract and dominate the attention of a viewer in this area. However, due to the tests' low altitude, limited number

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over a two-month period, and short duration (a maximum burn time of 3 minutes), no significant cumulative impacts on visual resources are expected.

- **Water Resources** - Cumulative impacts on water resources may result from incidental spills and releases associated with aircraft, launch vehicle, and reusable suborbital rocket preparation and propellant loading activities. Masten Space Systems would operate using established spill prevention procedures and would be responsible for the clean up any of spills or releases associated with the proposed action and tethered flight tests, resulting in a small cumulative impact.

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ACRONYMS AND ABBREVIATIONS

ALUCP	Airport Land Use Compatibility Plan
AST	Office of Commercial Space Transportation
CDP	Census- Designated Place
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CNEL	Community Noise Equivalent Level
CO	Carbon monoxide
CO ₂	Carbon dioxide
CSLAA	Commercial Space Launch Amendments Act of 2004
dB	Decibels
DoD	Department of Defense
DOT	Department of Transportation
EKAD	East Kern Airport District
EA	Environmental Assessment
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
FPPA	Farmland Protection Policy Act
H ₂	Hydrogen
H ₂ O	Water
kg/hr	kilograms per hour
L _{dn}	Day-night average sound level
LOX	Liquid oxygen
MSL	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NOTAM	Notice to Airmen
NO _x	Nitrogen oxides
NPL	National Priorities List
NRCS	Natural Resources Conservation Service
OSHA	Occupational Safety and Health Administration
PCC	Primary Compatibility Criteria
PM	Particulate Matter
PM ₁₀	PM with diameter 10 microns or less
ROD	Record of Decision
ROI	Region of Influence
SO _x	Sulfur oxides
USFWS	United States Fish and Wildlife Service
VOCs	Volatile Organic Compounds

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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.

1.1 Background

Masten Space Systems, a Santa Clara, California based aerospace company, proposes to conduct experimental flight tests of its XA0.1, XA0.2, and XL0.1 reusable suborbital rockets over the course of one year. This would include a series of low altitude test flights from the Mojave Airport in Mojave, California. The XA0.1, XA0.2, and XL0.1 reusable suborbital rockets would launch and land in a vertical orientation and would use liquid oxygen (LOX) and isopropyl alcohol as propellants. The proposed launch area is located at an active airport and spaceport with an existing launch site operator license. The potential environmental impacts of operating a launch site at the Mojave Airport in Mojave, California were analyzed in the 2004 *Final Environmental Assessment (EA) for the East Kern Airport District (EKAD) Launch Site Operator License for the Mojave Airport*, which is available on AST's website at: http://ast.faa.gov/lrra/comp_coop.htm. A paper copy is available at the East Kern Airport District office at the Mojave Airport.¹

The test flights would entail the suborbital rocket launching to a low altitude height for a period of 5 to 150 seconds before descent. Some of these tests would include an in-flight engine shutdown for a predetermined period of time, followed by an in-flight engine restart to conduct a slow rate of descent and an autonomous suborbital rocket landing.

Masten Space Systems also proposes to conduct a series of tethered flight tests that would involve the use of equipment to prevent the vehicle from reaching a specific altitude. These types of tests do not require a license or permit from the FAA; therefore these activities are not included in the scope of the proposed action. These activities are considered as part of the potential cumulative impacts resulting from the action.

¹ The California Environmental Quality Act (CEQA) imposes environmental analysis requirements for public agencies that directly undertake, support, or grant any type of permit or license for projects that may impact the environment in California. The February 2004 EA included a CEQA analysis because the East Kern Airport District (EKAD), a local public agency, was planning to undertake an activity which qualified as a project under CEQA (i.e., applying for a launch site operator license). The proposed action is for FAA to issue experimental permits to Masten Space Systems to conduct tests of reusable suborbital rockets at the Mojave Airport. EKAD would issue a lease to Masten triggering state CEQA requirements; however the Federal action does not involve any state agency activities. Thus this EA will be completed under FAA NEPA implementing regulations and EKAD will be the lead state agency responsible for compliance with all applicable CEQA requirements.

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Under the proposed action, the FAA would issue experimental permits to Masten Space Systems for test flights of its XA0.1, XA0.2, and XL0.1 reusable suborbital rockets. The FAA would issue an experimental permit for each suborbital rocket design. The decision to issue experimental permits for launch and reentries of reusable suborbital rockets by the FAA is considered a major Federal action; consequently, the FAA is responsible for analyzing the environmental impacts associated with permitting proposed launches and reentries as required by NEPA.

Under Title 49 U.S.C., Subtitle IX, Sections 70101-70121, Commercial Space Launch Activities Act, the FAA oversees, licenses, and regulates both launches and reentries of launch and reentry vehicles, and the operation of launch and reentry sites when carried out by U.S. citizens or within the United States. (49 U.S.C. 70104, 70105) Chapter 701 directs the FAA to exercise this responsibility consistent with public health and safety, safety of property, and the national security and foreign policy interests of the United States, and to encourage, facilitate, and promote commercial space launch and reentry by the private sector. (49 U.S.C. 70103, 70105)

The Commercial Space Launch Amendments Act of 2004 (CSLAA) promotes the development of the emerging commercial space flight industry and makes the FAA responsible for regulating private human space flight under Chapter 701. The CSLAA establishes an experimental permit regime for reusable suborbital launch vehicles. Congress directed that experimental permits could be issued 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 prior to obtaining a license for a launch or reentry using the design of the launch vehicle for which the permit would be issued.

The CSLAA's creation of an experimental permit regime provides the FAA with an alternative mechanism to regulate the launch and reentry of reusable suborbital rockets. For the purposes of this EA, the FAA examined the environmental impacts associated with the launch activities of the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets to make an informed decision on whether to issue experimental permits to Masten Space Systems.

Testing of launch vehicles has historically been conducted at Federal launch ranges operated by the Department of Defense (DoD) or the National Aeronautics and Space Administration (NASA). To enable and encourage the development and use of launch sites that are not operated or collocated with and 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 provided licensed launch site operators with safety requirements to protect the public from the risks associated with launch and reentry activities.

If in the future Masten Space Systems develops plans to conduct launch activities in a manner not authorized by the experimental permit, it would have to apply to the FAA for modification of the permit. Application for modification to the experimental permit also would be mandatory if any representation contained in the permit application that is material to public health and safety or the safety of property, is no longer accurate or complete.

1.2 Purpose and Need

The purpose of the proposed action is for Masten Space Systems to test its XA0.1, XA0.2, and XL0.1 reusable suborbital rockets. The company's intent is to use the initial tests of the XA0.1 and XA0.2 rockets to further refine the construction, propulsion, and flight control software/hardware technology of the XL0.1 rocket in preparation for the X Prize Cup competition and NASA's Lunar Lander Challenge competition. The XL0.1 rocket would be used to demonstrate reusable vertical takeoff and vertical landing technologies for a lunar lander.

This action is necessary for Masten Space Systems to test its reusable suborbital rockets and the associated technologies in preparation for the X Prize Cup competition, which is scheduled for October 2006 at the Las Cruces International Airport in Las Cruces, New Mexico.

1.3 Public Involvement

The Council on Environmental Quality (CEQ) implementing regulations for NEPA describe the public involvement requirements for agencies. (40 CFR 1506.6) This EA and FONSI for the Masten Space Systems experimental permits were released to the public in August 2006. The availability of this EA was published in the Antelope Valley Press newspaper, the Bakersfield Californian newspaper, and the *Aerotech News and Review* trade journal. All requests for additional information or copies of the EA and FONSI should be submitted to Ms. Stacey M. Zee, FAA Environmental Specialist, Office of Commercial Space Transportation, 800 Independence Ave SW, Suite 331, Washington, DC 20591; fax (202) 267-5463. All requests should reference "Masten Space Systems Environmental Assessment."

1.4 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 February 2004 EA describes the site location and the affected environment in detail. These descriptions have not changed as a result of the proposed action and therefore, much of the discussion of the site and the discussion on the affected environment are incorporated by reference from the February 2004 EA and are summarized in this EA as appropriate. Other analyses that were used to develop the February 2004 EA can be found in the references for this EA. The list of documents incorporated by reference includes the following:

- Department of Transportation. *Final Environmental Assessment for the East Kern Airport District Launch Site Operator License for the Mojave Airport*, February 2004.
- Department of Transportation. *Finding of No Significant Impact and Record of Decision, Extend Runway 12/30 and Parallel Taxiway A, for Mojave Airport*, May 2005.
- Department of Transportation. *Final Environmental Assessment/Initial Study for the 3,000-Foot Extension of Runway 12/30 at the Mojave Airport*, May 2005.

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In accordance with the CEQ regulations for NEPA documents, this EA tiers from the Programmatic EIS for Licensing Launches and the Programmatic EIS for Horizontal Launch and Reentry of Reentry Vehicles.

- Department of Transportation. *Final Programmatic Environmental Impact Statement for Licensing Launches* (PEIS LL), May 24, 2001. (Available at http://ast.faa.gov/lrra/comp_coop.htm#COMPLIANCE)
- Department of Transportation. *Final Programmatic Environmental Impact Statement for Horizontal Launch and Reentry of Reentry Vehicles*, December 2005. (Available at http://ast.faa.gov/files/pdf/Final_FAA_PEIS_Dec_05.pdf)

2 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 Proposed Action/Preferred Alternative

The proposed action is for the FAA to issue experimental permits to Masten Space Systems for test flights of its XA0.1, XA0.2, and XL0.1 reusable suborbital rockets at the Mojave Airport in Mojave, California. The FAA would issue a separate permit for each suborbital rocket design, which would cover launch and landing activities at the Mojave Airport site. The permits would have to be modified to cover proposed operations at the Las Cruces International Airport for the X Prize Cup event.² 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 a FONSI regarding the issuance of separate experimental permits for launches of the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets. The completion of the environmental review process does not guarantee that the FAA would issue experimental permits to Masten Space Systems. The project also must meet all FAA safety, risk, and operational area hazard containment requirements.

This EA addresses the overall impacts to the environment from the proposed operations anticipated for the one-year period encompassing the duration of an experimental permit. The activities included in this analysis are launching and landing the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets at the Mojave Airport in Mojave, California. This EA conservatively assumes that all 50 flight-tests would be conducted using the largest of the three suborbital rockets (see Section 2.1.2). Therefore, FAA did not specifically analyze the impacts associated with issuing a subset of experimental permits for a mix of rockets (e.g., permit one or two, but not all, of the reusable suborbital rockets types) because the impacts would be within the range analyzed and expected to produce fewer impacts. However, the FAA may decide to issue experimental permits to only a subset of Masten's proposed reusable suborbital rockets.

The following subsections provide background and description of the proposed action/preferred alternative, including proposed site location, rocket concept, and pre-flight, flight, and landing activities. Other sections in this chapter describe the no action alternative and alternatives considered but eliminated from detailed study.

2.1.1 Site Location

The Mojave Airport is located in the southeastern corner of Kern County, California on the east side of the unincorporated town of Mojave. The existing site conditions at the Mojave Airport are substantially the same as described in the February 2004 EA; therefore, the site description is incorporated by reference and this EA focuses on the aspects of the site that have changed since 2004.

Since February 2004 the East Kern Airport District proposed to extend runway 12/30 and parallel taxiway A. The potential environmental impacts of the runway extensions were

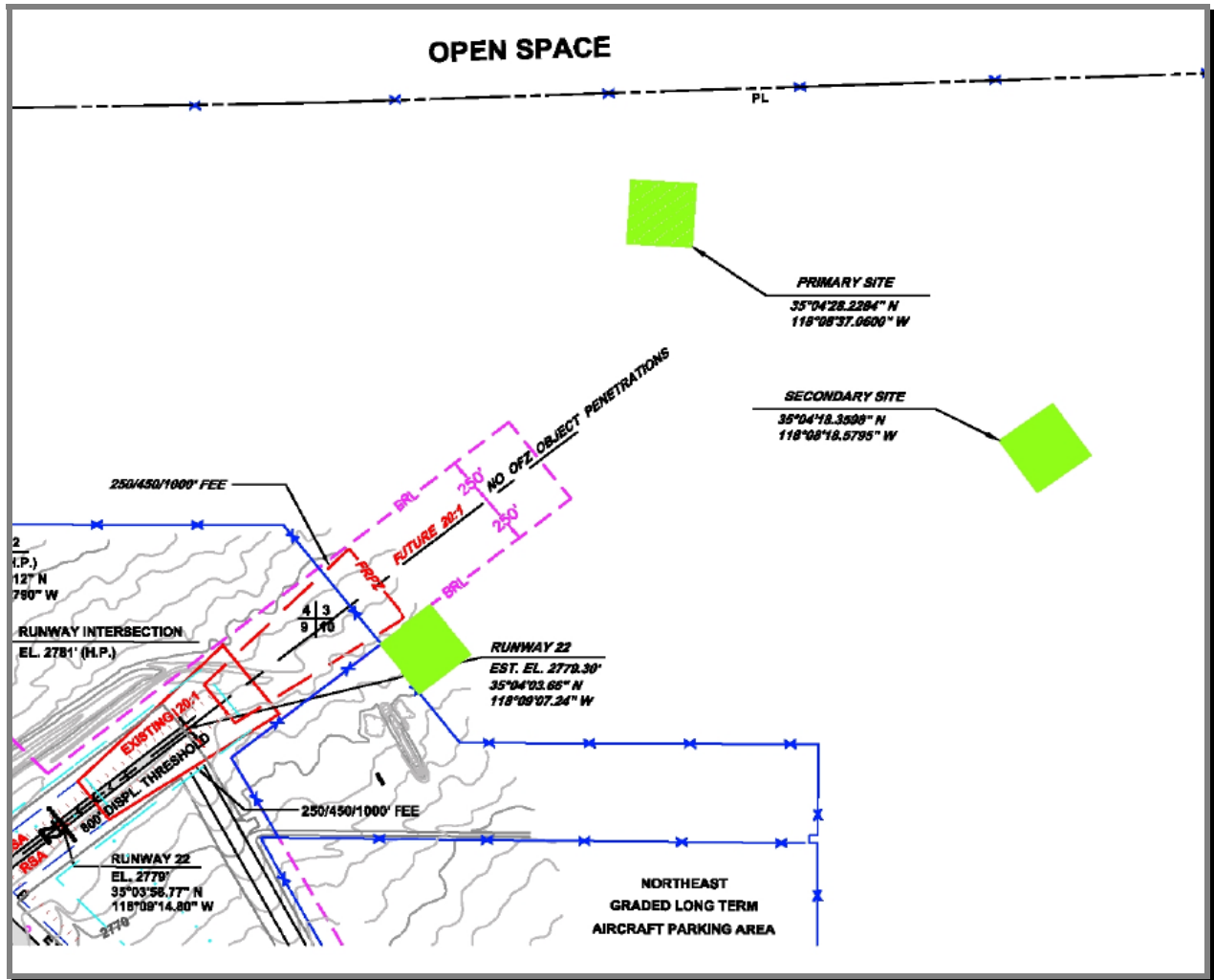
² The environmental impacts of launch and reentry activities of the Masten Space Systems reusable suborbital rockets at the Las Cruces International Airport are being analyzed in the X Prize Cup EA. When completed, the EA will be available on the AST's website.

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analyzed in the *Final Environmental Assessment Initial Study for 3,000-foot Extension of Runway 12/30 At Mojave Airport*. (FAA, 2005) The FAA issued a FONSI/Record of Decision for the proposed modifications on May 27, 2005. The EA analyzed the extension of Runway 12/30 296 meters (970 feet) to the north and 618 meters (2,028 feet) to the south to a total of 3,810 meters (12,500 feet) long and 61 meters (200 feet) wide. The EA also analyzed the extension of Parallel taxiway A to 3,658 meters (12,000 feet) long by 23 meters (75 feet) wide. At the time of the publication of this EA, the construction was still underway and expected to be completed in July 2006.

The test launches and landings of the vertically launched suborbital rockets would occur on two concrete pads that measure 3 meters by 3 meters (10 feet by 10 feet) each. The East Kern Airport District would either construct new concrete pads or place temporary concrete slabs on the ground during flight tests. As a conservative estimate, this EA assumes the concrete pads would have to be constructed, as opposed to temporary pads of the same size being brought in and laid down on the ground. Exhibit 2-1 presents the proposed location where the pads would be constructed, which is identified by a green box labeled the primary site. All necessary equipment and materials including the rockets and propellants would be transported by tank truck to and from the launch site as part of the proposed operations. Concrete for construction of the pads would be transported via standard concrete trucks.

Exhibit 2-1. Proposed Location of Vertically Launched Suborbital Rocket Testing at Mojave Airport



2.1.2 Reusable Suborbital Rocket Description

Under the proposed action, three separate vertically launched suborbital rockets, the XA0.1, XA0.2, and XL0.1, would be tested at the Mojave Airport. Each suborbital rocket would consist of a payload, avionics system, LOX tank, isopropyl alcohol tank, nitrogen tank and vernier module. The payload would consist of metal sheets or blocks. Ground equipment would be needed to support the launch and landing of the suborbital rockets. Exhibit 2-2 shows a picture of a vertically launched suborbital rocket.

Exhibit 2-2. Picture of Vertically Launched Suborbital Rocket



The XA0.1, XA0.2, and XL0.1 suborbital rockets range in size based on the number and size of the engines. A phased approach is being proposed to test these suborbital rockets, from smallest first to largest last. For the purpose of this analysis, this EA assumes 50 flight tests would be conducted and that all 50 tests would be performed using the largest of the three suborbital rockets proposed. The XL0.1 would be the largest of the three vehicles. Using the XL0.1 as the basis for the analysis bounds the potential impacts of the smaller vehicles. This allows for a conservative analysis of the potential impacts associated with the testing and operation of the Masten suborbital rockets from the proposed site.

The XL0.1 would have eight 2,224 Newton (500 pounds-force) engines. The propulsion system would consist of 270 kilograms (595 pounds) of isopropyl alcohol and 445 kilograms (981 pounds) of LOX. The XL0.1 would be 2.3 meters (7.6 feet) tall by 1.7 meters (5.5 feet) in diameter and its gross weight would be 1,451 kilograms (3,200 pounds) with payload and propellants. The medium size suborbital rocket (XA0.2) would have eight 2,224 Newton (500 pounds-force) engines with 59 kilograms (131 pounds) of isopropyl alcohol and 86 kilograms (190 pounds) of LOX. The smallest suborbital rocket (XA0.1) would have four 2,224 Newton (500 pounds-force) engines with 59 kilograms (131 pounds) of isopropyl alcohol and 86 kilograms (190 pounds) of LOX. Exhibit 2-3 presents a summary of the engine sizes for the proposed suborbital rockets.

Exhibit 2-3. Engine Sizes for Proposed Reusable Suborbital Rockets

Suborbital Rockets	Number of Engines	Thrust Newtons (pounds-force)	Liquid Oxygen Tank Size kilograms (pounds)	Isopropyl Alcohol Tank Size kilograms (pounds)
XA0.1	4	2,224 (500)	86.3 (190)	59.5 (131)
XA0.2	8	2,224 (500)	86.3 (190)	59.5 (131)
XL0.1	8	2,224 (500)	445 (981)	270 (595)

Testing would require the use of ground-based equipment to support the launch. Dollies and a forklift and/or crane would be needed to transfer the suborbital rocket from the transporter (typically a truck) to the launch pad. Two tank trucks would be used to transport and store the propellants. Six standard concrete trucks would be used to transport the concrete for constructing the two pads. Propellant loading of the suborbital rocket would occur at the launch pad and would require various plumbing and pumps. Other containers may be needed such as 208-liter (55-gallon) fuel drums, bottles of pressurized inert gases such as helium or nitrogen, or liquid nitrogen bottles. Test support equipment would be limited to laptop computers and radio transceivers.

2.1.3 Launch Activities

An experimental permit authorizes an unlimited number of launches and reentries for a particular reusable suborbital rocket design within a one-year period; however, Masten Space Systems has indicated that it would conduct the majority of its operations during a two-month period culminating in the X Prize Cup competition scheduled to be held in October 2006. Therefore, this EA analyzes a maximum number of 50 test flights occurring during a proposed two-month period of operations.

Masten Space Systems has also proposed a preliminary series of tethered tests to ensure proper functioning of the suborbital rockets before the start of the two-month period of test flights. The tethered tests are not included as part of this proposed action because an experimental permit is not required to conduct these tests.

2.1.3.1 Pre-Flight Activities

The concrete launch and landing pads would be constructed as part of pre-flight activities. The pads would each measure 3 meters by 3 meters (10 feet by 10 feet). Six tank trucks would be used to transport the concrete. One tank truck of isopropyl alcohol and one tank truck of LOX would be used to transport and store the propellants at Mojave Airport. The suborbital rockets would be assembled in a standard industrial building, and then transported to the launch pad. The suborbital rocket would be removed from the transporter and positioned at the launch pad using dollies, a forklift and/or crane. The suborbital rocket would be inspected for loosened electrical or mechanical connections or other damage. Flight control diagnostics and health checks would be run to ensure proper operation of electrical systems and moving parts.

Propellants for the suborbital rocket would be loaded at the launch pad in the following order: isopropyl alcohol, pressurants, and LOX. Following transfer, the loading equipment would be removed from the area. Standard safety precautions would be followed such as clearing the area of unnecessary personnel and ignition (including spark) sources. In the event of a spill, propellant-loading operations would be halted until the spill is properly cleaned up and has no reasonable chance of creating an explosion or combustion hazard during further operations. The Mojave Airport would not be shut down during the testing activities, which would occur during the daytime. However, runway 22 may be closed and a Notice to Airmen (NOTAM) for restrictions on runway 22 would be issued.

2.1.3.2 Flight Activities

A ground crew trained in the operations protocol specific to the location and the mission would conduct test flight operations. Because the Masten suborbital rockets would be unmanned, there would be no flight personnel onboard the rocket.

Tests would consist of vertical launch, lateral travel, and vertical landing. Tests conducted at the Mojave Airport would not rise above 152 meters (500 feet) and would remain under the control of the Mojave Airport Control Tower. The longest of these tests would last approximately 107 seconds at 100 percent throttle or 179 seconds at 60 percent throttle. The powered duration of the flight would be no more than 150 seconds; most tests would occur for no more than 60 seconds. Exhibit 2-4 presents a summary of the maximum test parameters that were used in the analysis for this EA.

Exhibit 2-4. Summary of Maximum Test Parameters for XL0.1 Suborbital Rocket

Suborbital Rocket	Number of Tests	Total Impulse	Powered Duration	Overall Duration	Projected Altitude
XL0.1	50	Up to 195 kilogram-seconds (430 pound-seconds)	Up to 150 seconds	Up to 179 seconds	Up to 152 meters (500 feet)

The local fire department and emergency medical services would be available during flight operations. All personnel involved with flight operations would be equipped with personal protective equipment and communications equipment.

2.1.3.3 Landing Activities

The XA0.1, XA0.2, and XL0.1 reusable suborbital rockets would be designed to make powered, vertical landings. The suborbital rocket would touch down on its legs and flight control systems that are unnecessary to vehicle recovery would be shut down. Any remaining LOX would be flash boiled and vented and the LOX system purged. Next, the isopropyl alcohol system would be drained into a suitable container and its systems purged. Finally, the remaining pressurants would be vented to the atmosphere prior to moving the rocket to its transport vehicle.

2.2 No Action Alternative

Under the no action alternative, the FAA would not issue experimental permits to Masten Space Systems and there would be no permitted flight tests of the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets at the Mojave Airport. The Mojave Airport would continue its current services as a general aviation airport and a launch site for horizontally launched suborbital rockets. Masten Space Systems would not be able to conduct permitted launches of the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets and the associated technologies in preparation for the X Prize Cup competition from this location.

2.3 Alternative 1

Under alternative 1, the test launches for the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets would occur at Mojave Airport from an area identified in Exhibit 2-1 as a green box labeled the secondary site. All other activities would remain the same as those discussed for the proposed action.

2.4 Alternative Considered but Eliminated from Detailed Study

An alternative location within the Mojave Airport was considered as the launch site for the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets. Exhibit 2-1 shows the alternative site in an unlabeled green box near the runway. The site was eliminated from detailed study because of its close proximity to the runway. For safety and logistical purposes, this site is not optimal for test launches. Therefore, this site will not be considered any further in this document.

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3 AFFECTED ENVIRONMENT

The existing environmental conditions at the Mojave Airport are substantially the same since the publication of the February 2004 EA; therefore, the discussion on the affected environment is incorporated by reference. The February 2004 EA is available on AST's website at http://ast.faa.gov/lrra/comp_coop.htm. Section 3.1 describes the modifications to the Mojave Airport since February 2004, and Section 3.2 provides a summary of existing conditions in the region of influence (ROI) where the Masten Space Systems' action is proposed to occur.

The information provided serves as a baseline from which to identify and evaluate environmental changes resulting from the proposed action and alternatives. 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 resources, and water resources.

3.1 Modifications at the Mojave Airport

This section describes the two modifications that have occurred at the Mojave Airport since the publication of the February 2004 EA. Extension of the existing runway 12/30 and parallel taxiway A was described in the *Final Environmental Assessment Initial Study for 3,000-foot Extension of Runway 12/30 At Mojave Airport*. (FAA, 2005) The FAA issued a FONSI/ROD for these changes at the Mojave Airport on May 27, 2005. Runway 12/30 is being extended to 296 meters (970 feet) to the north and 618 meters (2,028 feet) to the south to a total of 3,810 meters (12,500 feet) long and 61 meters (200 feet) wide. Parallel taxiway A is being extended to 3,658 meters (12,000 feet) long by 23 meters (75 feet) wide. At the time of the publication of this EA, the construction was still underway and expected to be completed in July 2006.

3.2 Existing Conditions

This section provides a summary of existing environmental conditions at the Mojave Airport as described in Chapter 3 of the February 2004 EA. For this analysis, the FAA determined that the ROI for each resource area would be limited to the Mojave Airport property boundaries. This determination was based on the fact that all proposed activities would occur at low altitudes within the airport property and under control of the Mojave Airport control tower. Exhibit 3-1 presents the definition and existing conditions of each of the 13 resource areas in terms of this specific ROI.

Exhibit 3-1. Summary of Existing Conditions at the Mojave Airport

Resource Area	Definition of Resource	Existing Conditions
Air Resources	Air quality in a given location is usually measured in terms of the concentration of various air pollutants in the atmosphere. The concentration is measured against Federal and/or state ambient air quality standards that protect public health.	The existing aircraft operations and tank farm at the Mojave Airport contribute to the condition of air quality in the region. The Mojave Airport is located within the Kern County Air Pollution Control District. In 2004, the District reported the following pollutant emissions inventory levels in tons per year: 34,168 carbon monoxide (CO), 13,677 nitrogen oxides (NO _x), 8,406 Volatile Organic Compounds (VOCs), 18,257 Particulate Matter (PM), and 1,460 sulfur oxides (SO _x). Eastern Kern County is in Federal non-attainment (subpart 1) and state non-attainment (moderate) for ozone. The sources of pollution in eastern Kern County are not solely responsible for exceeding the Federal ozone standards. Ozone and ozone precursor emissions are transported from both the San Joaquin Valley Air Basin and the South Coast Air Basin into Eastern Kern County. Several Portland cement plants in the area are major NO _x emission sources. The PM ₁₀ levels are primarily the result of fugitive dust, which is produced from high winds, dry soils and activities associated with mining, agriculture, and construction.
Airspace	The FAA categorizes airspace within the U.S. as controlled or uncontrolled. Controlled airspace requires air traffic control services. 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. Uncontrolled airspace can extend up to 4,420 meters (14,500 feet) above mean sea level (MSL) and is referred to as Class G airspace. Other classifications include special use airspace, military training routes, en route airways and jet routes, airports and airfields, and air traffic control.	The Mojave Airport is classified as Class D airspace within an 8.0-kilometer (4.3-nautical mile) radius of the airport and from ground-level up to 1,463 meters (4,800 feet) MSL when the control tower is in service. At all other times the airspace is classified as Class G and E. The Mojave Airport has an Air Traffic Control Tower on site that provides Visual Flight Rules services. The Mojave Airport is located within the R-2508 Complex, which is airspace made up of Military Operating Areas, Restricted Areas, and Air Traffic Control Assigned Airspace.

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Resource Area	Definition of Resource	Existing Conditions
Biological Resources	Native or naturalized vegetation, wildlife, and the habitats in which they occur are collectively referred to as biological resources. Biological resources include vegetation, wildlife, threatened and endangered species, and environmentally sensitive habitats. Threatened and endangered species are protected under the Endangered Species Act of 1973 (16 USC 1531 et seq.) and the California Endangered Species Act.	The Mojave Airport is situated on the western portion of the Mojave Desert and consists largely of developed property with scant biological resources. The Mojave Specific Plan identifies the Mojave Airport as part of an “urbanized, non-sensitive” area that has been developed, previously surveyed, or subject to mitigation for sensitive species. There are no permanent, naturally occurring surface waters or Federally protected wetlands at the Mojave Airport. Creosote clonal rings, unique to the Mojave creosote scrub formation, are not present on the Mojave Airport property. The desert tortoise (<i>Gopherus agassizii</i>) is listed as a Federally threatened species in the region and may occur at the Mojave Airport.
Cultural Resources	Cultural resources include prehistoric and historic artifacts, archaeological sites, historic buildings and structures, and traditional resources (such as Native American religious sites or traditional cultural properties). Paleontological resources are fossil remains of prehistoric plant and animal species and may include bones, shells, leaves, and pollen. Cultural resources of particular concern include properties listed or eligible for inclusion in the National Register of Historic Places (National Register).	There are 22 sites in Kern County that are listed in the National Register of Historic Places (National Register) and 26 sites that may be currently eligible for listing in the National Register; however, none of these sites are located within the ROI. Several Native American tribes may attach historic or cultural significance to lands in the area of the Mojave Airport, including the Lone Pine Paiute Shoshone, Timbisha Shoshone, San Manuel Band, Morongo Band, 29 Palms Band, Fort Mojave Tribe, Chemehuevi Tribe, Colorado River Indian Tribes, and Te-Moak Tribe of Western Shoshone Indians of Nevada. A 2003 cultural resources survey report suggested a historical resource designation for the main body of Mojave Airport and the well and trash dumpsite located to the southeast of the drainage detention basin. However, these sites have not been proposed as eligible for listing on the National or California Register of Historic Places, or other cultural inventories.
Geology and Soils	Geology and soils are earth resources that are described in terms of landforms, geology, and soil conditions as they could contribute to seismicity, erosion, and flooding. A geologic hazard is a naturally occurring or man-induced geologic condition that presents a risk or a potential danger to life and property. Such hazards could include phenomena such as landslides, flooding, ground subsistence, faulting, and earthquakes.	The geology in the area consists generally of pre-Tertiary and Tertiary age rock types, including sedimentary, igneous, and metamorphic rocks. The soil formations in the region are comprised of thick, unconsolidated, coarse-textured alluvial sediments composed of gravel, sand and silt of granitic composition. Mojave is in one of the most active and potentially dangerous seismic regions in the United States, falling within Seismic Zone 4 of the 1997 Uniform Building Code. The community of Mojave is subject to flash flooding, but the Mojave Airport is outside the boundaries of the 100-year flood plain.

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Resource Area	Definition of Resource	Existing Conditions
<p>Hazardous Materials and Waste</p>	<p>The terms hazardous material or hazardous waste include substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to the public health, welfare, or the environment when released. Substances are formally defined as hazardous by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC Section 9601 et seq., as amended. Hazardous waste is further defined in 40 CFR 261.3 as any solid waste that possesses hazardous characteristics of extraction procedure toxicity, ignitability, corrosivity, or reactivity, or is listed as a hazardous waste in Subpart D of 40 CFR Part 261. Transportation of hazardous materials is regulated by the Department of Transportation (DOT) as specified in 49 CFR.</p>	<p>The largest quantities of hazardous materials at the Airport are the airplane fuels. There is a bulk tank farm on site with seven above ground storage tanks and a total storage capacity of 500,000 liters (133,000 gallons). Two grades of fuel are stocked: Jet-A and 100 Low Lead. For the state fiscal year from July 2002 to June 2003, less than 7.6 million liters (just over 2 million gallons) of fuel were delivered to the airport by tank truck. All above ground storage tanks are monitored daily for spills, and the inspections are formally documented. Site personnel receive formal training in fuel handling, monitoring, and emergency response. Tanks have hydrocarbon leak detection systems. Spill response kits, which include barrier pads, are located throughout the tank farm. A spill response clean-up firm is under contract and available 24 hours, 7 days a week.</p> <p>A limited number of other hazardous materials are used on site in operations such as aircraft maintenance and rocket engine testing. These hazardous materials are currently stored in appropriate storage containers in hangars on the Mojave Airport.</p>

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Resource Area	Definition of Resource	Existing Conditions
<p>Health and Safety</p>	<p>Health and safety considerations include 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 issues as they pertain to the assessment of environmental impacts.</p>	<p>For over 25 years, the Mojave Airport has had general safety and health policies and procedures in place for handling explosive materials including rocket propellants. The Airport maintains an explosive site plan for all flight/landing and ground operations for proposed launch operations and has a contingency/emergency plan for handling explosive materials and procedures for providing notification to the proper authorities in the event of an incident. The Kern County Fire Marshall issues permits for use, storage, and handling of propellants and explosive materials, as required. Launch operators would comply with inventory and safety/separation requirements specifically for handling solid and liquid propellants. The Mojave Airport has a launch site accident investigation plan that addresses operations of all launch operators and tenants and ensures that the operations of one operator/tenant does not adversely affect the operations of other operators/tenants. The Airport also has a fuel policy governing safety procedures with which launch operators and tenants need to comply.</p>
<p>Land Use</p>	<p>Local planning departments designate land uses for specific areas, which describe the permitted development activities that are acceptable for the area (e.g., residential, commercial, industrial, etc.). Federal protection is afforded to Section 4(f) resources, which include 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. Prime, unique, and important farmlands are designated by the Natural Resources Conservation Service (NRCS) using the definitions set forth under the Farmland Protection Policy Act (FPPA).</p>	<p>The three major plans that control the land use development of the Mojave community are the County of Kern General Plan, the County of Kern Airport Land Use Compatibility Plan (ALUCP), and the Mojave Specific Plan. According to Kern County Zoning Map #196, the Mojave Airport is zoned M-2 PD (Medium Industrial, Precise Development Combining), which is consistent with the Mojave General Plan designation of service industry land use. Within the airport influence area, the ALUCP has five land use zones, A, B1, B2, C, and D. Each zone has location, safety, development, and usage specification. Mojave Airport has no prime farmland, unique farmland, farmland of statewide importance, general farmland, or designated recreational land uses.</p>

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Resource Area	Definition of Resource	Existing Conditions
Noise	<p>The FAA defines noise as unwanted sound that disrupts everyday activities such as communication and hearing and is generally considered annoying. Noise is measured in amplitude, frequency, and duration. Noise amplitude, or intensity, can be described in units of decibels (dB) with different noises having different frequencies.</p>	<p>The Mojave Airport currently operates facilities that serve general aviation activities, test pilot training, and research and development of military and non-military jet aircraft and rocket engines. The major source of noise at the Mojave Airport is aircraft activities. (Kern County, 2003d) Aircraft noise exposure occurs mainly in the vicinity of the runways (Runway 12-30, Runway 8-26, and Runway 4-22) and the taxi areas. There are no noise sensitive receptors or areas within the ROI at the Mojave Airport.</p>
Socioeconomics and Environmental Justice	<p>Socioeconomics is defined as the basic attributes and resources associated with the human environment, in particular population and economic activity. Socioeconomic resources consist of several primary elements including population, employment, and income. Other socioeconomic aspects that are often described may include housing and an overview of the local economy.</p> <p>Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Children’s health refers to the assessment of environmental health risks and safety risks that may disproportionately affect children.</p>	<p>The 2000 Census reported the population of the Mojave Census-Designated Place (CDP) to be 3,836 persons, with a population increase of only two percent between 1990 and 2000. Potential environmental justice populations may be present in the Mojave CDP because the percentage of Native American or Alaska Native populations and persons of Latino or Hispanic origin are “meaningfully greater” when compared to the state and U.S. populations. Additionally, the Mojave CDP has a higher percentage of the population living below the poverty line that is above the annual statistical poverty threshold, as defined by the Council on Environmental Quality, when compared to the state and U.S. populations.</p> <p>The 2000 Census reported a higher percentage of children both under the age of 5 and 18 years within the Mojave CDP when compared to the nationwide distribution of the population by age. When compared to the State of California, the Mojave CDP has only a slightly higher percentage of children under age 5 and has a slightly lower percentage of children under age 18.</p>

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Resource Area	Definition of Resource	Existing Conditions
Transportation	<p>Transportation refers to the capacity to move vehicles, people, and goods through the area of interest. Included in the affected environment are the road network, railway lines, and public transportation, including transit buses and commercial air service.</p>	<p>The airport is accessed from an off ramp of SR-58, located approximately 1.6 kilometers (1 mile) west of the end of the shared alignment. The exit is for Airport Boulevard. The airport property is close to the SR-58 exit, and the majority of facilities are located approximately 1.6 kilometers (1 mile) from the highway. The realignment of SR-58, which was recently completed, is 14 kilometers (9 miles) long and is located east and north of the Mojave Airport. The former SR-58 was redesignated Business SR-58, and is located south and west of the airport. Airport access continues to be the Airport Boulevard exit from the redesignated Business SR-58.</p> <p>Two railroad lines are in the vicinity of the Mojave Airport: the Union Pacific Railroad and the Burlington Northern and Santa Fe Railway. There is a railroad spur onto the airport property.</p>
Visual Resources	<p>Visual resources can be described as any naturally occurring or man-made feature that contributes to the aesthetic value of an area. 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.</p>	<p>The Mojave Airport would be characterized as low visual sensitivity because the site is currently an industrialized area. The existing operations at the airport consist of industrial uses that have been in place since 1935. The airport currently services approximately 300 planes per day from its three paved runways. At all times, many airplanes are parked at the airport, and they can be seen from SR-58 and SR-14, the two highways that intersect in the community of Mojave. Two rail lines also intersect in Mojave. On the airport grounds, there are over 1,214 hectares (3,000 acres) of undeveloped land available for industrial and aviation development. Current light sources at the airport include security lighting on the grounds and safety lighting on the runways, which are on overnight.</p>

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Resource Area	Definition of Resource	Existing Conditions
Water Resources	Water resources include surface water features including lakes, rivers, wetlands, and floodplains, as well as ground water resources (aquifers).	The Mojave Airport is located in the South Lahontan Hydrologic Region within the Mojave Desert, one of the most arid places in the United States. No surface water bodies are located on the Mojave Airport. The Mojave Airport is located in the Antelope Valley ground water basin, which reaches from southeast Kern County to northeast Los Angeles County. The majority of the water supply comes from ground water sources, which are recharged from precipitation that falls within the basin. Historically, the ground water withdrawal rates have exceeded the recharge rates, so water conservation is a key issue. The Mojave Airport is subject to local flooding as a result of strong but short duration storms, and was issued a storm water permit to allow discharges resulting entirely from storm events.

4 ENVIRONMENTAL CONSEQUENCES

This section describes the environmental consequences of the proposed action and alternatives on the existing natural and human environments within the ROI. This section analyzes and compares the potential environmental impacts from the proposed action, alternative 1, and the no action alternative.

4.1 Overview

4.1.1 Approach to Analysis

This impact analysis discusses the impacts of implementing the proposed action or alternative 1 as compared to the no action alternative. Impacts on 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.

4.1.2 Proposed Action

The proposed action is for the FAA to issue experimental permits to Masten Space Systems for test flights of its XA0.1, XA0.2, and XL0.1 reusable suborbital rockets at the Mojave Airport in Mojave, California. The FAA would issue a separate experimental permit for each rocket design. The permits would cover launch and landing activities at the Mojave Airport at the primary site shown in Exhibit 2-1.

4.1.3 Alternative 1

Under alternative 1, FAA would issue experimental permits for the same test flight operations as described in the proposed action; however, the activities would occur at the secondary site launch/landing pads location as shown in Exhibit 2-1. The same activities would occur as described for the proposed action.

4.1.4 No Action Alternative

Under the no action alternative, the FAA would not issue experimental permits to Masten Space Systems, and there would be no permitted test flights of its XA0.1, XA0.2, and XL0.1 suborbital rockets at the proposed site. The Mojave Airport would continue its current services as a general aviation airport and a commercial launch site. Masten Space Systems would not be able to conduct permitted test flights of the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets and the associated technologies at this location in preparation for the X Prize Cup competition.

4.2 Air Quality

4.2.1 Approach to Analysis

Air emissions would be generated during launch/landing operations and pre- and post-flight ground operations. This analysis considers emissions below 914 meters (3,000 feet) because the proposed vehicles would not exceed that altitude. In addition, this altitude is an appropriate cutoff because Federal regulations use 914 meters (3,000 feet) and below for determining contributions of emissions to the ambient air quality and for *de minimis* calculations. The air quality at the Mojave Airport in Eastern Kern County is in Federal non-attainment (subpart 1) and state non-attainment (moderate) for ozone, and state non-attainment for particulate matter (PM) with a diameter 10 microns or less (PM₁₀). The proposed action would require a Federal conformity analysis if the air emissions exceed certain *de minimis* levels or if the total emissions are regionally significant. Emissions are regionally significant when the emissions from the action equal or exceed 10 percent of the air quality control area's emissions inventory for any criteria pollutant.

4.2.2 Air Quality Impacts from Launches

Air quality impacts associated with vertically launched suborbital rocket launch operations were examined in terms of air emissions from launch/landing operations and from routine launch preparation operations. The air emissions from launch operations are from the rocket motor firing and all occur in the troposphere. The propellants are LOX and isopropyl alcohol. Possible emissions would include CO, carbon dioxide (CO₂), hydrogen (H₂), and H₂O. During a launch, the CO emitted would be expected to oxidize fully to CO₂ in the hot exhaust cloud; likewise, the H₂ would fully oxidize to H₂O. The emission weight fractions for CO₂ and H₂O are listed in Exhibit 4-1. The only criteria pollutant emitted from the rockets would be CO, and Kern County is in attainment for CO. Because all CO would fully oxidize in the troposphere, emissions from the rockets are not expected to increase atmospheric levels of CO; however as a conservative estimate, the mass of CO₂ produced from the emissions is also compared to the *de minimis* level for CO below.

Exhibit 4-1. Weight Fractions of Emissions from LOX and Isopropyl Alcohol Propellants

CO₂	CO	H₂	H₂O
0.65	--	--	0.35

Source: Calculated assuming a complete stoichiometric burn

The vertical launch vehicle tests would include vertical launch, lateral travel, and vertical landing. The vehicle would not rise above 152 meters (500 feet) during the testing, and therefore all emissions would be in the troposphere. The longest of these tests would last approximately 107 seconds at 100 percent throttle or 179 seconds at 60 percent throttle. The powered duration of the flight would be no more than 150 seconds; most tests would occur for no more than 60 seconds. To calculate the emissions during the flight, several assumptions were made.

- There are three proposed vertically launched suborbital rockets that range in size and number of engines. For the purpose of this analysis, it was assumed that all 50 tests in 2006 would be performed with the largest of the three suborbital rockets.
- The propulsion system would consist of 270 kilograms (595 pounds) of isopropyl alcohol and 445 kilograms (981 pounds) of LOX.
- All of the propellants would be expended during the 107-second flight.

The total emissions for an assumed 50 suborbital rocket launches in 2006 (see Exhibit 4-2) were estimated as the product of the propellant use during flight (all in the troposphere) and the weight fractions in Exhibit 4-1.

Exhibit 4-2. Total Emissions Estimated for Suborbital Rocket Launches in 2006

Year	Number of Launches^a	Propellant Use Per Flight kilograms (pounds)	CO₂ Emissions kilograms (pounds)	H₂O Emissions kilograms (pounds)
2006	50	715 (1,576)	23,238 (51,230)	12,513 (27,585)

^aEntire flight path is below 914 meters (3,000 feet)

4.2.3 Air Quality Impacts from Ground Operations

Emissions from vertically launched suborbital rocket launch operations can also occur from use of ground support equipment. It is expected that there would be a relatively small number of these and therefore would have few emissions. For delivery of the propellants, it was assumed that

- 270 kilograms (595 pounds) isopropyl alcohol and 445 kilograms (981 pounds) of LOX would be needed per flight in 2006;
- Each isopropyl alcohol truck would carry 28,123 kilograms (62,000 pounds) or 34,826 liters (9,200 gallons), and each LOX truck would carry 17,418 kilograms (38,400 pounds) or 11,356 liters (3,000 gallons); and
- Based on these values, two trucks in 2006 would be needed to bring propellants to Mojave Airport to support the proposed suborbital launches.

The truck traffic would produce emissions as shown in Exhibit 4-3. It was assumed that each truck trip would be 80 kilometers (50 miles). Emission rates developed for heavy-duty diesel powered vehicles traveling 48 kilometers (30 miles) per hour were based on California’s emission factor model. (California Environmental Protection Agency, Air Resources Board, 2002) The rates are 0.81 gram/kilometer (0.05 ounce/mile) for hydrocarbons (Volatile Organic Compounds [VOCs]), 5.02 grams/kilometer (0.28 ounce/mile) for CO, 5.16 grams/kilometer (0.29 ounce/mile) for NO_x, and 0.40 gram/kilometer (0.02 ounce/mile) for PM₁₀.

Exhibit 4-3. Total Estimated Annual Emissions from Trucks Delivering Propellants to Mojave Airport to Support Suborbital Rocket Launches

Year	Flights/year	IPA Trucks	LOX Trucks	Total Trucks	CO kilograms (pounds)	NO _x kilograms (pounds)	VOC kilograms (pounds)	PM ₁₀ kilograms (pounds)
2006	50	1	1	2	0.80 (1.8)	0.83 (1.8)	0.13 (0.29)	0.064 (0.14)

Two concrete pads, each measuring 3 meters by 3 meters (10 feet by 10 feet) and approximately 20 centimeters (8 inches) thick, would be constructed for the proposed launches/landings. The only significant air quality impacts associated with the construction of these pads would be emissions from cement trucks. These pads will require approximately 46 cubic meters (60 cubic yards) of concrete, approximately six concrete trucks loads.³ It was conservatively assumed that all six trucks would be operating for 10 hours during construction of the launch pads. The emission factors in kilograms per hour (kg/hr) and total estimated emissions from these vehicles are summarized in Exhibit 4-4. Fugitive dust emissions from the construction of these pads are expected to be minimal because the pads would be small and require a relatively short construction period. Therefore no further analysis of emissions from the pad construction was performed.

Exhibit 4-4. Total Estimated Emissions from Delivery Trucks Required for Construction of Two Concrete Pads

Trucks	Hours	CO (kg/hr) ^a	VOC (kg/hr) ^a	NO _x (kg/hr) ^a	SO _x (kg/hr) ^a	CO kilograms (pounds)	VOC kilograms (pounds)	NO _x kilograms (pounds)	SO _x kilograms (pounds)
6	10	0.81	0.08	1.89	0.20	49 (108)	5 (11)	113 (249)	12 (26)

Source: *Compilation of Air Pollutant Emission Factors (AP-42)*, Volume II - Cement trucks were classified as off highway trucks

4.2.4 Air Quality Impacts from Proposed Action

Exhibit 4-5 shows the total emissions below 914 meters (3,000 feet) for this proposed action in year 2006. Under Federal law, it is necessary to conduct a conformity analysis for criteria pollutants that do not meet Federal attainment standards. Eastern Kern County is in non-attainment for ozone for Federal attainment standards. Therefore, if ozone precursors (VOCs or NO_x) were above certain *de minimis* levels per year, it would be necessary to conduct a conformity analysis. Air analyses as shown in Exhibit 4-5 indicate that NO_x and VOC emissions would be 0.1 metric tons (0.1 tons) per year and 0.005 metric tons (0.006 tons) per year, respectively. These would not be above the *de minimis* level of 91 metric tons (100 tons) per year. Therefore, there would be no exceedances of the NAAQS from the proposed action and a NAAQS assessment is not required to evaluate the potential for significant air quality impacts

³ Concrete trucks typically have a capacity of 7-8 cubic meters (9-11 cubic yards) (Source: National Ready Mixed Concrete Association, “Ready Mix Concrete.” Accessed at: <http://www.nrmca.org/aboutconcrete/howdelivered.asp>)

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under NEPA. (FAA/USAF, 1997) Also, although the Mojave facility is located in an attainment area for other criteria pollutants, Exhibit 4-5 shows that total emissions from launch and truck operations are well below the *de minimis* annual emission levels for NAAQS non-attainment areas for all criteria pollutants. As explained in Section 4.1.1, all CO emissions from the launches were assumed to oxidize fully to CO₂. However, to provide a conservative estimate of possible CO increase in the troposphere if all CO did not oxidize, the mass of CO₂ emitted from the launches was added to the CO mass from truck emissions from Exhibit 4-5 for a total of 23.2 metric tons (25.6 tons). This value is still well below the 91 metric ton (100 ton) *de minimis* level for CO.

As demonstrated in Exhibit 4-5 the total emissions from the proposed action represent much less than 10 percent of the area's emissions inventory for CO, NO_x, VOCs, and PM. These data demonstrate that the emissions are not regionally significant (i.e., do not equal or exceed 10 percent of regional emissions inventory for the air quality control area for any criteria pollutant). Based on both of these threshold tests, there is no need for a Federal conformity analysis. None of the emissions are expected to expose the nearby population or sensitive receptors to substantial pollutant concentrations. Also, the emission products should not expose the population to objectionable odors of types that do not already exist from existing airport operations (e.g., propellant, fuel and exhaust odors).

Exhibit 4-5. Air Emissions below 914 meters (3,000 feet) from the Proposed Action in 2006

Emission Activities	CO₂	CO	NO_x^a	VOC^a	PM	H₂O	SO_x
Launch, kilograms (pounds)	23,238 (51,230)	--	--	--	--	12,513 (27,585)	--
Ground Operations, kilograms (pounds)	--	50 (110)	114 (251)	5.1 (11)	0.064 (0.14)	--	12 (26)
Total, kilograms (pounds)	23,238 (51,230)	50 (110)	114 (251)	5.1 (11)	0.064 (0.14)	12,513 (27,585)	12 (26)
Total, metric tons/year (tons/year)	23.2 (25.6)	0.05 (0.06)	0.1 (0.1)	0.005 (0.006)	0.0001 (0.0001)	12.5 (13.8)	0.01 (0.01)
Comparison Against Regulatory Threshold Screening Tests							
Test 1 - Regulatory <i>De Minimis</i> Thresholds, metric tons/year (tons/year)^b							
<i>de minimis</i> level – all non-attainment zones (for NO _x and VOC outside transport region)	--	91 (100)	91 (100)	91 (100)	--	--	91 (100)
<i>de minimis</i> level – all non-attainment zones (inside ozone transport region)	--	--	91 (100)	45 (50)	--	--	--
<i>de minimis</i> level – moderate non-attainment zones	--	--	--	--	91 (100)	--	--
<i>de minimis</i> level – serious non-attainment zones	--	--	45 (50)	45 (50)	64 (70)	--	--
<i>de minimis</i> level – severe non-attainment zones	--	--	23 (25)	23 (25)	--	--	--
<i>de minimis</i> level – extreme non-attainment zones	--	--	9 (10)	9 (10)	--	--	--
Test 2 – Percent of Regional Emissions^c							
Kern County Air District 2004 emissions	--	1.6E-4 %	9.2E-4 %	6.7E-5 %	4.0E-7%	--	--

^aNO_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).

^bAll regulatory *de minimis* levels are shown here; however the area is not in attainment only for NO_x and VOC under subpart 1, which designates 91 metric tons/year for each as the *de minimis* level.

^cPercent is 100 times the activities divided by the regional inventory of emissions for the Kern County Air District for 2004. The air district emissions were available from the California Air Resource Board (CARB, 2005). Total organic gas emissions are presented at VOC regional emissions.

4.2.5 Alternative 1

Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts to air quality would be the same as under the proposed action.

4.2.6 No Action Alternative

Under the no action alternative, the FAA would not issue permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impacts on air quality.

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 operational area. 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 proposed suborbital launch degrade the FAA's ability to control air traffic near the proposed operational area or provide necessary safety during flight operations.

4.3.2 Proposed Action

If a flight takes place within Class A, Class B, Class C, or Class D airspace, or within the boundaries of the surface area of Class E airspace designated for an airport, the FAA requires that applicants complete an agreement with the responsible Air Traffic Control Tower as part of the permitting process. Furthermore, the speed and ascent angle for rocket launches are substantially different than for an aircraft; therefore additional FAA safety analyses and real time tracking of position and velocity are required to ensure safe operation in the National Airspace System. Masten would need to coordinate with the Mojave Tower for their proposed operations within the designated airspace.

No significant impacts to Mojave Airport airspace would occur as a result of the proposed action. Under the proposed action, a maximum of 50 launches would be conducted in the two months prior to the X Prize Cup in October 2006. As of 2003, the Mojave Airport averaged 18,301 flights per year and was operating at only three percent capacity. (FAA, 2004) Although the number of flights at the Mojave Airport has increased since 2003, the airport still operates at a fraction of maximum capacity. An additional 50 launches per year would represent an increase in activity of less than one percent.

Furthermore, tests conducted at the Mojave Airport would not rise above 152 meters (500 feet), and would occur entirely within Class E airspace. The longest of these tests would last approximately 107 seconds at 100 percent throttle or 179 seconds at 60 percent throttle. The increase in low altitude flights would not exceed the capabilities of the Mojave Air Traffic Control Tower and would not result in a significantly higher probability of in-flight mishaps. No military training routes, en route airways, jet routes or surrounding airport airspaces intersect the Mojave Airport airspace. Therefore, the proposed action would not significantly change airspace activities.

4.3.3 Alternative 1

Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on airspace would be the same as those discussed for the proposed action.

4.3.4 No Action Alternative

Under the no action alternative, the FAA would not issue permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impacts on airspace.

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.

Impacts on biological resources would be considered significant if they resulted in harm, harassment, or destruction of any endangered, threatened, or rare species including a species proposed for listing, candidate species, or species considered sensitive in local or regional plans, policies, or regulations, or by the California Department of Fish and Game (CDFG) or U.S. Fish and Wildlife Service (USFWS). This would include interferences with the movement of native resident or migratory fish or wildlife species, migratory birds, established native resident or wildlife migration corridors, breeding areas, or the use of native wildlife nursery sites. The loss of a substantial number of individuals of any native plant or animal species that could affect abundance or diversity of that species beyond normal variability is also considered significant. Any impacts or modifications to designated critical or sensitive habitats, including riparian habitat or other sensitive natural communities identified in local or regional plans, policies, or regulations, or by the CDFG or USFWS, would be considered significant.

Substantial adverse effects on federally protected wetlands as defined by Section 404 of the Clean Water Act through direct removal, filling, hydrological interruption, or other means may be considered significant. Potential effects to biological resources also include conflict with local policies or ordinances protecting biological resources, such as a tree preservation policy, or conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

4.4.2 Proposed Action

Activities under the proposed action that could potentially impact biological resources include launch pad construction and a maximum of 50 launches of suborbital rockets. No federally protected wetlands or other ecologically critical areas are located at the Mojave Airport; therefore adverse effects to these areas would not occur. The proposed action would not have a substantial adverse effect on any riparian habitat or other sensitive natural community because such areas have not been identified on or near the airport.

Launch and landing activities would occur on two concrete pads, each covering a 3 meters by 3 meters (10 feet by 10 feet) area at the Mojave Airport. This habitat supports a minimal number of wildlife and plant species. The habitat that would be lost due to pad construction activities is similar to other habitat in the area and the wildlife species that would be displaced by the activities would be able to relocate to these areas.

Noise during test flights may startle wildlife and temporarily disrupt their activities (e.g., feeding/foraging, breeding, or resting). However, emissions and noise levels from the proposed action would be significantly less than those produced by existing aircraft in the region. A maximum of 50 test flights would result in infrequent short-term increases in emissions and noise as compared to existing flight operations in the region, and thus impacts on biological resources would not be significant.

The Mohave ground squirrel (*Spermophilus mohavensis*), a California state-listed threatened species, has historically occurred throughout the community of Mojave. There have been no documented occurrences of this species at the Mojave Airport and the airport property does not contain designated critical habitat. (FAA, 2004) The preferred habitats of the Mohave ground squirrel—creosote scrub, saltbush, and/or Joshua tree woodland—do not occur within the airport property. If individuals are observed on the airport property, personnel would follow appropriate USFWS and CDFG protocol. Due to the urbanized nature of the site, limited potential for species occurrence and compliance with USFWS and CDFG protocol, no adverse effects on the Mohave ground squirrel are anticipated.

The desert tortoise (*Gopherus agassizii*), a USFWS federally-listed, threatened wildlife species, has limited potential to occur at the Mojave Airport. Critical habitat for the tortoise has been designated in portions of Kern County, but not within the airport property. (FAA, 2004) As the result of consultation for the February 2004 EA, the USFWS requested that the FAA conduct visual surveys of the runway prior to take-off and landing of suborbital vehicles as a protective measure for desert tortoise that may be within the Mojave Airport fence. If a desert tortoise were discovered at the airport, personnel would follow appropriate USFWS and CDFG protocols. On May 31, 2006, the FAA contacted the USFWS to propose the same protective measure for the desert tortoise under the proposed action in this EA. Visual surveys of the launch and landing area would be conducted prior to test flights. After review of potential impacts, the FAA determined and the USFWS concurred, that the proposed action is not likely to affect listed species or critical habitat. A copy of communication with the USFWS is included in Appendix A of this EA.

4.4.3 Alternative 1

Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on biological resources would be the same as those discussed for the proposed action.

4.4.4 No Action Alternative

Under the no action alternative, the FAA would not issue a permit to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impacts on biological resources.

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 on 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 on or eligible for listing on the National Register 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

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 exist within the Mojave Airport property, and the proposed action would not affect any sites that may be potentially eligible. The FAA made this determination based on the fact that no cultural resources within the airport property meet the criteria of 36 CFR 800.5(a)(1). If cultural resources were identified during the construction of the launch and landing pads, appropriate authorities would be contacted and construction would cease.

There are 21 sites listed on the National Register for Kern County, California. (NRHP, 2006) Because there are no sites listed or eligible for listing on the National Register within the community of Mojave, and because all activities associated with the proposed action would occur within the airport property, no adverse effects on National Register sites would be anticipated. The California list of State Historical Landmarks identifies 42 sites in Kern County. (California Resources Agency, 2006) Because none of the listed sites occur within the Mojave Airport, the proposed action would have no adverse impact on state historical resources.

The proposed action would not be expected to cause a substantial adverse change in the significance of a historical or archeological resource; directly or indirectly destroy a unique paleontological resource or site or unique geologic feature; or disturb any human remains. A search of the Native American Consultation Database and previous environmental assessments of Kern County yielded several Native American tribes that may attach historic or cultural significance to lands in the area of the Mojave Airport. (National Park Service, 2006; FAA, 2004) These tribes include the Lone Pine Paiute Shoshone, Timbisha Shoshone, San Manuel Band, Morongo Band, 29 Palms Band, Fort Mojave Tribe, Chemehuevi Tribe, Colorado River Indian Tribes, and Te-Moak Tribe of Western Shoshone Indians of Nevada. Because no notable Tribal cultural resources are located at the airport, adverse effects on Tribal cultural resources would not be anticipated.

4.5.3 Alternative 1

Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on cultural resources would be the same as those discussed for the proposed action.

4.5.4 No Action Alternative

Under the no action alternative, the FAA would not issue permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impacts on cultural resources.

4.6 Geology and Soils

4.6.1 Approach to Analysis

Impacts on geology and soils would be considered significant if the proposed action and alternatives resulted in exposure of individuals or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault; strong seismic ground shaking; seismic-related ground failure, including liquefaction; or landslides. Substantial soil erosion or loss of topsoil would be considered significant.

4.6.2 Proposed Action

Activities under the proposed action that could potentially impact geology and soils include launch pad construction and the use of hazardous materials. Launch and landing activities would occur on two concrete pads measuring 3 meters by 3 meters (10 feet by 10 feet) at Mojave Airport. The terrain in the proposed operational area is flat and the construction activities would not alter existing drainage patterns. No significant impacts from erosion, loss of topsoil, or sediment runoff would be anticipated. Best management practices would be used to minimize any erosion or sediment changes from the construction of the concrete launch and landing pads.

Operations under the proposed action would involve the use of hazardous materials with the potential for leaks and spills (e.g., propellants, lubricants, solvents). 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.

The proposed action 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, or from propellant spills during propellant loading.

The deposition of exhaust emissions during vehicle launch would not result in substantial contamination, erosion, or loss of topsoil. The LOX/isopropyl alcohol propellants would not result in substantial contamination, erosion, or loss of topsoil. The breakup of the XA0.1, XA0.2, or XL0.1 suborbital rockets 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. In the event of an accident, Masten would implement the Mojave Airport's launch site accident investigation plan. 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.

Launches would require shipments of propellants, temporary storage of those propellants, 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 Mojave Airport's Spill Prevention Control and Countermeasures Plan would limit the likelihood of soil contamination. In substantial quantities this would cause the surface soil to become contaminated. However, launch activities would comply with all applicable Federal and state regulations governing propellant storage and waste disposal, which would reduce the likelihood of soil contamination occurring. Therefore, the impacts on soil would not result in substantial contamination, erosion or loss of topsoil.

4.6.3 Alternative 1

Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on geology and soils would be the same as those discussed for the proposed action.

4.6.4 No Action Alternative

Under the no action alternative, the FAA would not issue permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impacts on geology and 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

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- 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 Environmental Protection Agency (EPA) in accordance with CERCLA [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

The primary hazardous materials used in support of test flights at the proposed launch site would be propellants. The XA0.1, XA0.2, and XL0.1 reusable suborbital rockets are fueled by isopropyl alcohol, a non-toxic liquid alcohol fuel, with hazardous characteristics similar to the jet fuels currently used and stored without adverse impact at the Mojave Airport. The rockets’ oxidizer is LOX, a non-toxic cryogenic liquid. Fuel and oxidizer would be kept in separate, secured containers during transport using two separate tank trucks. Propellants would be shipped to the Mojave Airport on an as-needed basis. Propellants would be stored at the proposed launch site, but not for extended periods of time.

Propellant loading operations would occur at the launch pad. Should a spill occur, Masten would implement the Mojave Airport’s spill prevention control plan, which would minimize impacts to the environment. Masten Space Systems personnel 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 oils, lubricants, and solvents, would be used. No adverse impacts would be anticipated from these additional hazardous materials. 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 Mojave Airport. The transport, use, or disposal of hazardous materials associated with operations under the proposed action would not pose a substantial hazard to the public or the environment.

Hazardous wastes generated under the proposed action include remaining isopropyl alcohol not consumed during launch and landing operations. The amount of remaining isopropyl alcohol for the maximum of 50 flight tests is not expected to exceed the regulatory limit of a conditionally exempt small quantity generator. To qualify as a small quantity generator, a business must generate less than 102 liters (27 gallons) or 100 kilograms (220 pounds) of hazardous waste per month. (Kern County Waste Management Department, 2006) The isopropyl alcohol waste would be treated and disposed of in accordance with RCRA regulations and other applicable regulations at the Kern County Special Waste Facility Eastern Region located at the Mojave Airport. On site waste management capacity at the Mojave Airport is adequate to manage this amount of waste and adherence to standard hazardous waste management procedures would minimize releases. Therefore, impacts associated with hazardous waste management would not

be significant. The proposed launch site would not involve property listed or potentially listed on the NPL. Overall, there would be no significant impacts anticipated from hazardous material use or hazardous waste management that would exceed the threshold of significance described in FAA Order 1050.1E, Appendix A, Section 10.

4.7.3 Alternative 1

Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts from hazardous materials and hazardous waste management would be the same as discussed for the proposed action.

4.7.4 No Action Alternative

Under the no action alternative, the FAA would not issue permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impacts from hazardous materials and hazardous waste management.

4.8 Health and Safety

4.8.1 Approach to Analysis

Public safety impacts of Masten Space Systems' activities at the Mojave Airport are assessed to determine if launch operations personnel or members of the general public are substantially endangered as a result of these activities.

As described in FAA's *Guidelines for Experimental Permits for Reusable Suborbital Rockets*, experimental permit applicants are required to perform a hazard analysis that identifies and characterizes each of the hazards and assesses the risk to public health and safety and safety of property resulting from each permitted flight. A hazard analysis is a necessary part of the Mission and Safety Review for the FAA experimental permit determination to assess the possible hazards associated with proposed launch and landing operations. 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 and landing-related operations and activities that have the potential for environmental impact are considered in this EA.

4.8.2 Proposed Action

Potential health and safety impacts under the proposed action could result from propellant management, propellant loading operations, and test flights of the XA0.1, XA0.2, and XL0.1 suborbital rockets. Management activities include the transport, handling, storage and potential disposal of propellants. Potential accidents during any of these activities could present impacts to health and safety including traffic accidents due to transportation activity on and off the site and exposure to propellants during loading operations.

The road traffic that would result from transporting equipment and personnel to and from the proposed launch site would only add a few vehicles above existing traffic loads. Six trucks would be required to transport the concrete pad materials to the proposed site and for the suborbital rockets, and two trucks would be required to transport and store propellants. Currently, the Mojave Airport receives about 264 deliveries of propellants annually. (FAA, 2004) Additional deliveries under the proposed action represent only a slight increase in traffic and should not materially increase the number of traffic accidents on the roadways in and around the Mojave Airport.

All transport of hazardous materials and hazardous waste 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 transportation 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.

No significant health and safety impacts are expected from propellant management. Trained ground crew personnel would follow established standard operating procedures during propellant loading operations in accordance with all applicable safety regulations including OSHA 29 CFR 1910.106, Flammable and Combustible Liquids. Spills of hazardous materials would be handled by trained ground crew personnel following the airport's standard containment and cleanup protocol. Emergency response would be available should it be necessary during a hazardous material incident.

No significant health and safety impacts from test flight operations would be expected given that existing operations are conducted remotely from a safe distance away from the proposed launch site. Masten Space Systems has established a safety clear zone designed to contain potential adverse effects of a failed launch operation and would verify that all ground crew personnel and members of the public are outside of the safety clear zone before and during each launch. Emergency response and the local fire department would be on standby during each launch to respond to accidents or fires. Potential health and safety impacts could occur in the unlikely event of a failure during the takeoff, mid-flight, or landing phase; however, the XA0.1, XA0.2, and XL0.1 are unmanned reusable suborbital rockets and no flight personnel would be onboard. Because of these established safety mitigation measures, no significant health and safety impacts are expected.

4.8.3 Alternative 1

Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on health and safety would be the same as those discussed for the proposed action.

4.8.4 No Action Alternative

Under the no action alternative, the FAA would not issue permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impacts on health and safety.

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 that 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 that exceed the applicable thresholds of significance, a similar conclusion usually may be drawn with respect to compatible land use. Land use impacts are described in terms of the launch and landing activities under the proposed action and the establishment of a safety clear zone.

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). 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

No significant impacts on land uses would occur as a result of the proposed action. The Kern County General Plan, the Mojave Specific Plan, the West Mojave Plan, and the Kern County ALUCP are the applicable land use planning documents for the Mojave Airport. The Mojave Airport is a highly developed, urbanized, non-sensitive area, and habitat and nature conservation plans are not applicable to the airport. The Kern County ALUCP has established Primary Compatibility Criteria (PCC) zones within the airport influence area. The PCC zones were developed in the airport influence area in consideration of the current and future activities of the airport, and have location, safety, development, and usage specifications.

The proposed suborbital rocket testing would take place in land use zone B1, and the proposed action meets acceptable use criteria for that zone. Although vertical launches and landings are not typically conducted at Mojave Airport, the suborbital rockets are equal to or less than the airport's typical horizontally launched vehicles in size, power, and noise. Runway 22 may need to be closed during suborbital rocket testing, but the airport would not be shut down. Therefore, there would not be a significant change in airport activities under the proposed action. All land uses and building restrictions in the PCC zones on the Mojave Airport would be maintained as defined in the Kern County ALUCP. The proposed action does not include any major additions or modifications to the airport facilities that would physically divide an established community. Therefore, the proposed action would not result in a conflict with an applicable land use, habitat conservation, or natural community conservation plan.

No farmlands or agricultural use lands are located on the Mojave Airport. No prime farmland, unique farmland, farmland of state importance, or general farmland would be converted to a non-agricultural use as a result of the proposed action. No conflicts with existing agricultural uses or

Williamson contracts would occur as a result of the proposed action.⁴ No parks, recreational facilities, or Section 4(f) resources are located within the Mojave Airport property, and thus no impacts to these land uses and resources would be expected.

4.9.3 Alternative 1

Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on land use would be the same as those discussed for the proposed action.

4.9.4 No Action Alternative

Under the no action alternative, the FAA would not issue permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur, and land use at the Mojave Airport would not change.

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 XL0.1, XA0.1, and XA0.2 suborbital rockets. Because the XL0.1 is the largest of these rockets and has the potential to produce the most noise, the noise analysis is based on a launch manifest of all XL0.1 rockets to conduct a conservative analysis of impacts. The XL0.1 suborbital rocket's engines would be ignited on the ground; therefore, the analysis of rocket engine noise associated with this type of vehicle begins while the vehicle is still on the ground.

A significant impact would be a substantial (5 dB) permanent or temporary increase in noise level even though the magnitude of overall noise may be within land use compatibility, the exposure of people residing or working in the airport area to excessive noise levels, or noise levels that exceed the following applicable noise standards:

- State of California Building Code Part 2, Title 24 requires areas exposed to noise levels of 60 dB community noise equivalent level (CNEL) or greater to achieve an annual interior noise level of 45 dB CNEL through acoustical insulation measures,
- California's Land Use Compatibility for Community Noise Environments guidelines require a CNEL of 65 dB for exterior areas and 45 dB for interior areas for sensitive land uses, and
- The Kern County General Plan Noise Element, the Mojave Specific Plan, and the Kern County ALUCP require transportation noise sources to meet a 65 dB yearly day-night

⁴ The California Legislature passed the Williamson Act in 1965 to preserve agricultural and open space lands by discouraging premature and unnecessary conversion to urban uses. The Act creates an arrangement whereby private landowners contract with counties and cities to voluntarily restrict their land to agricultural and compatible open-space uses. The vehicle for these agreements is a rolling term 10-year contract (i.e., unless either party files a "notice of non-renewal," the contract is automatically renewed for an additional year). In return, restricted parcels are assessed for property tax purposes at a rate consistent with their actual use, rather than potential market value. (FAA, 2004)

average sound level (L_{dn}) for exterior noise levels and a 45 dB L_{dn} for interior noise levels for areas with sensitive land uses.

A non-significant impact would be an insubstantial change in noise level even though the overall magnitude is greater than land use compatibility standards.

4.10.2 Proposed Action

The launch and landing of XL0.1 suborbital rocket would not cause a significant impact to noise levels in the ROI. The XL0.1 would have eight 2,224 Newtons (500 pounds-force) engines. The propulsion system would consist of 270 kilograms (595 pounds) of isopropyl alcohol and 445 kilograms (981 pounds) of LOX. Tests conducted at the Mojave Airport would not rise above 152 meters (500 feet). The longest of these tests would last approximately 107 seconds at 100 percent throttle or 179 seconds at 60 percent throttle. The powered duration of the flight would be no more than 150 seconds; most tests would occur for no more than 60 seconds.

No significant impacts to noise levels at the Mojave Airport would occur as a result of the proposed action. Approximately 1,226 jet aircraft takeoff and land at the Mojave Airport annually (an average of three to four per day). (FAA, 2004) Of that, 713 are military jet aircraft, such as the F-4 and the Saab Draken. High performance, afterburning jet aircraft like the F-4 and the Saab Draken cause high intensity single event noise levels at the Mojave Airport. (FAA, 2004)

The suborbital rockets that would be tested will be much smaller and much quieter than the F-4 or other aircraft taking off and landing at the Mojave Airport. Furthermore, the frequency of the launches would be low. The proposed action, at a maximum, would launch and land 50 XL0.1 suborbital rockets in 2006 over a two month period, or an average of five to six launches per week. XL0.1 flight tests would last 179 seconds at most. Conservative assumptions are that for the entire three minutes, the rocket engine is ignited. It is also assumed that all launches would occur during daylight hours (7 AM to 7 PM). With approximately five to six launches per week at three minutes per launch, the Mojave Airport would be exposed to a total of 16.5 minutes of additional high intensity noise level per week. The total time of additional high intensity noise levels is likely overestimated due to conservative assumptions of launch vehicles and launch time periods.

The amount of noise produced by an engine is related to several factors including the thrust produced by the engine. The F-4 jet aircraft with afterburners used at the Mojave Airport has a thrust of 79,623 Newtons (17,900 pounds); this corresponds to a maximum A-weighted sound level of 109.7 dB at a distance of 305 meters (1,000 feet). (FAA, 2004) The XL0.1 vehicle proposed for launch from the Mojave Airport in 2006 would have a maximum thrust of 8,896 Newtons (2,000 pounds), which is significantly lower than the thrust of the F-4 jets and other aircraft currently operating at the airport. It is therefore anticipated that the noise levels produced by the launch of the XL0.1 vehicle would be lower than the noise levels produced by aircraft already in use at the Mojave Airport. Because the Mojave Airport currently experiences high intensity noise levels due to military jet flights and stationary rocket testing, the additional noise level would be much lower than existing noises and there are no noise sensitive receptors

or areas within the ROI at the Mojave Airport, impacts to noise levels during launches at the Mojave Airport would be insignificant.

The proposed action would not expose persons to or generate noise levels in excess of standards established by the California State Building Code, the California Land Use Compatibility for Community Noise Environments guidelines, the Kern County General Plan, the Mojave Specific Plan, or the Kern County ALUCP. The proposed action would not result in a significant permanent or temporary increase in ambient noise levels in the Mojave Airport vicinity.

4.10.3 Alternative 1

Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described under the proposed action, and impacts on ambient noise levels would be the same as those discussed for the proposed action.

4.10.4 No Action Alternative

Under the no action alternative, the FAA would not issue permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, 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, the ROI for this analysis is the Mojave CDP even though effects on socioeconomics and environmental justice should not extend beyond the proposed operational area. This analysis will be divided into socioeconomics, environmental justice, and children's health for the proposed action and no action alternative. This analysis compares the potential impacts to the significance thresholds in FAA Order 1050.1E.

4.11.2 Proposed Action

It has been determined that the proposed action does not have any substantial impacts on 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 will discuss in more detail why the proposed action does not exceed the thresholds of significance applicable to socioeconomics, environmental justice, or children's health.

4.11.2.1 Socioeconomics

Since no new development would be required to support the proposed action and existing personnel would be used to conduct suborbital rocket testing, it would not induce significant population growth in the Mojave CDP. Because the proposed site is on airport land, no business or residents would be displaced so no decrease in population would be expected and no disruption to local businesses would be expected. No impacts on employment are expected because no jobs would be created or eliminated as a result of the proposed action; and therefore, no increase or decrease in the demand for housing would be expected.

4.11.2.2 Environmental Justice

Because only existing personnel would be used to conduct launch activities, the proposed action would not have an impact on the health or environment of minority or low-income populations located at or near the airport. Noise levels generated during suborbital rocket launches would be short-term in nature and overall predicted noise levels would not exceed ambient noise levels in residential areas. Because these noise levels would be significantly less than those generated by existing vehicles in the region, would occur infrequently over the course of a year, and already occur as part of existing activities in the region, these short-term noise impacts would be less than significant for environmental justice communities.

4.11.2.3 Children's Health

Effects from the proposed action are not concentrated in an area that might contain proportionally more children. The percentage of children under 18 in the Mojave CDP is greater than the percentage throughout the U.S., but less than the percentage in California. Although the Mojave CDP has a higher percentage of children under age five than the U.S. or California, any effects from the proposed action should not disproportionately impact the health and safety of children as compared to adults. Therefore, the impacts of the proposed action on children's health and safety should not be disproportionate as defined under EO 13045.

4.11.3 Alternative 1

Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described under the proposed action, and impacts on socioeconomics, environmental justice, and children's health would be the same as those discussed for the proposed action.

4.11.4 No Action Alternative

Under the no action alternative, the FAA would not issue permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur, and there would be no change in current activities at the Mojave Airport. Therefore, there would be no impacts on socioeconomics, environmental justice, or children's health.

4.12 Transportation

4.12.1 Approach to Analysis

The analysis of transportation impacts addresses ground traffic entering and leaving the Mojave Airport area. 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 systems around the Mojave Airport.

4.12.2 Proposed Action

Activities associated with the proposed action that could impact ground transportation around the Mojave Airport include transporting personnel, propellants, and the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets and associated components to the proposed launch site. The proposed action does not call for the use of the Mojave Airport rail spur; therefore, no impacts on rail transportation are anticipated.

The increased road traffic that would result from transporting equipment and personnel to and from the proposed launch site would only add a few vehicles above existing traffic loads on Business SR-58. Six trucks would be required to transport the concrete pad materials to the proposed site and the suborbital rockets, and two tank trucks would be required to transport and store propellants. Currently, the Mojave Airport receives approximately 264 deliveries annually. (FAA, 2004) Activities under the proposed action would only increase the number of deliveries by small amount. In addition, transport of equipment and personnel would be limited to two-month operational period, which would result in a relatively infrequent and insignificant increase in number of vehicles on local roads at any given time.

The Mojave Airport is located at the crossroads of major north/south and east/west roadways and existing access roads could easily handle this level of vehicle traffic without a change in level of service designation or a significant change in the volume to capacity ratio. The proposed action would not result in inadequate emergency access or parking capacity at the Mojave Airport. No more than two additional passenger vehicles and eight delivery trucks would be anticipated as part of the proposed action, and this would not materially increase the number of traffic accidents, increase traffic congestion, or cause a decline in the level of service of local roadways. Overall, no significant transportation impacts would be expected.

4.12.3 Alternative 1

Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on transportation would be the same as those discussed for the proposed action.

4.12.4 No Action Alternative

Under the no action alternative, the FAA would not issue permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impact on transportation.

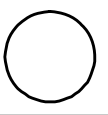
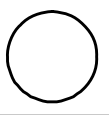
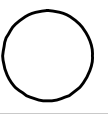
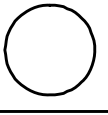
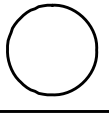
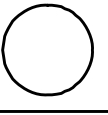
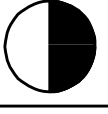
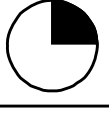
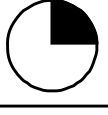
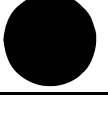
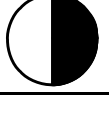
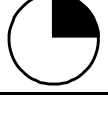




4.13 Visual Resources

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 on 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 area surrounding the proposed launch site. 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 4-6 graphically displays the concepts of intensity and context.

Exhibit 4-6. Determination of Impact Based on Visual Dominance and Visual Sensitivity

Intensity Visual Dominance	Context Visual Sensitivity		
	<i>High</i>	<i>Moderate</i>	<i>Low</i>
Would generally be overlooked "Not Noticeable"			
Noticeable, but not detract from the existing dominant landscape features "Visually Subordinate"			
Changes compete for attention with other viewsd features "Visually co-dominant"			
Changes demand attention "Visually dominant"			
Impact Determination			
   			
Not Significant Adverse, but not significant Significant, but mitigable Significant and unavoidable			

4.13.2 Proposed Action

If members of the general public happen to be in the area during the proposed testing, the rocket-powered launches would be similar to the current visual setting but might attract and dominate the attention of a viewer in this area because of the vertical operation and characteristics of the rockets when compared to the horizontally launched aircraft and rockets currently in operation at the airport. In these few cases the launch itself might be "visually dominant"; however, the relatively small number of test flights of the XA0.1, XA0.2, and XL0.1 suborbital rockets (a maximum of 50 over a two-month period) and the temporary nature of the visual change (a maximum flight time of 3 minutes) would mitigate any resulting impacts. In addition, the Mojave Airport, as an active airport and industrial site, is a low visual sensitivity area, and so the resulting impact rating for "visually dominant" intensity ratings would be adverse, but not significant.

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 and mitigation measures might be required to shield viewers in the area from light generated as a result of the launch. Masten Space Systems has not proposed any nighttime operations at this time. If night launches were proposed in the future they would be analyzed in a separate environmental analysis.

The new concrete launch and landing pads would blend with the current active industrial nature of the site and would not cause any visual resource impacts.

4.13.3 Alternative 1

Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on visual resources would be the same as those discussed for the proposed action.

4.13.4 No Action Alternative

Under the no action alternative, the FAA would not issue permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impact on visual resources.

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 on water resources:

- The degree to which the action may adversely affect water quality and supply, wetlands, or wild and scenic rivers,
- Whether the action threatens a violation of Federal, state, or local law or requirements imposed for water resources,
- The degree to which the action may encroach on floodplains and cause deterioration of natural and beneficial floodplain values, and
- Whether the action is consistent with the applicable state's Coastal Zone Management Plan.

4.14.2 Proposed Action

Potential impacts to ground water resources could occur as a result of accidental spills or leaks of propellants during onsite fueling and purging operations. Isopropyl alcohol rapidly biodegrades in both soil and water environments. (HSDB, 2005) Any accidental releases of isopropyl alcohol into the environment would not be expected to persist or migrate from soils to ground water; therefore, no significant impacts on ground water quality would be expected. LOX is a non-toxic cryogenic liquid that evaporates if not kept at an extremely low temperature, so any accidental release of LOX would evaporate and not impact ground water.

In the event of a catastrophic accident, unspent propellants could be released into the environment, and debris and wreckage could impact drainage patterns or storm water flows. But, the small size of the proposed suborbital rockets and the low probability of a catastrophic event would make the impacts insignificant. Extensive emergency response and clean-up procedures would further reduce the magnitude and duration of any impacts.

Activities under the proposed action would not use significant amounts of ground water. The proposed action would not substantially deplete ground water supplies or interfere with ground water recharge such that there would be a net deficit in aquifer volume or a lowering of the local ground water table; therefore, no significant impacts on ground water supply are anticipated.

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Activities under the proposed action would not result in any contaminant releases that would cause violations of local, state, or Federal water quality requirements. The existing storm water system and permit would be adequate for the proposed action. In addition, surface water bodies, wetlands, and wild and scenic rivers are not present at the Mojave Airport; therefore, there would be no impacts to these resource areas.

The Mojave Airport is located outside the 100-year flood hazard plain. Under the proposed action, no structures that may impede or redirect flood flows would be placed within the 100-year floodplain and therefore, no significant impacts on floodplains would be expected. The Mojave Airport is also located in the interior of the state and not within California's coastal zone as defined in the state Coastal Zone Management Plan. Thus, the proposed action is not required to conform to the California Coastal Zone Management Plan.

Sediment runoff into surface waters from the construction of the concrete launch and landing pads would be minimized using best management practices.

4.14.3 Alternative 1

Under alternative 1, test flight operations would occur at the secondary site at Mojave Airport as shown in Exhibit 2-1. All activities would occur as described for the proposed action, and impacts on water resources would be the same as those discussed for the proposed action.

4.14.4 No Action Alternative

Under the no action alternative, the FAA would not issue permits to Masten Space Systems. No test launches of the XA0.1, XA0.2, and XL0.1 suborbital rockets would occur at the Mojave Airport, and there would be no impacts on water resources.

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5 CUMULATIVE IMPACTS

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:

- Ongoing commercial, military, and private aviation activities at the Mojave Airport,
- Activities described under the proposed action, and
- A series of up to 65 tethered flight tests of the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets. Tethered flight tests would involve the use of equipment to prevent the vehicle from rising above 2.1 meters (7 feet) and rocket engine firings of up to 3 minutes. These types of tests would not require a license or permit from the FAA.

The proposed action has been evaluated for cumulative impacts on air quality, airspace, biological resources, hazardous materials, health and safety, noise, transportation, visual resources, and water resources. The results of this evaluation are presented below.

5.1 Air Quality

To examine cumulative localized air quality impacts, the U.S. EPA has specified screening tests in its various regulations. The screening tests are:

1. The proposed action does not produce emissions above certain *de minimis* levels for criteria pollutants for areas that are in non-attainment for Federal ambient air quality standards, and
2. The action must not be considered regionally significant. Regionally significant actions are ones for which the total emissions from the action equal or exceed 10 percent of the air quality control area’s emissions inventory for any criteria pollutant.

To determine the potential cumulative impacts to ambient air quality, emissions below 914 meters (3,000 feet) were evaluated. Exhibit 5-1 includes estimated emissions from current airport operations, the launch of the vertically launched suborbital rockets, tethered test flights of the vertically launched suborbital rockets, propellant and concrete delivery trucks, and propellant loading operations at the Mojave Airport. Emissions from 65 tethered tests flights and their associated truck emissions were calculated using the same method as presented in Section 4.1.1 and 4.1.2 for the flights included in the proposed action. For each tethered test flight, the rocket engines would be fired for a maximum of 3 minutes, and the rocket would be tied down so that it could not rise more than 2.1 meters (7 feet). It was assumed that all the propellant would be burned during these test flights and two trucks would be required to bring the propellant for the 65 tethered flights.

Exhibit 5-1. Cumulative Air Emissions below 914 Meters (3,000 Feet) Including the Proposed Action in 2006, kilograms (pounds)

Emission Activities	CO	NO_x	VOC	PM	SO_x
Existing Aircraft Operations					
Total Emissions from Aircraft Operations at Mojave Airport	125,011 (275,603)	11,676 (25,741)	13,573 (29,923)	11,258 (24,819)	1,443 (3,181)
Total Emissions from Aircraft Fueling Operations (Jet-A fuel and aviation fuel gasoline storage and dispensing) at Mojave Airport	-	-	2,186 (4,818)	-	-
Proposed Action					
Suborbital Rocket Test Flights (50)	-	-	-	-	-
Delivery Trucks for Suborbital Rocket Propellants (2)	0.80 (1.8)	0.83 (1.82)	0.13 (0.29)	0.064 (0.14)	--
Concrete Delivery Trucks for Launch Pad Construction (6)	49 (108)	5 (11)	113 (249)	-	12 (26)
Cumulative Actions					
Tethered Test Flights (65)	-	-	-	-	-
Delivery Trucks for Tethered Test Flight Propellants (2)	0.80 (1.8)	0.83 (1.82)	0.13 (0.29)	0.064 (0.14)	-
Total	125,013 (275,606)	11,678 (25,745)	15,759 (34,743)	11,258 (24,820)	1,443 (3,181)
Total metric tons/year (tons/year)	125.0 (137.8)	11.7 (12.9)	15.8 (17.4)	11.3 (12.4)	1.5 (1.6)
<i>De minimis</i> Threshold Requirements metric tons/year (tons/year)		91 (100)	91 (100)		
Percent of Regional Emissions*	0.4%	0.09%	0.2%	0.07%	0.1%

*Percent is 100 times the emissions of CO, NO_x, VOC, PM, and SO_x from activities divided by the regional inventory of emissions in 2004 for the Kern County Air District (CARB, 2005)

As seen in Exhibit 5-1, the launch of up to 50 vertically launched suborbital vehicles in 2006 in conjunction with other aircraft operations and tethered test flights at the Mojave Airport, would not exceed either of the two screening tests described above for potential cumulative impacts. Therefore, no significant cumulative impacts to air quality are expected.

Cumulative impacts of emissions from launches have the potential to affect global warming. The total CO₂ emissions for the proposed action and the tethered test flights would be approximately 53,450 kilograms (117,830 pounds) in 2006. The cumulative impact on global warming from launches would be insignificant when compared to emissions from other industrial sources. In 2004, CO₂ emissions from both energy consumption and industrial processes totaled 5,973 million metric tons (6,584 million tons). (EIA, 2006) The proposed

action would account for only a fraction (less than 1×10^{-6} percent) of these CO₂ emissions. Consequently, the total expected CO₂ emissions from the proposed action would be insignificant. There would be no emissions that directly affect ozone depletion. Therefore, no significant cumulative impacts on air quality are expected.

5.2 Airspace

Cumulative airspace impacts associated with the proposed action are not anticipated given that coordination and scheduling procedures would be developed with the Mojave Airport Air Traffic Control Tower. In addition, the increase in flight activity at the Mojave Airport would be less than one percent, with all activities occurring below 152 meters (500 feet) for permitted launches and below 2.1 meters (7 feet) for tethered flight tests.

5.3 Biology

No significant cumulative impacts on biological resources would occur as a result of the proposed action. The loss of 18.6 square meters (200 square feet) of potential wildlife habitat from the construction of two concrete pads would not be significant because the area supports minimal plant and wildlife species and is very similar to the surrounding area. The cumulative noise and emissions increases resulting from ongoing aviation activities, the proposed action, and the tethered flight tests could result in an adverse impact on biological resources. However, the biological resources affected would be those that have already been able to tolerate the existing noise and emissions associated with the active airport. Protective mitigation measures are in place for the federally listed, threatened desert tortoise (*Gopherus agassizii*); therefore significant cumulative impacts on threatened and endangered species are not anticipated.

5.4 Hazardous Materials and Hazardous Wastes

Cumulative impacts from hazardous materials use could occur as a result of a combined increase in the quantity of propellants necessary to support ongoing commercial, military, and private aviation activities, up to 65 tethered flight tests, and up to 50 flight tests under the proposed action. However, propellants in support of tethered flight tests and permitted launches would be shipped to the Mojave Airport on an as-needed basis and would not be stored at the proposed launch site for extended periods of time. If a spill were to occur, Masten Space Systems would conform to the Mojave Airport's spill prevention control plan, which would minimize impacts on the environment. All propellants and other hazardous materials would be handled, stored, and used in compliance with all applicable regulations, which would serve to minimize releases and associated environmental impacts. The activities considered under the cumulative impacts analysis would increase the amount of hazardous waste generated on site; however, on site waste management capacity is adequate to manage this amount of waste and Masten Space Systems would not exceed the regulatory limit of a conditionally exempt small quantity generator. No significant cumulative impacts would result from the use of hazardous materials and hazardous waste management.

5.5 Health and Safety

Cumulative impacts on health and safety could occur as a result of the increase in the quantity of propellants handled and in the number of both tethered flight tests and permitted launches

conducted at the Mojave Airport. Trained ground crew personnel would follow established standard operating procedures during propellant handling and loading operations in accordance with all applicable safety regulations. Tethered flight tests would follow all the same public and worker safety protocol as permitted launches; therefore impacts would be similar to those described in Section 4.8.2. Because all operations would follow established safety procedures, no significant cumulative impacts on health and safety are expected.

5.6 Noise

Background noise at the Mojave Airport would increase with the increased level of activity from the tethered flight tests and permitted launches of the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets. During flight tests, the noise levels could potentially be very high, but because there would be at most 65 tethered flight tests and 50 permitted launches over the course of two months and the short duration (a maximum burn time of 3 minutes) of these events, the overall impacts within the noise environment of the active airport would be relatively small. The impacts of flight tests would be relatively small when compared to the existing high intensity noise levels due to military jet flights and stationary rocket engine testing at the Mojave Airport; therefore no significant cumulative noise impacts are expected.

5.7 Transportation

Cumulative impacts to transportation could occur as a result of the increase in road traffic that would result from transporting equipment and personnel in support of ongoing aviation activities, the proposed action, and the tethered flight tests. The combined increase resulting from these activities would only add a few vehicles above existing traffic loads on Business SR-58. No more than two additional passenger vehicles and eight delivery trucks would be anticipated as part of the proposed action, and the two vehicles required for tethered flight tests would not materially increase the number of traffic accidents, increase traffic congestion, or cause a decline in the level of service of local roadways; therefore, no significant cumulative impacts are expected.

5.8 Visual Resources

The construction of two concrete pads under the proposed action would be similar to existing airport infrastructure and would not significantly alter the current visual landscape. Tethered flight tests and permitted launches of the XA0.1, XA0.2, and XL0.1 reusable suborbital rockets may attract and dominate the attention of a viewer in this area because of the vertical operation and characteristics of the rockets when compared to the horizontally launched aircraft and rockets currently in operation at the airport. However, the flight tests would not rise above 2.1 meters (7 feet) for tethered tests and 152 meters (500 feet) for permitted launches. Due to the tests' low altitude, limited number, and short duration (a maximum burn time of 3 minutes), no significant cumulative impacts on visual resources are expected.

5.9 Water Resources

Cumulative impacts to water resources may result from incidental spills and releases associated with aircraft, launch vehicle, and reusable suborbital rocket preparation and propellant loading activities. Masten Space Systems would operate according to established spill prevention

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procedures and would be responsible for the clean up any of spills or releases associated with the proposed action and tethered flight tests; resulting in a small cumulative impact.

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6 MITIGATION MEASURES

Mitigation measures are actions that may be implemented to prevent or reduce the environmental consequences of the activities considered in an EA or EIS. No significant environmental impacts would be expected from the proposed action; therefore, mitigation measures would not be necessary for resource areas, except potentially for biological resources.

Biological Resources

As the result of informal consultation for the February 2004 EA, the USFWS requested that the FAA conduct visual surveys of the runway prior to take-off and landing of suborbital vehicles as a protective measure for a desert tortoise that may be within the Mojave Airport fence. If a desert tortoise were discovered at the airport, personnel would follow appropriate USFWS and CDFG protocols. On May 31, 2006, the FAA contacted the USFWS to propose the same protective measure for the desert tortoise under the proposed action. Visual surveys of the launch pad would be conducted prior to test flights.

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7 AGENCY CONSULTATION

Ms. Judy Hohman, U.S. Fish and Wildlife Service, was contacted on May 31, 2006. See Appendix A for a copy of the letter.

Mr. Milford Wayne Donaldson, California State Historic Preservation Officer, was contacted on June 6, 2006. See Appendix A

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8 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, but still foreseeable.” Some development projects pose the potential for secondary or induced 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 experimental permits to Masten Space Systems for test flights of its XA0.1, XA0.2, and XL0.1 reusable suborbital rockets at the Mojave Airport in Mojave, California would not induce or limit population growth, economic activity, or public service requirements. Additionally, there are no known specific future actions that would be dependent on the proposed action. Therefore, no secondary or induced impacts are expected to result from the proposed action.

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Masten Space Systems Environmental Assessment

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11 REFERENCES

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APPENDIX A AGENCY CONSULTATION LETTERS



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
PAS 2918.4414.5939

July 17, 2006

Stacey M. Zee
Commercial Space Transportation
Federal Aviation Administration
800 Independence Avenue, SW
Washington, D.C. 20591

Subject: Masten Space Systems, Vertical Reusable Suborbital Rockets

Dear Ms. Zee:

We have reviewed your request for informal consultation regarding the potential effects that the issuance of permits by the Federal Aviation Administration to Masten Space Systems to launch three different vertical reusable suborbital rockets at the Mojave Airport may have on the federally threatened desert tortoise (*Gopherus agassizii*). The Federal Aviation Administration is preparing an environmental assessment in accordance with the National Environmental Policy Act to evaluate the potential environmental effects of issuing the permits. We received your request on June 5, 2006.

The tests would be conducted from two 10-foot by 10-foot concrete test pads. The East Kern Airport District, which manages the Mojave Airport, would either construct new concrete pads or place temporary concrete slabs on the ground during the test flights. You requested whether surveys of test areas for desert tortoises prior to the test flights would be sufficiently protective.

Bob Rice of the East Kern Airport District informed Ray Bransfield of my staff that desert tortoises have not been observed within the boundaries of the Mojave Airport for many years, during either routine operations of the airport or during focused surveys. The most recent focused survey, which occurred approximately 4 months ago, was conducted in the area of the proposed test launches. Given this lack of observations, we conclude that desert tortoises are either not present within the boundaries of the Mojave Airport or that they occur there in extremely low numbers.

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Because desert tortoises are either absent from or occur in extremely low numbers at the Mojave Airport, they are unlikely to be encountered during the proposed tests. Additionally, the pre-launch surveys proposed by the East Kern Airport District would prevent any desert tortoises from being killed or injured. Finally, the minor amount of habitat disturbance associated with the tests is not likely to affect the ability of desert tortoises to feed or shelter within the area, if, indeed, any remain within the airport's boundaries. The proposed test area is not located within designated critical habitat of the desert tortoise.

If you have any questions, please contact Ray Bransfield of my staff at (805) 644-1766, extension 317.

Sincerely,

A handwritten signature in black ink, appearing to read "Carl T. Benz". The signature is fluid and cursive, with the first name "Carl" being the most prominent part.

Carl T. Benz
Acting Assistant Field Supervisor
Mojave/Great Basin Desert Division

STATE OF CALIFORNIA - THE RESOURCES AGENCY

ARNOLD SCHWARZENEGGER, Governor

**OFFICE OF HISTORIC PRESERVATION
DEPARTMENT OF PARKS AND RECREATION**

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www.ohp.parks.ca.gov



13 June 2006

Reply To: FAA060612A

Stacey M. Zee
Environmental Specialist
Federal Aviation Administration
Commercial Space Transportation
800 Independence Ave, SW
Washington, DC 20591

Re: Section 106 Consultation for Proposed Test Launch Activities at Mojave Airport,
Kern County, CA.

Dear Ms. Zee:

Thank you for initiating consultation with me pursuant to 36 CFR Part 800, the regulation that implements Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470f), as amended, and other applicable regulations. Your 6 June 2006 letter requests that I concur with a determination of "No Historic Properties Affected" for this undertaking.

As I understand it, the undertaking consists of issuance of experimental permits for Masten Space Systems to conduct test launches of three different vertical reusable suborbital rockets from two test pads. These test launches would be conducted from two 10 x 10 feet concrete pads which would be located as shown in Exhibit 1 of your letter.

The APE for the project is confined to the area around these two sites. I find this sufficient pursuant to 36 CFR 800.4(a)(1). Likewise, I find the FAA's efforts to identify historic properties pursuant to 36 CFR 800.4(b) satisfactory. There were no historic properties located within the APE for this project. Therefore, I concur with the FAA's determination of No Historic Properties Affected by this undertaking.

Thank you again for considering historic properties in your planning process. If you have any questions or concerns, please contact Amanda Blosser of my staff at (916) 653-9010 or at ablosser@parks.ca.gov.

Sincerely,

A handwritten signature in cursive script that reads "Susan K. Stratton for".

Milford Wayne Donaldson, FAIA
State Historic Preservation Officer

MWD:ab