Federal Aviation Administration

Draft Environmental Assessment for the Launch and Reentry of SpaceShipTwo Reusable Suborbital Rockets at the Mojave Air and Space Port

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Draft Environmental Assessment for the Launch and Reentry of SpaceShipTwo Reusable Suborbital Rockets at the Mojave Air and Space Port

AGENCY: Federal Aviation Administration (FAA), lead agency; United States Air Force and National Aeronautics and Space Administration, cooperating agencies

ABSTRACT: This Draft Environmental Assessment (EA) for the launch and reentry of SpaceShipTwo reusable suborbital rockets at the Mojave Air and Space Port analyzes the potential environmental impacts of the Proposed Action to issue experimental permits and/or launch licenses to operate SpaceShipTwo reusable suborbital rockets and WhiteKnightTwo carrier aircraft at the Mojave Air and Space Port in Mojave, California. Under the No Action Alternative, the FAA would not issue experimental permits or launch licenses for operation of SpaceShipTwo and WhiteKnightTwo from the Mojave Air and Space Port. The Mojave Air and Space Port would continue its existing operations.

This Draft EA analyzes the potential environmental impacts of the Proposed Action and No Action Alternative on the following resource areas: air quality; biological resources (including fish, wildlife, and plants); historical, architectural, archaeological, and cultural resources; hazardous materials, pollution prevention, and solid waste; health and safety; land use (including Department of Transportation Section 4(f) properties); light emissions and visual resources; noise and compatible land use; socioeconomic resources, environmental justice, and children's environmental health and safety; and cumulative impacts.

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This Draft EA becomes a Federal document when evaluated, signed, and dated by the responsible FAA official.

Issued in Washington, DC on: 3/7/2012

Dr. George C. Nield
Associate Administrator for Commercial Space Transportation
Responsible FAA Official

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LIST OF EXHIBITS

Exhibit

ACRONYMS AND ABBREVIATIONS

AFB	Air Force Base
AST	Office of Commercial Space Transportation
ATCAA	Air Traffic Control Assigned Airspace
BMSSC	Black Mountain Supersonic Corridor
CCB	Complex Control Board
CCF	Central Coordinating Facility
CDNL	C-weighted Day-Night Average Sound Level
CFR	Code of Federal Regulations
CEQ	Council on Environmental Quality
CO	carbon monoxide
CO_2	carbon dioxide
dB	decibel
dBA	A-weighted sound level
DNL	day-night average sound level
DoD	U.S. Department of Defense
EA	Environmental Assessment
EDMS	Emissions and Dispersion Modeling System
EKAD	East Kern Airport District
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
FR	Federal Register
GHG	greenhouse gas
H_2	hydrogen
H_2O	water
HASC	High Altitude Supersonic Corridor
HTPB	hydroxyl-terminated polybutadiene
JPPB	Joint Policy and Planning Board
LTO	landing/takeoff
MMT	million metric ton
MOA	Military Operations Area

N_2	nitrogen
N_2O	nitrous oxide
NAAQS	National Ambient Air Quality Standard
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NM	nautical mile
NO_X	nitrogen oxides
PEIS	Programmatic Environmental Impact Statement
PM	particulate matter
$PM_{2.5}$	particulate matter 2.5 microns or less in diameter
PM_{10}	particulate matter 10 microns or less in diameter
psf	pounds per square foot
ROI	Region of Influence
SHPO	State Historic Preservation Officer
SO_X	sulfur oxides
SPORT	Space Positioning Optical Radar Tracking
TRACON	Terminal Radar Approach Control
U.S.C.	United States Code
USAF	United States Air Force
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compound

1. INTRODUCTION

1.1 Background

Multiple companies propose to operate SpaceShipTwo reusable suborbital rockets and WhiteKnightTwo carrier aircraft at the Mojave Air and Space Port in Mojave, California. These proposals require FAA issuance of experimental permits and/or launch licenses. Issuing experimental permits and launch licenses are considered major Federal actions subject to environmental review under the National Environmental Policy Act of 1969, as amended (NEPA; 42 United States Code [U.S.C.] 4321, et seq.). The FAA/AST prepared this Draft Environmental Assessment (EA) in accordance with NEPA, Council on Environmental Quality (CEQ) NEPA implementing regulations (40 Code of Federal Regulations [CFR] Parts 1500 to 1508), and FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures, Change 1*, to evaluate the potential environmental impacts of activities associated with the FAA/AST's Proposed Action of issuing experimental permits and launch licenses to operate SpaceShipTwo and WhiteKnightTwo at the Mojave Air and Space Port (see Section 2.1 for a more detailed description of the FAA/AST's Proposed Action).

According to FAA regulations, an applicant must provide enough information for the FAA to analyze the potential environmental impacts associated with the operation of SpaceShipTwo and WhiteKnightTwo. The information provided by an applicant must be sufficient to enable the FAA to comply with the requirements of NEPA. This EA is intended to fulfill NEPA requirements for analyzing the potential environmental impacts of issuing an experimental permit and/or launch license for the operation of SpaceShipTwo and WhiteKnightTwo. The successful completion of the environmental review process does not guarantee that the FAA/AST would issue an experimental permit and/or launch license to operators of SpaceShipTwo and WhiteKnightTwo. The project also must meet all FAA safety, risk, and financial responsibility requirements per 14 CFR Part 400. Additional environmental analyses would be required for future proposed activities not addressed in this EA or in previous environmental analyses.

The FAA/AST previously analyzed the environmental impacts of reusable suborbital rocket operations at the Mojave Air and Space Port in the September 2009 Final Programmatic Environmental Impact Statement for Streamlining the Processing of Experimental Permit Applications (2009 FAA PEIS) (FAA 2009a). The 2009 FAA PEIS, which is hereby incorporated by reference, did not specifically consider the environmental impacts of SpaceShipTwo or WhiteKnightTwo operations, but did evaluate the environmental impacts of 400 annual horizontal and 300 annual vertical rocket launches at the Mojave Air and Space Port over a five-year period, from 2009 to 2014. In order to focus this EA on impacts specific to SpaceShipTwo and WhiteKnightTwo operations at the Mojave Air and Space Port, where the 2009 FAA PEIS provides information and analyses common to all reusable suborbital rocket activities at the Mojave Air and Space Port, the discussion in the 2009 FAA PEIS is summarized and incorporated by reference. Where impacts are specific to SpaceShipTwo and WhiteKnightTwo operations, a detailed discussion is included in this EA. An electronic copy of the 2009 FAA PEIS can be downloaded from the FAA/AST website at: http://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/nepa_docs/review/documents_completed/.

The East Kern Airport District (EKAD) holds a launch site operator license to operate the Mojave Air and Space Port as a commercial space launch site. The FAA/AST granted the Launch Site Operator License to EKAD on June 17, 2004, after the FAA issued an EA (FAA 2004) on February 18, 2004 (hereafter referred to as the 2004 FAA EA), analyzing the environmental impacts of operating a launch site at the Mojave Air and Space Port. A Finding of No Significant Impact (FONSI) for the 2004 FAA EA was published in the *Federal Register* (69 *FR* 22584) on February 26, 2004. The FAA/AST renewed the Launch Site Operator License in 2009, and it expires on June 16, 2014. Relevant information from the 2004 FAA EA is referenced as appropriate in the affected environment and impact analyses for this EA. This EA does not address the Launch Site Operator License.

As the agency responsible for issuing experimental permits and launch licenses to operate reusable suborbital rockets, the FAA is the lead agency for preparation of this EA. The United States Air Force (USAF) and the National Aeronautics and Space Administration (NASA) have agreed to serve as cooperating agencies for the preparation of this EA. The Air Force Flight Test Center, Edwards Air Force Base (AFB) is one of three principal military entities conducting activities in the special use airspace (R-2508) where SpaceShipTwo and WhiteKnightTwo operations would occur (see Section 2.1.1 below for more information). NASA has special expertise and interest in the operation of reusable suborbital rockets through its programs, such as its Flight Opportunities Program, which are intended to help foster the development of the commercial reusable suborbital transportation industry.

1.2 Purpose and Need for the Proposed Action

The ***purpose*** of the Proposed Action in this EA is to fulfill the FAA's responsibilities under the Commercial Space Launch Act, 51 U.S.C. Subtitle V, ch. 509, §§ 50901-50923 for oversight of commercial space launch activities, including issuing experimental permits and launch licenses to operate reusable suborbital rockets. The ***need*** for the action results from the statutory direction from Congress under the Commercial Space Launch Act to facilitate rocket developers' research and development associated with testing new design concepts, new equipment, or new operating techniques; compliance with requirements; and flight crew training; and to encourage, facilitate, and promote commercial space launches and reentries by the private sector; in order to strengthen and expand U.S. space transportation infrastructure. The FAA/AST could receive multiple applications for experimental permits and launch licenses to operate SpaceShipTwo and WhiteKnightTwo. The FAA/AST must review all applications and determine whether to issue an experimental permit or launch license, as appropriate.

1.3 Request for Comments on the Draft EA

The FAA is initiating a public review and comment period for this Draft EA. Interested parties are invited to submit comments on environmental issues and concerns, preferably in writing, on or before April 13, 2012, or 30 days from the date of publication of the Notice of Availability in the *Federal Register*, whichever is later. The FAA invites interested agencies, organizations, Native American tribes, and members of the public to submit comments on all aspects of this Draft EA. The FAA will consider all comments on this Draft EA in preparing a Final EA. To facilitate FAA consideration and response to comments, it is critical that comments be as specific as possible and clearly state concerns or recommendations related to the issues addressed in this Draft EA.

2. PROPOSED ACTION AND NO ACTION ALTERNATIVE

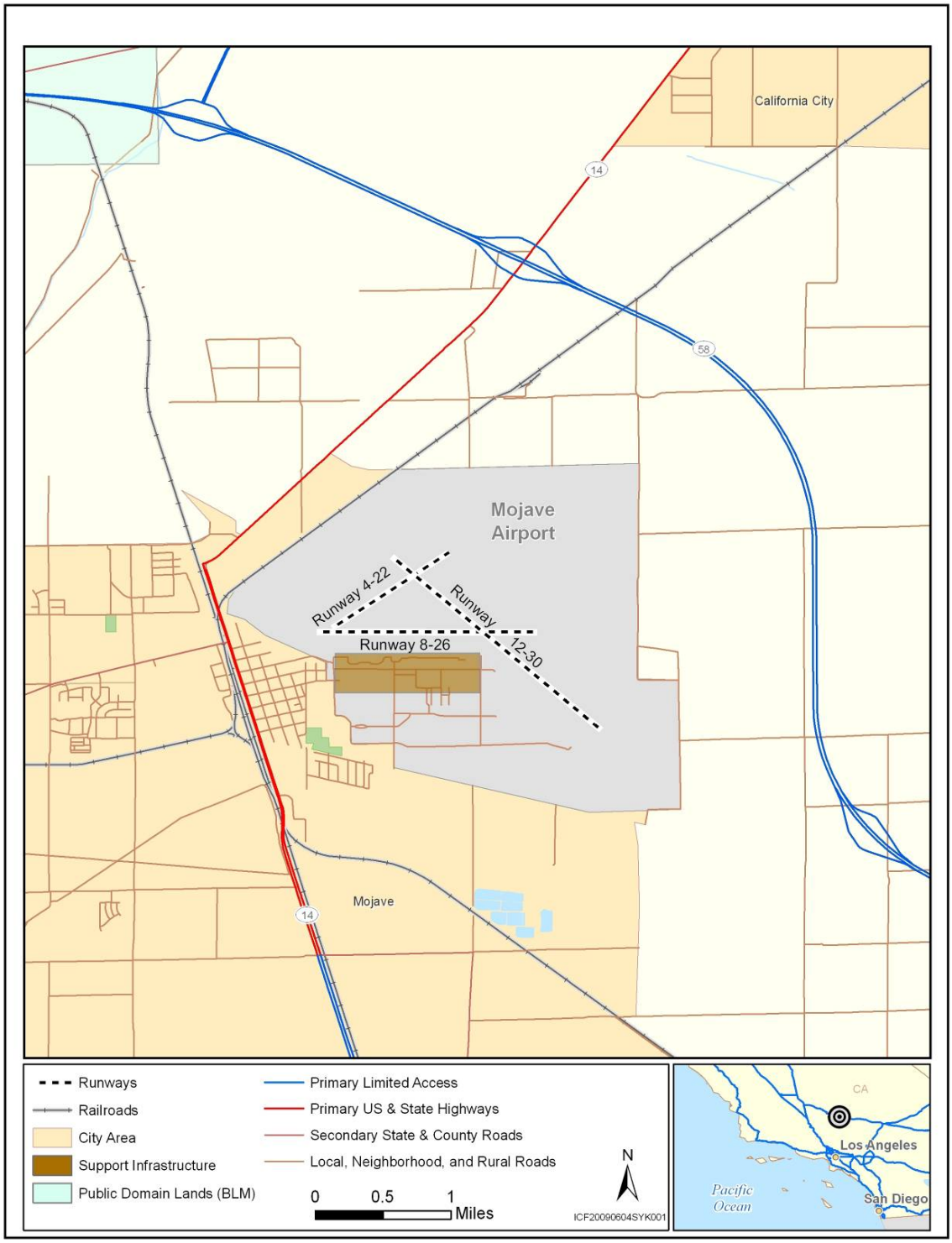
2.1 Proposed Action

The Proposed Action (preferred alternative) is for the FAA/AST to issue experimental permits and launch licenses to conduct the activities described in this EA at the Mojave Air and Space Port (see Exhibit 2-1 below and Sections 2.1.2.5 and 3.6 of the 2009 FAA PEIS for a description of the Mojave Air and Space Port). Under the FAA/AST's experimental permit program (implemented by 14 CFR Part 437), the FAA/AST may issue experimental permits to commercial launch operators for the operation of developmental reusable suborbital rockets on suborbital trajectories. An experimental permit is valid for one year and authorizes an unlimited number of launches and reentries of a reusable suborbital rocket from a U.S. launch site. A permitee can renew its permit by submitting an application to the FAA/AST at least 60 days before the permit expires. The FAA/AST can also issue launch licenses for the operation of reusable suborbital rockets (14 CFR Part 431). A launch license for a reusable launch vehicle is valid for two years and authorizes a licensee to launch and reenter, or otherwise land, any of a designated family of reusable launch vehicles within authorized parameters, including launch sites and trajectories, transporting specified classes of payloads to any reentry site or other location designated in the license. A licensee can renew its license by submitting an application to the FAA/AST at least 90 days before the license expires. This EA assumes that the FAA could issue either new or renewed experimental permits and launch licenses.

Although experimental permits and launch licenses could authorize unspecified number of launch and reentries, for the purposes of evaluating environmental impacts in this EA, the FAA/AST has assumed a maximum of up to 30 total launches and reentries per year of SpaceShipTwo at the Mojave Air and Space Port, for a total of up to 150 launches and reentries of SpaceShipTwo between 2012 and 2016. The FAA/AST used this estimate to develop an upper bound to assess the potential environmental impacts of the Proposed Action. As mentioned in Section 1.1 of this EA, the 2009 FAA PEIS evaluated the potential environmental impacts of multiple operators conducting 400 annual horizontal rocket launches at the Mojave Air and Space Port through 2014. The proposed 30 annual launches and reentries of SpaceShipTwo at the Mojave Air and Space Port through 2014 would be a component of the 400 annual launches addressed by the PEIS. The potential environmental impacts of the proposed launches and reentries of SpaceShipTwo from the Mojave Air and Space Port that are not covered by the PEIS are considered in this EA. Additional operators could be covered by the PEIS analysis, which analyzed 370 more annual launches than the SpaceShipTwo proposal. If the total number of launches and reentries under all issued experimental permits and launch licenses (new or renewed) for SpaceShipTwo operations exceeded 30 per year during 2012 to 2016, additional environmental analyses would be required, as appropriate.

Operations associated with the Proposed Action would primarily consist of two components: a carrier aircraft (i.e., WhiteKnightTwo) and the mated SpaceShipTwo. Both WhiteKnightTwo and SpaceShipTwo would be piloted during operations. During a launch, WhiteKnightTwo would takeoff from an existing runway at the Mojave Air and Space Port and ascend to an altitude of approximately 50,000 feet, where SpaceShipTwo would be released. SpaceShipTwo would ignite its rocket motor and ascend on a nearly vertical trajectory until all rocket

Exhibit 2-1. Mojave Air and Space Port and Surrounding Area[a,b]



a. Source: FAA 2009

b. Note: The Mojave Airport has been renamed to the Mojave Air and Space Port since the development of this graphic. Mojave, CA is considered an unincorporated community.

propellants are consumed, coast to apogee (the highest point in the vehicle flight trajectory), and then glide unpowered to a horizontal landing back on the runway. Up to two smaller support aircraft could also accompany WhiteKnightTwo to track SpaceShipTwo operations. The remainder of Section 2.1 describes Special Use Airspace operations (2.1.1) and SpaceShipTwo, WhiteKnightTwo, and the support aircraft (2.1.2) – Description (2.1.2.1), Propellants (2.1.2.2), Pre-flight and Post-flight activities (2.1.2.3), and Flight Profile (2.1.2.4).

Under the Proposed Action in this EA, the FAA/AST could issue experimental permits or launch licenses to multiple operators of SpaceShipTwo and WhiteKnightTwo. This EA does not reference specific operators, and assumes that the potential environmental impacts associated with operating SpaceShipTwo and WhiteKnightTwo under experimental permits and launch licenses would be identical. It is anticipated that several SpaceShipTwo rockets and WhiteKnightTwo aircraft would be built and operated over time.

The Proposed Action does not include any construction activities. The Mojave Air and Space Port's existing infrastructure, which consists of an air traffic control tower, rocket motor test stands, launch pads, engineering facilities (including the recently built 68,000 square foot hangar), a high bay building, and an existing runway (Runway 12-30 or Runway 08-26), would be used for takeoff and landing activities.

2.1.1 Special Use Airspace Operations

As discussed in Section 3.1.2 of this EA, the off-site operating area includes the R-2508 Complex, which includes all the airspace and associated land presently used and managed by the three principal military entities conducting activities in the Upper Mojave Desert region: Air Force Flight Test Center, Edwards AFB; Army National Training Center, Fort Irwin; and Naval Air Warfare Center Weapons Division, China Lake. When this airspace is not needed for U.S. Department of Defense (DoD) activities, it is released to the FAA for joint use (USAF 2011a). Operation of SpaceShipTwo, WhiteKnightTwo, and the support aircraft within the R-2508 Complex would be compatible with the operations currently being conducted in this airspace and would be conducted under a Letter of Agreement or other appropriate coordination or approvals between the aircraft operators and the managers of each special use airspace involved. After takeoff from the Mojave Air and Space Port, the WhiteKnightTwo and support aircraft would enter the R-2508 Complex under control of either the High Desert Terminal Radar Approach Control (TRACON) (call sign "Joshua Approach") or the Space Positioning Optical Radar Tracking (SPORT) Radar Control Facility located at Edwards AFB, or the Mojave Air Traffic Control Tower. High Desert TRACON is an FAA Air Traffic Control Facility and the controlling agency for the R-2508 Complex. All operations (including takeoff, launch, and landing) would be conducted under control of one of these facilities to ensure appropriate integration with other aircraft operations in the special use airspace. The R-2508 Complex would not close during launch or reentry operations, and all launches and reentries would be coordinated with the appropriate DoD agency.

2.1.2 SpaceShipTwo, WhiteKnightTwo, and Support Aircraft

2.1.2.1 Description

The carrier aircraft, WhiteKnightTwo, is powered by four Pratt and Whitney PW308A engines with a total thrust of approximately 27,600 pounds. WhiteKnightTwo would carry the mated

SpaceShipTwo (see Exhibit 2-2) during takeoff and launch events. WhiteKnightTwo has a wingspan of approximately 140 feet and a maximum gross takeoff weight of approximately 70,000 pounds.

SpaceShipTwo has a hybrid rocket motor with a thrust in the range of 50,000 to 85,000 pounds and a burn time of approximately 60 seconds. The wingspan of SpaceShipTwo is approximately 27 feet, and its maximum launch weight is approximately 29,000 pounds. SpaceShipTwo has an un-fueled/dry weight of approximately 13,500 pounds.

Exhibit 2-2. SpaceShipTwo Mated to WhiteKnightTwo

Source: Virgin Galactic 2011a

Up to two other support aircraft operating from the Mojave Air and Space Port could be used to track SpaceShipTwo operations. Support aircraft would takeoff from an existing runway after WhiteKnightTwo and stay aloft with WhiteKnightTwo until SpaceShipTwo returns to the runway. These support aircraft could include a twin turboprop aircraft such as a Beach Starship (tracking at a higher altitude) and a single-engine piston aircraft such as an Extra 300 (tracking at a lower altitude).

2.1.2.2 Propellants

WhiteKnightTwo uses Jet A fuel and has a maximum fuel capacity of approximately 21,600 pounds. The Beach Starship support aircraft uses Jet A fuel, and the Extra 300 uses aviation gasoline (100 Low Lead) as its fuel.

SpaceShipTwo uses a hybrid propellant with nitrous oxide (N_2O) as an oxidizer and a solid organic material, such as, but not restricted to, nylon, hydroxyl-terminated polybutadiene (HTPB) rubber, plastic, or similar non-explosive organic material, as fuel. Depending on what fuel is used, nylon would be fabricated onsite at the Mojave Air and Space Port, and HTPB would be manufactured off-site in Poway, California. Section 2.1.1.2 of the 2009 FAA PEIS describes hybrid propulsion systems, including the HTPB rubber/N_2O combination of fuel and oxidizer.

SpaceShipTwo has a total propellant capacity (i.e., oxidizer plus fuel) of approximately 15,500 pounds. The solid fuel cartridge, approximately 15 feet long by 33 inches in diameter, integrated with a nozzle throat and nozzle expansion bell called a case, throat, and nozzle, is a single-use item which would be replaced after each flight.

If a flight were aborted after release of SpaceShipTwo from WhiteKnightTwo, it might be necessary to release the N_2O oxidizer from the tank via redundant release valves before SpaceShipTwo glides to a landing. This process could be completed in 2 to 9 minutes. SpaceShipTwo's solid fuel would remain onboard and would return to the ground with SpaceShipTwo.

2.1.2.3 Pre-flight and Post-flight Activities

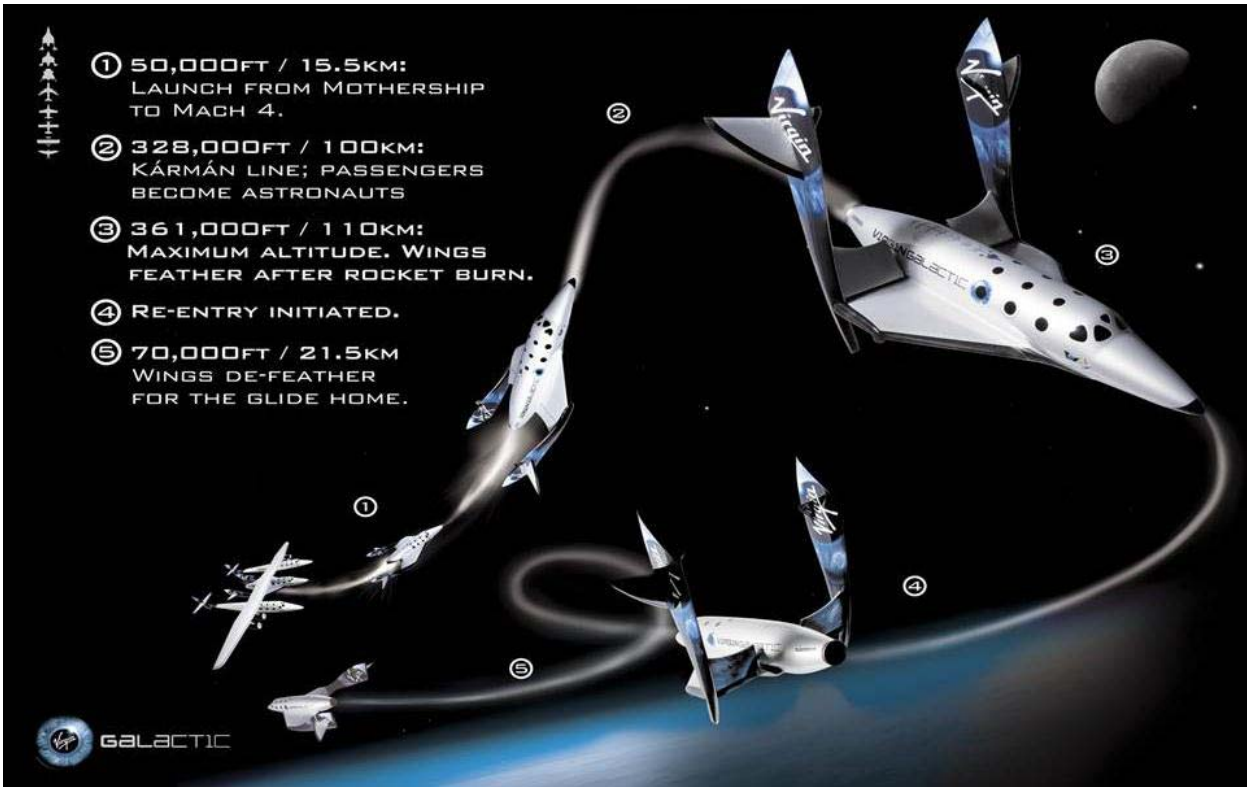
Pre- and post-flight activities would include preparing SpaceShipTwo, WhiteKnightTwo, and the support aircraft for takeoff and launch and providing ground operations support (see Section 2.1.1.3 and 2.1.1.5 of the 2009 FAA PEIS for additional detail). All hazardous pre-flight ground operations would take place in a specified location which has established appropriate safety clear zones in accordance with the Mojave Air and Space Port's launch site operator's license.

For nominal launches, all of the oxidizer would be consumed during SpaceShipTwo powered flight. For aborted flights, the oxidizer would be released before landing, while the solid fuel would remain onboard and would be returned to the ground with SpaceShipTwo. For a nominal launch, no hazardous post-flight ground operations would be required to return SpaceShipTwo to safe conditions, and SpaceShipTwo would be returned to the hangar. In the event the oxidizer is not completely consumed or released, SpaceShipTwo would be moved to an area with an established safety clear zone, and the remaining oxidizer and fuel would be removed in accordance with the Mojave Air and Space Port's Explosive Site Plan. WhiteKnightTwo and the support aircraft would not be affected by an aborted SpaceShipTwo launch and would land as planned.

2.1.2.4 Flight Profile (Takeoff, Flight, and Landing)

SpaceShipTwo and WhiteKnightTwo takeoffs, launches, and landings at the Mojave Air and Space Port would occur only during daytime hours. WhiteKnightTwo with the mated SpaceShipTwo would takeoff horizontally from Runway 12-30 or Runway 08-26 at the Mojave Air and Space Port and fly to the designated launch area within the R-2508 Complex. WhiteKnightTwo would ascend to an altitude of approximately 50,000 feet, and SpaceShipTwo would be released (see Exhibit 2-3). Once released, SpaceShipTwo would fall for several seconds prior to ignition of the rocket motor. WhiteKnightTwo would pull away but remain in flight until shortly after SpaceShipTwo lands. Following ignition of the rocket motor, SpaceShipTwo would climb at supersonic speed (in excess of 768 miles per hour) until propellants are consumed, at or around 150,000 feet, after which the rocket motor would shut off. SpaceShipTwo would then coast to an apogee of at least 360,000 feet above mean sea level. For exoatmospheric flight, a cold gas (compressed air) reaction control system would be used for attitude control. There would be no propellant combustion during the descent of SpaceShipTwo. SpaceShipTwo would fly only suborbital trajectories and therefore would not reach Earth orbit.

Exhibit 2-3. SpaceShipTwo Flight Profile



Source: Virgin Galactic 2011b

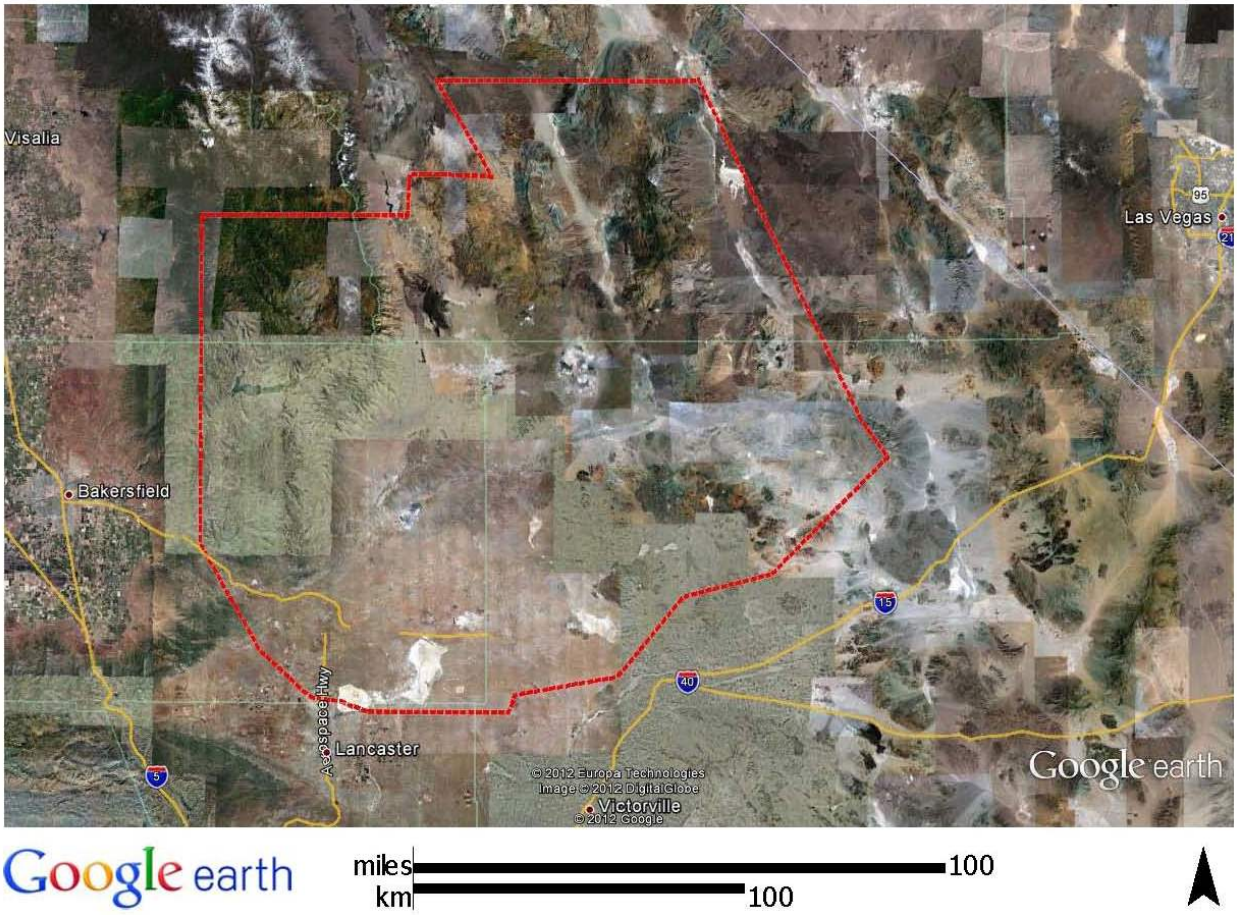
SpaceShipTwo would reenter the Earth's atmosphere in a feathered configuration to make the vehicle less streamlined and to increase drag, thus slowing down the vehicle. SpaceShipTwo would descend from the point of reentry until reaching an altitude of approximately 70,000 feet at which point SpaceShipTwo would switch to a normal or un-feathered configuration and glide unpowered, with no propellant combustion, to a horizontal landing on the designated runway at the Mojave Air and Space Port. A sonic boom would be generated during reentry, at the point at which SpaceShipTwo is no longer supersonic (around 80,000 feet). No supersonic operations would occur outside the area outlined in Exhibit 2-4. WhiteKnightTwo would make a powered horizontal landing on the designated runway at the Mojave Air and Space Port.

Up to two support aircraft could also be used to track SpaceShipTwo and WhiteKnightTwo during flight and would land after SpaceShipTwo and WhiteKnightTwo. In the event of an off-nominal reentry or aborted flight, SpaceShipTwo would glide to the most appropriate contingency or emergency landing site, such as the nearest public, military, or private airport or dry lake bed.

2.2 No Action Alternative

Under the No Action Alternative, the FAA would not issue experimental permits or launch licenses for the operation of SpaceShipTwo and WhiteKnightTwo from the Mojave Air and Space Port. The Mojave Air and Space Port would continue its existing operations.

Exhibit 2-4. Supersonic Operations Area



2.3 Resource Areas Analyzed in this EA

Because the 2009 FAA PEIS is incorporated by reference, the scope of this EA focuses on those resource areas that might be affected by impacts specific to the Proposed Action for SpaceShipTwo, WhiteKnightTwo, and support aircraft operations. These resource areas include the following: air quality; biological resources (including fish, wildlife, and plants); historical, architectural, archaeological, and cultural resources; hazardous materials, pollution prevention, and solid waste; health and safety; land use (including Department of Transportation Section 4(f) properties); light emissions and visual resources; noise and compatible land use; socioeconomic resources, environmental justice, and children's environmental health and safety; and cumulative impacts. This EA summarizes and incorporates by reference the discussion in the 2009 FAA PEIS and does not analyze in further detail the potential impacts to the following environmental resource areas.

Construction Impacts – No construction activities are planned as part of the Proposed Action.

Coastal Resources – The Mojave Air and Space Port is not located in a coastal area, and the Proposed Action would not have an impact on coastal resources.

Water Quality – The Proposed Action would not involve discharges to surface waters or groundwater. Any accidental release of hazardous materials would be minimized through adherence to the EKAD Spill Prevention Control and Countermeasures Plan. In the unlikely event of a launch failure occurring outside of the Mojave Air and Space Port, any potential impacts to water quality would be minimized by emergency response and clean-up procedures.

Wetlands – There are no jurisdictional wetlands at the Mojave Air and Space Port. In the unlikely event of a launch failure occurring outside of the Mojave Air and Space Port, any potential impacts to wetlands would be minimized by emergency response and clean-up procedures.

Floodplains – The Mojave Air and Space Port does not have any 100-year floodplains, and the Proposed Action would not encroach on any base floodplains based on a 100-year flood.

Wild and Scenic Rivers – There are no federally designated Wild and Scenic Rivers at the Mojave Air and Space Port. There are federally designated Wild and Scenic Rivers within the R-2508 Complex, including the Amargosa River, Kern River, Kings River, and potentially portions of Cottonwood Creek, Merced River, Owens River Headwaters, and Tuolumne River. However, because the probability of a crash is low, and because Wild and Scenic Rivers are widely dispersed throughout the region, it is unlikely that debris would impact a Wild and Scenic River.

Farmlands – The Proposed Action would not convert farmland to nonagricultural use.

Natural Resources and Energy Supply – The Proposed Action would not result in the development of new facilities or result in notable changes in local energy demands or consumption of other natural resources.

Secondary (Induced) Impacts – The Proposed Action would not involve the potential for induced or secondary impacts to surrounding communities, such as shifts in population movement and growth, public service demands, and economic activity. The resources analyzed would incur negligible impacts; therefore, the potential for secondary (induced) impacts would also be expected to be negligible.

3. AFFECTED ENVIRONMENT

As noted in Section 1.1 above, the 2009 FAA PEIS is incorporated by reference. Sections 3.1 and 3.6 of the 2009 FAA PEIS fully describe existing general and on-site-specific (i.e., Mojave Air and Space Port) environmental conditions for all resource areas evaluated in the 2009 FAA PEIS. The on-site affected environment is therefore only briefly summarized in this EA. In compliance with the CEQ regulations at 40 CFR § 1502.15, the level of detail provided in this chapter is commensurate with the importance of the impact on these resources.

3.1 Overview of the Proposed Operational Area

This section gives an overview of the proposed operational area, which is referred to as the Region of Influence (ROI) and is divided into on-site and off-site areas. The ROI is divided into on-site and off-site areas to distinguish between the Mojave Air and Space Port property and the area surrounding it where operations would occur. A similar approach was used in the 2004 FAA EA, although the off-site ROI in this EA is larger than the off-site ROI in the 2004 FAA EA.

On-Site ROI

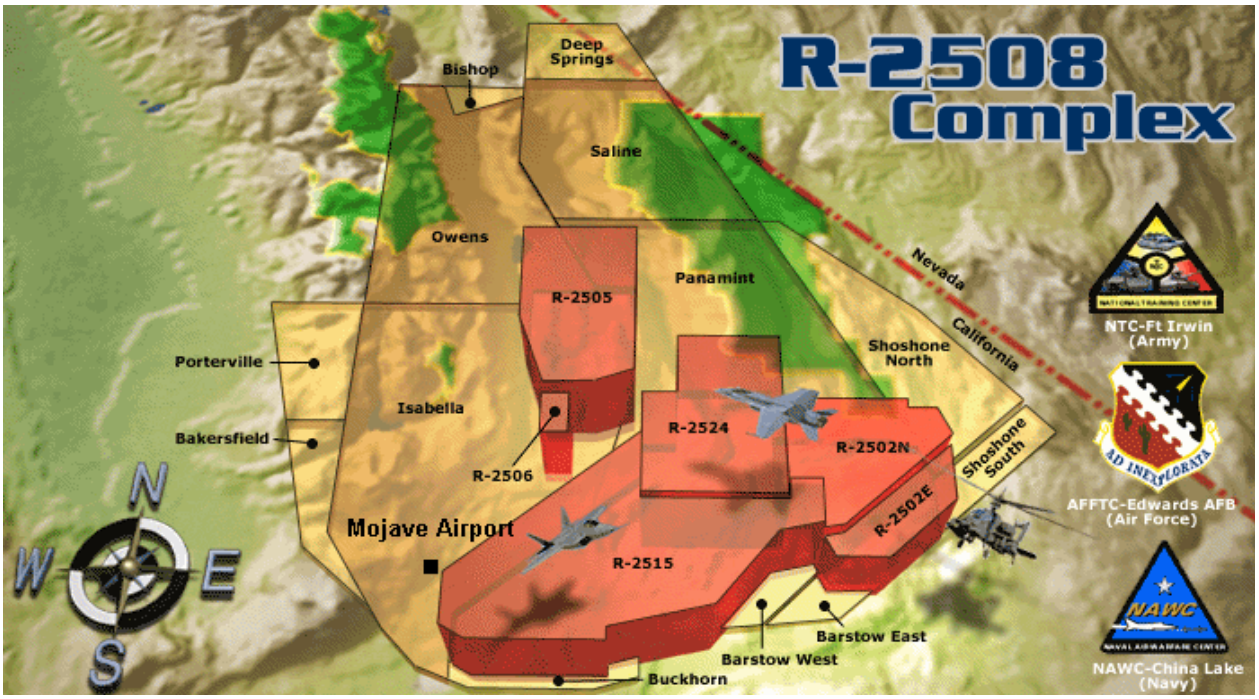
The on-site ROI, defined as the boundaries of the Mojave Air and Space Port, was described in Sections 2.1.2.5 and 3.6 of the 2009 FAA PEIS and is summarized here. EKAD holds a launch site operator license to operate the Mojave Air and Space Port as an FAA-licensed commercial space launch site. The Mojave Air and Space Port is approximately 3,000 acres and is located in Kern County, California east of the unincorporated community of Mojave. There are more than 60 aviation and technology companies located at the Mojave Air and Space Port, making the Mojave Air and Space Port one of the largest employment centers in eastern Kern County (Mojave Air and Space Port 2011). In addition to being a general-use public airport, Mojave Air and Space Port supports flight testing, commercial space industry development, and aircraft maintenance activities. Existing infrastructure at the Mojave Air and Space Port used to support launch activities consists of an air traffic control tower, rocket motor test stands, launch pads, engineering facilities, a high bay building, and two runways (Runway 12-30 and Runway 8-26). More than 300 acres are zoned specifically for rocket motor testing and development. Exhibit 2-1 displays the three runways and the area immediately surrounding the Mojave Air and Space Port.

Off-Site ROI

The off-site ROI is more than 20,000 square miles and is defined by the boundaries of the R-2508 Complex. The R-2508 Complex includes restricted areas R-2508, R-2502N, R-2502E, R-2505, R-2506, R-2524, and R-2515, and adjacent Military Operations Areas (MOAs) and Air Traffic Control Assigned Airspace (ATCAA) areas (see Exhibit 3-1). It encompasses large portions of Inyo, Kern, San Bernardino, and Tulare counties in east-central California. It also includes small portions of Fresno and Los Angeles counties in California, and Esmeralda County in Nevada. Major communities beneath the R-2508 Complex include the cities of California City and Ridgecrest.

A large portion (approximately 82 percent) of the land beneath the R-2508 Complex is managed by Federal agencies, including the National Park Service (26.8 percent), Bureau of Land Management (24.6 percent), Department of Defense (DoD) (17.4 percent), and the U.S. Forest

Exhibit 3-1. R-2508 Complex[a,b]



a. Source: Edwards AFB 2012.
b. Note: The Mojave Airport has been renamed the Mojave Air and Space Port since the development of this graphic.

Service (13 percent) (California Governor's Office of Planning and Research 2008). This area is largely undeveloped desert consisting of shrub and brush vegetation (Kern County 2011).

The R-2508 Complex includes all the airspace and associated land presently used and managed by the three principal DoD entities conducting activities in the Upper Mojave Desert region:

- Air Force Flight Test Center, Edwards AFB;
- National Training Center, Fort Irwin (U.S. Army); and
- Naval Air Warfare Center Weapons Division, China Lake (USAF 2011a).

Management of the R-2508 Complex falls under the R-2508 Joint Policy and Planning Board (JPPB). The JPPB was founded in 1975 under direction of the Joint Logistics Commanders and approved by the respective Service Chiefs and the Office of the Secretary of Defense (USAF 2011a). JPPB members are Commanders of the three DoD entities listed above. The R-2508 Complex Control Board (CCB), established in 1975, is comprised of individuals directly representing their respective JPPB Commander (USAF 2011a). The mission of the CCB is to supervise management of the R-2508 Complex.

Under direction of the R-2508 CCB, the R-2508 Central Coordinating Facility (CCF) is located at Edwards AFB and is the managing and scheduling authority for R-2508 Complex shared-use airspace (USAF 2011a). Within the policy, scope, and limitations set by the CCB, the CCF has autonomous authority for the R-2508 Complex shared-use airspace when the Complex is

scheduled and activated for military use. When the airspace is not needed for DoD activities, it is released to the FAA for joint use (USAF 2011a).

The purpose of the R-2508 Complex airspace is to confine military and other special-use activities, including certain types of test or training flight or weapons uses, to locations where they can be performed effectively while ensuring the greatest practical level of safety for all civil and military airspace users. Inside the R-2508 Complex, the DoD conducts military operations and training flights that require aircraft to fly at supersonic speeds, sometimes as low as 200 feet above the ground (FAA 2004).

3.2 Air Quality

Section 3.1.1 of the 2009 FAA PEIS provides a general description of air quality and climate change, and discussion of the regulatory setting including the National Ambient Air Quality Standards (NAAQS) and the California Ambient Air Quality Standards. Section 3.6.1 of the 2009 FAA PEIS discusses existing air quality conditions at the Mojave Air and Space Port. Section 3.2.1 below describes the attainment status of the on- and off-site ROIs. Section 3.2.2 below provides updated information on existing air quality conditions.

On- and Off-Site ROIs

The Mojave Air and Space Port is located within the Eastern Kern Air Pollution Control District. Eastern Kern County is in Federal nonattainment and state nonattainment for the 8-hour ozone standards, state nonattainment for the 1-hour ozone standard, and state nonattainment for particulate matter (PM) less than 10 micrometers in diameter (PM_{10}). Nonattainment status means that measured ambient concentrations have violated the standard in the recent past. Exhibit 3-2 lists the Eastern Kern Air Pollution Control District attainment status for criteria pollutants. As part of its efforts to reach attainment status, the Eastern Kern Air Pollution Control District has developed several planning documents, including the Federal Ozone Attainment Demonstration Plan, which have been approved by the U.S. Environmental Protection Agency (EPA) and are included in the California Ozone State Implementation Plan. The documents outline baseline and future regional emission inventories, mandated emission reductions, and computer modeling to demonstrate future attainment of the Federal ozone standard. Kern County has also developed the California Clean Air Act Kern County Ozone Air Quality Attainment Plan (most recently updated in December 2005).

Exhibit 3-2. Eastern Kern Air Pollution Control District Attainment Status for Criteria Pollutants[a]

Pollutant	California Standard	Federal Standard
Ozone, 1 hour	Nonattainment	– (Standard revoked)
Ozone, 8 hour	Nonattainment	Nonattainment[b,c]
PM_{10}[d]	Nonattainment	Nonattainment – Serious
$PM_{2.5}$[d]	Unclassified	Unclassifiable[c]
Carbon monoxide	Unclassified	Unclassifiable
Nitrogen dioxide	Attainment	Unclassifiable
Sulfur dioxide	Attainment	Unclassifiable
Lead particulates	Attainment	Unclassifiable

a. Sources: EPA 2011a, CARB 2010.

b. 2006 Federal standard of 0.08 parts per million (ppm). The proposed designation under the 2008 standard of 0.075 ppm is the same.

Exhibit 3-2. Eastern Kern Air Pollution Control District Attainment Status for Criteria Pollutants[a]

c. Nonattainment status means that measured ambient concentrations have violated the standard in the recent past. Maintenance status means that an area was previously designated nonattainment but re-designated as attainment due to meeting the standard. Unclassifiable status means that EPA did not have sufficient data to make an attainment designation. EPA treats federally unclassifiable areas as attainment for regulatory purposes.

d. PM_{10} and $PM_{2.5}$ refer to particles that are less than 10 and 2.5 micrometers in diameter, respectively.

Because Eastern Kern County is designated Federal nonattainment for ozone and PM_{10}, the EPA General Conformity requirements (41 CFR 93 Subpart B) apply to emissions of nitrogen oxides (NO_x), volatile organic compounds (VOCs), and PM_{10}. The Proposed Action would require a Federal conformity determination if it led to an increase in NO_x, VOC, or PM_{10} emissions that exceeded the thresholds, or *de minimis* levels, specified in the conformity rule. The General Conformity *de minimis* thresholds for this area are 100 tons per year of NO_x, 100 tons per year of VOCs, and 70 tons per year of PM_{10}. If the emissions increase caused by the proposed project exceeds the thresholds, a General Conformity determination is required; if the emissions increase does not exceed the thresholds, no further conformity evaluation is required.

As discussed in Section 4.1 below, only emissions generated by aircraft during takeoff and landing would occur in the on-site ROI. Most of the emissions in the off-site ROI would occur above 3,000 feet and would not be mixed to ground level, and thus are not considered with respect to compliance with ambient air quality standards or the General Conformity rule. Therefore, the discussion of existing air quality conditions covers the on-site ROI.

Existing Air Pollutant Levels Measured in the ROI

The California Air Resources Board operates an air quality monitoring site at the Mojave Air and Space Port, at 923 Poole Street, which measures concentrations of ozone, $PM_{10,}$ and PM less than 2.5 micrometers in diameter ($PM_{2.5}$). Exhibit 3-3 summarizes the monitoring results for the most recent three years of data. Ozone levels exceeded the NAAQS on 41 days in 2008, 32 days in 2009, and three days in 2010. PM_{10} levels exceeded the NAAQS on one day in 2008. $PM_{2.5}$ levels did not exceed the NAAQS in 2008–2010.

Exhibit 3-3. Maximum Measured Air Pollutant Concentrations At Mojave Air and Space Port[a]

Pollutant and Averaging Period (Unit)	2008	2009	2010
Ozone, 8 hour (parts per billion)	102	84	83
PM_{10}, 24-hour (micrograms per cubic meter)	154.0	68.0	52.8
$PM_{2.5}$, 24-hour (micrograms per cubic meter)	19.1	12.7	10.0
$PM_{2.5}$, annual (micrograms per cubic meter)	6.8	5.1	Insufficient data

a. Source: CARB 2011.

The nearest additional air quality monitoring sites are located in Lancaster (about 26 miles from the airport), Canebrake (about 37 miles from the airport), and Ridgecrest (about 46 miles from the airport), California. Aircraft landing at or taking off from the airport pass through 3,000 feet altitude within a few miles of the runway, and their emissions do not disperse to ground level at the distances at which these monitors are located. Accordingly, the Lancaster, Canebrake, and Ridgecrest monitors are outside the ROI, and this EA does not report measured concentrations for sites other than Mojave.

3.3 Biological Resources (Including Fish, Wildlife, and Plants)

Section 3.1.2 of the 2009 FAA PEIS provides a general description of biological resources in the on-site ROI, including a description of the regulatory setting. Section 3.6.2 of the 2009 FAA PEIS provides existing conditions for biological resources at the Mojave Air and Space Port.

The Mojave Air and Space Port is situated on the western portion of the Mojave Desert in California and consists largely of developed property. The Mojave Specific Plan (Kern County 2003) is one of three major plans used to control development of the Mojave community (see Section 3.7 below for other land use plans). The Mojave Specific Plan identifies the Mojave Air and Space Port as an "urbanized non-sensitive area" that has already been developed. The area surrounding the Mojave Air and Space Port (including land underlying the R-2508 Complex) is rich in biological diversity because of its varied vegetation communities, distinct landforms, and location adjacent to the Transverse Ranges, the Sierra Nevada, the Colorado Desert, and the Great Basin (FAA 2004).

On-Site ROI

Potential animals in the on-site ROI include invertebrates, reptiles, mammals, and migrant and local birds. Because there is little rainfall and only intermittent streams in the on-site ROI, there are no fish in the on-site ROI (FAA 2004). Exhibit 3-4 presents state and federally protected animal species listed by the U.S. Fish and Wildlife Service (USFWS) and/or California Department of Fish and Game that might be present at or within the vicinity of the on-site ROI. Of the listed animal species potentially occurring in the on-site ROI, the federally threatened desert tortoise (*Gopherus agassizii*) and the state threatened Mohave ground squirrel (*Xerospermophilus mahavensis*) are the only species that have been known to occur at the Mojave Air and Space Port in the past (FAA 2004). Section 4.6.2.3 of the 2009 FAA PEIS provides brief descriptions of the desert tortoise and Mohave ground squirrel.

Exhibit 3-4. State and Federally Listed Animal Species Potentially Occurring in the On-Site ROI[a]

Common Name	Scientific Name	Federal Status	State Status
Mohave ground squirrel	*Xerospermophilus mahavensis*	Not listed	Threatened
Desert tortoise	*Gopherus agassizii*	Threatened	Threatened
California condor	*Gymnogyps californianus*	Endangered	Endangered[b]
Least Bell's vireo	*Vireo bellii pusillus*	Endangered	Endangered[b]
Southwestern Willow flycatcher	*Empidonax traillii extimus*	Endangered	Endangered[b]

a. Sources: USFWS 2012, CDFG 2012

b. Note: The U.S. Fish and Wildlife Service (USFWS 2012) lists these three species as potentially occurring in the on-site ROI. However, the California Department of Fish and Game does not list these three species as being documented in the U.S. Geological Survey 7.5' topographic quad of the Mojave Air and Space Port (CDFG 2012).

During informal consultation in 2007 between the Ventura USFWS Office and EKAD for a water line and tank project at the Mojave Air and Space Port, the USFWS stated desert tortoises have not been detected within the Mojave Air and Space Port during surveys conducted over several years and are not expected to reoccupy the area due to high levels of human activity and large amounts of disturbed land (USFWS 2007, see Appendix B). The USFWS also noted the

Mojave Air and Space Port is not within the boundaries of critical habitat of the desert tortoise or any other federally listed species (USFWS 2007, 59 *FR* 5820–5866 [February 8, 1994]). The USFWS did not expect that any other federally listed species was likely to occur at the Mojave Air and Space Port at the time (USFWS 2007). Therefore, the USFWS concluded that, at such time, desert tortoises were not present within the boundaries of the Mojave Air and Space Port and would not be affected by the water line and tank project or future activities undertaken at the Mojave Air and Space Port (USFWS 2007). The FAA is not aware of any indication that desert tortoises or any other federally listed species have been located within the Mojave Air and Space Port since the 2007 consultation, and no new federally listed species have been added to the list for the on-site ROI (USFWS 2012). Furthermore, the USFWS informed the FAA that no desert tortoise surveys would be required prior to launch activities at the Mojave Air and Space Port (FAA 2009b).

On April 27, 2010, the USFWS announced[1] it was conducting a status review of the Mohave ground squirrel based on a petition to federally list the species as endangered. Based on this review, the USFWS issued a 12-month finding on the petition on October 6, 2011, stating that listing the Mohave ground squirrel as threatened or endangered was not warranted at this time.[2]

The region surrounding the Mojave Air and Space Port to the east consists of Mojave creosote bush scrub, which may be intermixed with chenopod scrub formations (FAA 2004). Joshua tree habitats can be seen in western portions of the region. Exhibit 3-5 lists the only current state and federally protected plant species that might be present at or within the vicinity of the Mojave Air and Space Port.

Exhibit 3-5. State and Federally Listed Plant Species Potentially Occurring in the On-Site ROI[a]

Common Name	Scientific Name	Federal Status	State Status
Bakersfield cactus	*Opuntia basilaris var. treleasei*	Endangered[b]	Endangered

a. Sources: USFWS 2012, CDFG 2012

b. Species not listed as occurring in the on-site ROI by the U.S. Fish and Wildlife Service (USFWS 2012), but listed as occurring in the U.S. Geological Survey 7.5' topographic quad of the Mojave Air and Space Port by the California Department of Fish and Game (CDFG 2012).

Off-Site ROI

Like the on-site ROI, potential animals in the off-site ROI include invertebrates, reptiles, mammals, fish, and migrant and local birds. As mentioned in Section 3.1 above, a large portion of the land in the off-site ROI is federally owned and contains large areas of uninterrupted wildlife habitat. For example, two sensitive ecological areas, as defined by the county of Los Angeles, occur within Edwards AFB. Piute Ponds, in the southwestern corner of Edwards AFB, supports a significant number of waterfowl and provides a stopover area for migratory birds. Mesquite woodlands, in the south-central portion of Edwards AFB, provide a unique habitat for bird species such as phainopepla (*Phainopepla nitens*) and loggerhead shrike (*Lanius ludovicianus*) (USAF 2001).

There is designated critical habitat for the desert tortoise within the off-site ROI (59 *FR* 5820–5866 [February 8, 1994]). For example, approximately 60,800 acres (or about 100 square miles)

[1] 75 *FR* 22063 (April 27, 2010)

[2] 76 *FR* 194 (October 6, 2011).

of the Edwards AFB (located in the off-site ROI) falls within the Fremont-Kramer Desert Wildlife Management Area, one of 12 critical habitat units in the southwestern United States (USAF 2008a). In addition to the desert tortoise and Mohave ground squirrel, other state and federally listed animal species occur in the counties that comprise the off-site ROI and thus could be present within the off-site ROI (see Exhibit A-1 in Appendix A for a list of these species). For example, the off-site ROI contains important habitat for desert bighorn sheep, and some pools and drainages are the only habitat for certain protected fish species, such as pupfish (USAF 2001).

The off-site ROI contains many species of plants, including those associated with the Sequoia, Kings Canyon, and Death Valley National Parks; Sequoia and Inyo National Forests; Domeland and John Muir Wilderness Areas; wildlife and waterfowl refuges; and land managed by the Bureau of Land Management. Mojave Desert plant communities in the off-site ROI include creosote bush scrub, Joshua tree woodland, arid-phase saltbush scrub, halophytic-phase saltbush scrub, lake beds, and mesquite woodlands. These desert plant communities match closely the on-site ROI vegetation. Various non-desert scrub communities are also common within the R-2508 Complex area, including shadscale scrub, chaparral, and sage-grass (also known as sagebrush grassland) (USAF 2001).

The western portion of the R-2508 Complex overlies the Sierra Nevada Range and a portion of the San Joaquin Valley. The vegetation contained in these regions differs substantially from the vegetation found within the Mojave Desert. Mountain slope elevation and the accompanying microclimate gradient result in a zoning of plant communities on east- and west-facing slopes. Several coniferous forest types occur in the Sierra Nevada, including red fir forest, yellow pine forest, mixed coniferous forest, and pinyon-juniper woodlands. Subalpine forests dominated by high-elevation pines, and alpine habitats, also known as fell fields, occur at high elevations in the Sierra Nevada. At lower elevations, foothill grasslands, also known as valley grasslands, are dominated by various grass species. This low-growing herbaceous community is limited to the lower elevations of the western Sierra Nevada and the San Joaquin Valley. Foothill woodlands are dominated by oaks at lower elevations and certain pines at upper elevations on the western side of the Sierra Nevada (USAF 2009).

Exhibit A-2 in Appendix A lists plant species that are federally listed in the counties comprising the off-site ROI and thus potentially could occur within the off-site ROI.

3.4 Historical, Architectural, Archaeological, and Cultural Resources

Section 3.1.3 of the 2009 FAA PEIS provides a general description of historical, architectural, archaeological, and cultural resources, including a definition, description, and regulatory setting. Section 3.6.3 of the 2009 FAA PEIS and Section 3.5 of the 2004 FAA EA provide existing conditions for historical, architectural, archaeological, and cultural resources for the on-site ROI at the Mojave Air and Space Port.

On-Site ROI

As described in the 2009 FAA PEIS, there are no recorded cultural resources or sites listed on or eligible to be listed on the National Register of Historic Places at the Mojave Air and Space Port or in the immediate vicinity. Investigations conducted as part of preparing the 2004 FAA EA concluded that no designated tribal lands are on Mojave Air and Space Port property, although

Southern Paiute, Western Shoshone, Yokuts, and Mojave descendants reside in the surrounding region.

Off-Site ROI

A recent search identified 652 known sites in the California counties of Fresno, Inyo, Kern, Los Angeles, San Bernardino, and Tulare that are listed on the National Register of Historic Places (DOI 2012). One site was listed for Esmeralda County, Nevada (DOI 2012). There are many more known sites in the off-site ROI that may be eligible for listing in the National Register of Historic Places. These include sites identified as American Indian, archaeological, or Native American sites and California State Historical Landmarks.

3.5 Hazardous Materials, Pollution Prevention, and Solid Waste

Section 3.1.5 of the 2009 FAA PEIS provides a general description of hazardous materials, pollution prevention, and solid waste, including a description of the regulatory setting. Section 3.6.5 of the 2009 FAA PEIS provides existing conditions for this resource area at the Mojave Air and Space Port.

On-Site ROI

The Mojave Air and Space Port uses hazardous materials for various institutional activities, which in turn generate hazardous wastes. Hazardous materials and waste are managed in accordance with applicable Federal, state, and local rules and regulations. Most of the hazardous materials at the Mojave Air and Space Port are airplane fuels and rocket propellants (oxidizers and fuels). Other maintenance related materials used, stored, and generated on site include acetylene, paints, used motor and hydraulic oil, gear lubricant, and hydraulic fluid.

There is a bulk tank farm on site with seven above-ground storage tanks that stock Jet-A and 100 Low Lead gasoline fuel. There is also another tank on site that can hold up to 50 tons of N_2O. EKAD has a Spill Prevention Control and Countermeasures Plan in place that outlines operating procedures used to prevent fuel spills. All above-ground fuel storage tanks are monitored daily for spills, and the inspections are formally documented.

Off-Site ROI

Similar to the Mojave Air and Space Port, the off-site ROI contains hazardous materials and waste associated with the military installations located within the off-site ROI. These hazardous materials and waste are managed in accordance with applicable Federal, state, and local regulations and site-specific (e.g., Air Force Flight Test Center, Edwards AFB) environmental and safety standards.

3.6 Health and Safety

Section 3.1.6 of the 2009 FAA PEIS provides a general description of health and safety, including a description of the regulatory setting. Section 3.6.6 of the 2009 FAA PEIS provides existing conditions for this resource area at the Mojave Air and Space Port.

On-Site ROI

The Mojave Air and Space Port provides Jet A and 100 Low Lead gasoline fuel services for aircraft on site. In accordance with the Fueling Policy for Jet A and 100 Low Lead fuels, only EKAD personnel can conduct fuel service activities at the Mojave Air and Space Port. The EKAD Administrative Code, Section 4-2.11, Fuel Handling, addresses safety measures that EKAD personnel and customers must follow before, during, and after providing fuel services. In accordance with the EKAD Administrative Code, a Fueling Policy was established to address all fueling activities at the Mojave Air and Space Port. This policy details requirements regarding proper fueling techniques, storage of fuel and salvage fuel, and spill response and reporting. Additionally, the EKAD Spill Prevention Control and Countermeasures Plan provides guidance for operation of the above-ground fuel storage tanks.

Emergency response services at the Mojave Air and Space Port consist mainly of the EKAD Aerospace Rescue Fire Fighting unit. The fire fighting crew is trained and qualified in fire and rescue techniques, and its response requirements follow the guidelines of the National Fire Protection Standard 402 and the U.S. Air Force Defense Logistics Agency Manual 8210.1. The Kern County Fire Department, located 0.25 mile from the Mojave Air and Space Port, provides 24-hour support to the EKAD Aerospace Rescue and Fire Fighting unit. Additionally, a Special Crash Rescue Vehicle is located at the Mojave Air and Space Port, which is specifically designed to respond to launch vehicle accidents. Hall Ambulance provides on-site, 24-hour, land-based emergency medical services, and Mercy Air provides on-site, 24-hour, air-based emergency medical services.

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

Off-Site ROI

Edwards AFB, approximately 30 miles east of the Mojave Air and Space Port, provides local emergency response services via the mutual aid system and can provide Aerospace Rescue and Fire Fighting crews, security forces, and emergency medical services. A community response plan is in place to communicate and coordinate emergency alerts and responses to the surrounding Mojave community (FAA 2004). Additional military entities within the off-site ROI likely have their own emergency response systems (e.g., the National Training Center at Fort Irwin and the Naval Air Warfare Center Weapons Division at China Lake).

3.7 Land Use (Including U.S. Department of Transportation Section 4(f) Properties)

Section 3.1.7 of the 2009 FAA PEIS provides a general description of land use, including a description of the regulatory setting. Section 3.6.7 of the 2009 FAA PEIS provides existing conditions for this resource area at the Mojave Air and Space Port.

On-Site ROI

Three major plans control the land use development of the Mojave community including:

- *County of Kern General Plan.* In California, state law makes a General Plan the foundation and central feature of the local planning process. Each county and each city is required to prepare, adopt, and maintain a General Plan to govern the physical development of all the land area under its jurisdiction. A General Plan is a type of constitution governing the physical growth and change in the community. No land division, parcel map, conditional use permit, or rezoning can be approved unless it is found to be consistent with the adopted plan (Kern County 2009).
- *County of Kern Airport Land Use Compatibility Plan*. This plan was developed to establish procedures and criteria for Kern County and the incorporated cities to address compatibility issues when making planning decisions regarding airports and the land uses around them (Kern County 2011).
- *Mojave Specific Plan.* The Mojave Specific Plan provides a detailed description of how to implement the goals, objectives, and policies of the General Plan in a manner appropriate to the smaller unincorporated areas of the County (Kern County 2003).

In addition, the Mojave Air and Space Port Airport Layout Plan Update provides information pertaining to the airport and the area it serves, forecasts of aviation activity through 2030, identification of the adequacy of existing airport facilities, and an airport development plan (EKAD 2010). A detailed land use discussion specific to the on-site (and immediate surrounding areas) for the Mojave Air and Space Port was provided in the 2004 FAA EA and the 2009 FAA PEIS, and that discussion is incorporated by reference in this EA.

Off-Site ROI

The various land uses in the R-2508 Complex are characterized in the R-2508 Complex User's Handbook (USAF 2011a). Edwards AFB and the R-2508 Complex have served an important role in test flight activities and development of supersonic vehicles as well as NASA's Space Shuttle orbiter program, and these types of testing activities are typical of those that currently occur in the R-2508 Complex. Land use plans for the areas within the R-2508 Complex have been developed in consideration of these existing military and supersonic vehicle activities.

In 2008, a Joint Land Use Study for the R-2508 Complex was developed (California Governor's Office of Planning and Research 2008). A Joint Land Use Study is a collaborative planning effort between active military installations, surrounding counties and cities, and other affected agencies. The overall goal of a Joint Land Use Study is to reduce potential conflicts while accommodating growth, sustaining the economic health of the region, and protecting public health and safety. The public was provided with the opportunity to participate in the Joint Land Use Study process through a series of public forums held in October 2007 and April 2008. The R-2508 Joint Land Use Study is not an adopted plan, but rather, a recommended set of compatibility guidelines that can be implemented by local jurisdictions, Native American tribes, agencies, and organizations to guide their future compatibility efforts. While the strategies in the Joint Land Use Study are not mandatory obligations, they were developed with representatives of the stakeholders involved, thereby providing a set of strategies designed to meet local needs.

Typical operations within the R-2508 Complex include:

- Aircraft research and development in all stages of flight,
- Operational weapons test and evaluation flights,

- Student pilot training,
- Air combat maneuvering and proficiency flights, and
- Civilian test aircraft in direct support of DoD and/or defense testing.

Aircraft operations occurring in the R-2508 Complex must remain flexible because airspace requirements are not entirely predictable. Therefore, to best use the available airspace, participating aircraft operating in the R-2508 Complex shared-use airspace are not given exclusive use of the airspace and are considered to be operating under concurrent operations (operations occurring simultaneous to other aircraft operations in the airspace) (USAF 2011a).[3] Participating aircraft must accept radar traffic advisories issued by Joshua Approach, China Control, or SPORT unless otherwise coordinated, and use the "see-and-avoid" principle[4] to avoid interfering with the missions of other aircraft using the airspace (USAF 2011a).

The R-2508 Complex includes sensitive areas such as populated areas and National Parks. Flights within the R-2508 Complex shall be conducted so that a minimum of annoyance is experienced by persons on the ground (USAF 2011a). The R-2508 User's Handbook specifies that definite and particular effort shall be taken to fly in such a manner that the individuals (in sensitive areas) do not believe they or their property are endangered (USAF 2011a). All communities within the R-2508 Complex are considered "noise sensitive areas" (USAF 2011a). Noise sensitive areas shall be avoided by a minimum of 3,000 feet (USAF 2011a). The only exception to the 3,000 foot restriction is while operating on a CCF-approved test plan (USAF 2011a). Populated areas located within the R-2508 Complex include the following: Big Pine, Boron, Cartago, Independence, Inoykern, Johannesburg, Keeler, Kernville, Lake Isabella, Lone Pine, Mojave, Mt. Mesa, North Edwards, Olancha, Onyx, Randsburg, Red Mountain, Ridgecrest, Rosamond, South Lake, Stovepipe Wells, Tehachapi, Trona, Weldon, and Wofford Heights (California Governor's Office of Planning and Research 2008, USAF 2011a).

The Federal statute that governs impacts on any publicly owned land for Department of Transportation agencies is commonly known as the Department of Transportation Act, Section 4(f) provisions, although it was recodified and renumbered as 49 U.S.C. Section 303 (c). Department of Transportation agencies must consider impacts to Section 4(f) properties when evaluating the impacts of a proposed transportation activity. Section 4(f) stipulates that Department of Transportation agencies cannot approve the use of any Section 4(f) land unless the following conditions apply:

- There is no feasible and prudent alternative to the use of the land;
- The action includes all possible planning to minimize harm to the property resulting from use.

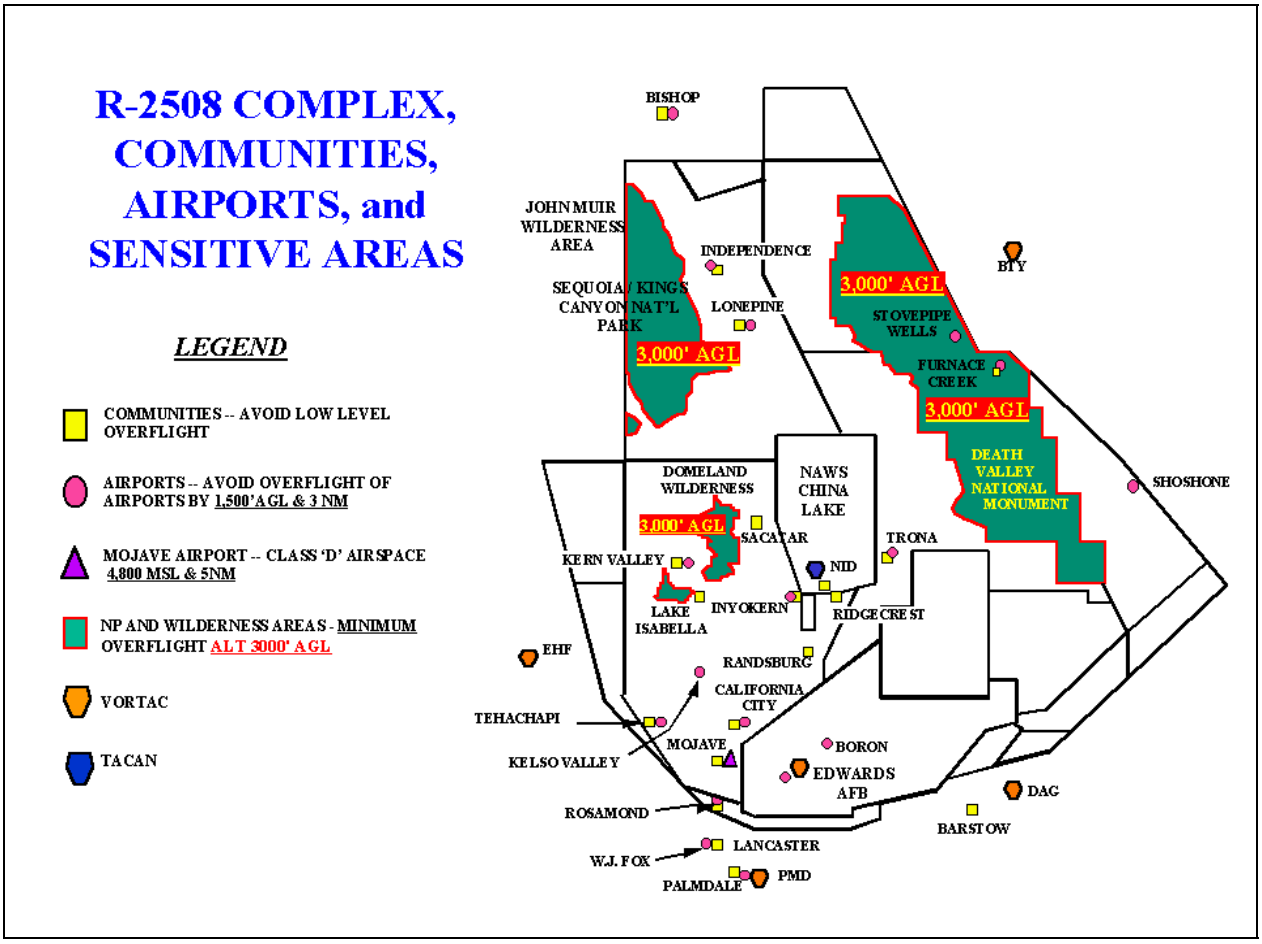
Section 4(f) properties within the R-2508 Complex include but are not limited to Sequoia, Kings Canyon, and Death Valley National Parks; Kiavah, Bright Star, Domeland, and John Muir Wilderness Areas; publicly owned parks, recreational areas, wildlife and waterfowl refuges; and

[3] "Participating aircraft" are aircraft under the command of, or sponsored by, the Navy, Air Force, or Army, members of the R-2508 Joint Policy and Planning Board, and civilian aircraft under Letter of Agreement with the R-2508 Complex Control Board, whose flights require operations above FL180 (18,000 MSL) (USAF 2011a). Civilian flights in the R-2508 Complex that will remain below FL180 (18,000 MSL) for the entire mission are not considered participating aircraft (USAF 2011a).

[4] "See and avoid" is described in 14 CFR § 91.113 as "When weather conditions permit, regardless of whether an operation is conducted under instrument flight rules or visual flight rules, vigilance shall be maintained by each person operating an aircraft so as to see and avoid other aircraft."

public and private historical sites. Exhibit 3-6 shows sensitive land use areas located within the R-2508 Complex, as identified in the R-2508 User's Handbook (USAF 2011a).

Exhibit 3-6. Sensitive Land Use Areas within the R-2508 Complex[a,b]



a. Source: USAF 2011a

b. Note: Exhibit may not contain every noise-sensitive area within the R-2508 Complex.

Management of the R-2508 Complex falls under the R-2508 JPPB. The JPPB deals with airspace planning issues and addresses any violations to airspace use over sensitive areas within the R-2508 Complex (USAF 2011a). The R-2508 Complex scheduling requirements apply to all R-2508 Complex flight activities, including special operations and large-scale exercises. As mentioned above, the CCF is the managing and scheduling authority for R-2508 Complex shared-use airspace. The CCF coordinates mission requirements of all R-2508 Complex users to ensure optimum airspace utilization and safety. In the R-2508 User's Handbook, low-flying aircraft over National Parks and Wilderness areas was identified as a sensitive issue, because noise complaints in these areas gain national attention (USAF 2011a).

To minimize the potential for noise impacts over sensitive areas within the R-2508 Complex, the JPPB specifies minimum altitudes at which aircraft may operate over sensitive areas. All participating aircrews operating within the R-2508 Complex over the Sequoia and Kings Canyon National Parks in the western Owens work area must maintain an altitude of 18,000 feet or above unless that area is specifically scheduled in accordance with current established procedures

through the CCF. All participating aircraft requesting the airspace below 18,000 feet over Sequoia and Kings Canyon National Parks in the western Owens work area must schedule use of that airspace in advance with the CCF in accordance with current procedures. Unscheduled operations below 18,000 feet over Sequoia and Kings Canyon National Parks are authorized at any time for safety of flight considerations.

All aircrews shall maintain a minimum altitude of 3,000 feet and a lateral separation[5] of 3,000 feet from Sequoia and Kings Canyon National Parks, Death Valley National Park (1977 Park Boundaries), Domeland, and John Muir Wilderness Areas (USAF 2011a).

The CCB must give approval for any deviation of uses of the airspace within the R-2508 Complex; this includes overflights of sensitive areas such as National Parks. The R-2508 Complex User's Handbook states that existing restrictions (such as National Park overflight altitudes) are in place to help preserve use of the R-2508 Complex to fulfill missions and to protect other interests in the area (USAF 2011a). The R-2508 Complex User's Handbook suggests that potential airspace users not request deviations to existing restrictions (USAF 2011a).

3.8 Light Emissions and Visual Resources

Section 3.1.8 of the 2009 FAA PEIS provides a general description of light emissions and visual resources, including a description of the regulatory setting. Section 3.6.8 of the 2009 FAA PEIS provides existing conditions for these resource areas at the Mojave Air and Space Port. Visual resources are the natural and man-made features that constitute the aesthetic qualities of an area. Landforms, surface water, vegetation, and man-made features are the fundamental characteristics of an area that define the visual environment and form the overall impression that an observer receives of an area.

On-Site ROI

The existing conditions at the Mojave Air and Space Port would be characterized as having low visual sensitivity because the site is currently an industrialized area that supports air and spacecraft operations. Approximately 300 planes use the three runways at the Mojave Air and Space Port each day. Numerous airplanes are continuously parked at the Mojave Air and Space Port, which can be seen from two highways that intersect in the community of Mojave. Two rail lines also intersect in Mojave. There are numerous wind farm projects located in the area west of the Mojave Air and Space Port and several solar projects in the area surrounding the Mojave Air and Space Port.

Current light sources at the Mojave Air and Space Port include security lighting on the grounds and safety lighting on the runways, which are illuminated at night.

Off-Site ROI

In the off-site ROI, the visual landscape frequently includes aircraft operating throughout the R-2508 Complex. The presence of aircraft is a frequent feature of the visual resources in the R-2508 Complex. Additional visual resources include National Parks and wilderness areas, as discussed in Section 3.7 above.

[5] Lateral separation refers to the minimum distance an aircraft must keep from different airplanes or areas within the airspace.

Light sources within the R-2508 Complex include lighting in the populated areas listed in Section 3.7 above as well as lighting from other industrial areas and airports located within the R-2508 Complex.

3.9 Noise and Compatible Land Use

Section 3.1.10 of the 2009 FAA PEIS provides a general description of noise, including a description of the regulatory setting. Environmental noise levels are typically measured in units called decibels (dB) and then converted to A-weighted decibels (dBA). This adjustment filters out both low and high frequency sounds and approximates the frequency response of human hearing. To account for noise disturbance over time, the dBA values over a one year period are averaged over a 24-hour period resulting in an average annual day, incorporating a 10-dBA penalty weighting for noise occurring at night (10pm to 7am). This produces the day-night average sound level (DNL), which is considered by the FAA and many other agencies to be one of the more appropriate metrics for estimating the degree of annoyance caused by noise.

The noise environment in the State of California may also be described in terms of community noise equivalent level (CNEL). CNEL is essentially the same as DNL except in the CNEL, the 24-hour period is broken into three periods – day (7am to 7pm), evening (7pm to 10pm), and night (10pm to 7am) – with weightings of 5 dBA applied to the evening period and 10 dBA to the night period. FAA recognizes CNEL as an acceptable alternative noise metric, requiring the use of either DNL or CNEL for noise analyses. Because the use of a two-period (DNL) versus three-period (CNEL) measurement for aircraft noise around airports typically yields an insignificant difference (0.7 dBA at most), this analysis employs the DNL metric.

On-Site ROI

Section 3.6.10 of the 2009 FAA PEIS provides existing conditions for noise at the Mojave Air and Space Port. Noise at the Mojave Air and Space Port originates from four primary sources: roadways, railroads, aircraft, and research and development facilities (Kern County 2003). Aircraft activities are the primary source of noise at the Mojave Air and Space Port. Exposure to aircraft noise occurs mainly in the vicinity of the runways and taxi areas. Approximately 17,575 annual aircraft operations occur at the Mojave Air and Space Port annually (Kern County 2011). Of those, about 7.3 percent (or 1,283) are military jet aircraft operations, such as takeoff and landings of the F-4 and the Saab Draken. In addition, aerospace companies based at the Mojave Air and Space Port and the Naval Air Warfare Center at China Lake periodically test experimental rocket engines at the site (NASA 2005, USAF 2011a). The Mojave Specific Plan, under the noise element, states that the "Mojave Airport exhibits a high degree of compatibility with other land uses in the Mojave area. Because of the relatively low level of aircraft traffic into and out of the airport, noise is not a serious concern for established residents and businesses" (Kern County 2003). Land use restrictions established in the Kern County Airport Land Use Compatibility Plan also serve to reduce any potential noise impacts on land uses adjacent to the Mojave Air and Space Port (Kern County 2011).

Off-Site ROI

Noise within the R-2508 Complex is generated, in part, by the operations conducted within the airspace, including aircraft research and development, operational weapons test and evaluation flights, student pilot training, air-combat maneuvering and proficiency flights, and civilian-

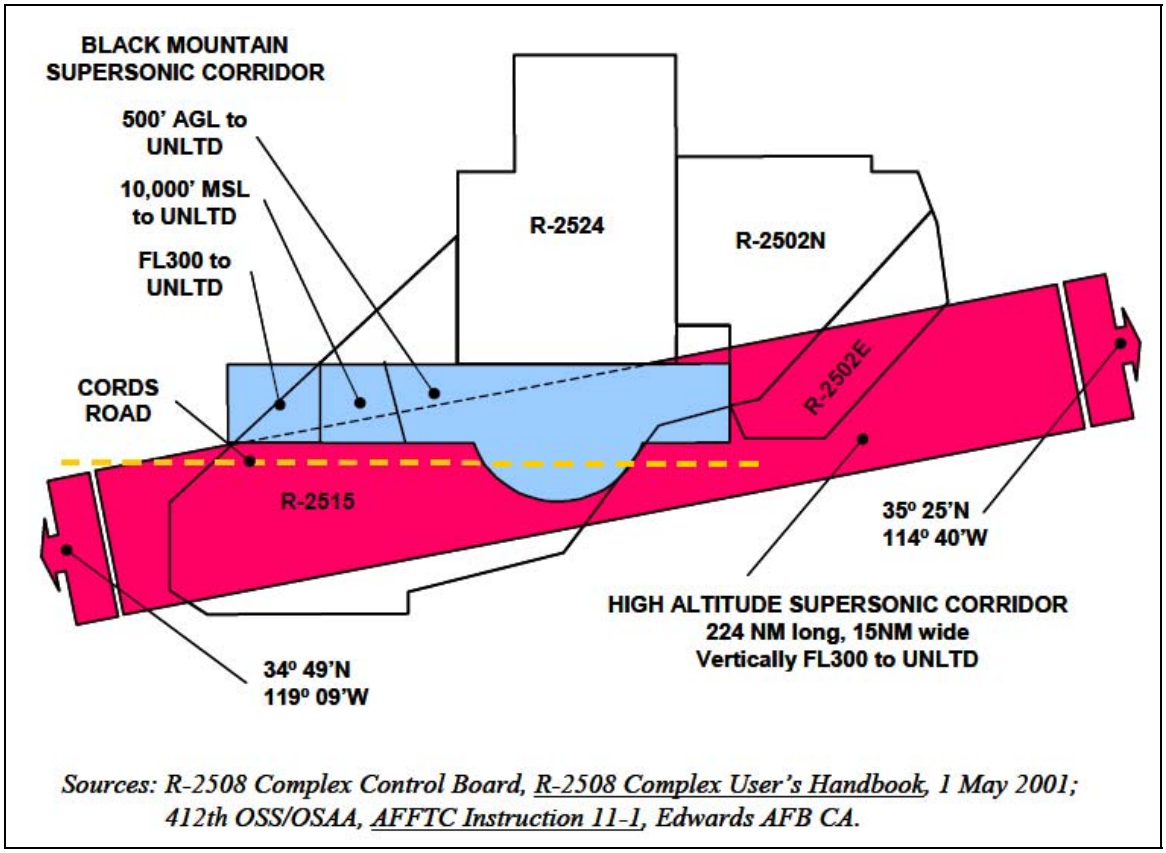
aircraft testing in direct support of DoD and/or commercial defense testing (USAF 2011a). Uses of the airspace and underlying lands include bombing ranges, supersonic corridors, low altitude high speed maneuvers, radar intercept areas, and refueling training areas (California Governor's Office of Planning and Research 2008). Within the R-2508 Complex, the participating aircraft are typically high-performance prototypes or existing operational aircraft such as the F-15, F-16, F-18, F-22, or F-35 (USAF 2009, 2011a). These aircrafts are operated at military power settings or lower by USAF, U.S. Army, U.S. Navy, or other entities, typically generating noise averages ranging from 94 to 121 dBA (measured at the time of the event, 1,000 feet under the flight path).

Other noise sources within the R-2508 Complex include those associated with activities in the populated areas of the off-site ROI. Ambient noise originates principally from vehicle traffic on highways, off-road recreational vehicles, trains, and construction activities. Military aircraft operations and traffic on highways generally contribute the most noise sources in the R-2508 Complex.

Supersonic Corridors

The R-2508 Complex contains two designated supersonic corridors, as shown in Exhibit 3-7: the R-2515 High Altitude Supersonic Corridor (HASC) and the Black Mountain Supersonic Corridor (BMSSC). The HASC is 15 nautical miles (NM) wide and 224 NM long. The BMSSC is 8 NM wide and 57 NM long, with a 9.5 NM radius circular extension for turning (U.S. Army 2003, USAF 2011a).

Exhibit 3-7. Supersonic Corridors in R-2508



a. Source: U.S. Army 2003

Supersonic flight is authorized in the HASC and BMSSC when scheduled (USAF 2011a). The CCB is responsible for granting permission to conduct supersonic flight within the established supersonic corridors (HASC and BMSSC) or to generate sonic booms outside of these corridors (but within the R-2508 airspace).

Noise generated in the two designated supersonic corridors is largely the result of sonic booms, the primary noise impact associated with supersonic activity. Sonic booms are typically heard beneath a supersonic aircraft, sometimes beyond the supersonic corridor boundaries and throughout the R-2508 Complex. The width of the noise path affected by the sonic boom extends one-half NM to the side for each 1,000 feet of flight altitude above ground level of the aircraft. For example, the sonic boom from a supersonic aircraft at 20,000 feet altitude would be heard in a path nominally 20 NM wide (within 10 NM either side of the ground track), but not likely beyond that distance (USAF 2010).

Sonic booms have been known to be heard throughout the R-2508 Complex. Historically, the supersonic corridors at Edwards AFB have hosted an average of 650 supersonic flights per year since 1980. During the 1990s, supersonic flights at Edwards AFB occurred at an average rate of 663 per year, while from 2000–2004, this average rate increased to 831 supersonic flights per year (USAF 2004). From 2006–2011, BMSSC flights at Edwards Air Force Base occurred at an average rate of 800 supersonic flights per year (USAF 2011b).

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

Section 3.1.11 of the 2009 FAA PEIS provides a general description of socioeconomics, environmental justice, and children's environmental health and safety, including a description of the regulatory setting. Section 3.6.11 of the 2009 FAA PEIS provides existing conditions for socioeconomics, environmental justice, and children's environmental health and safety at the Mojave Air and Space Port, which are still valid.

On- and Off-Site ROIs

No schools, daycare facilities, playgrounds, or other places with high concentrations of children are located in the on-site ROI. Two schools – Mojave Elementary and Mojave Junior/Senior High School – are located less than 1,000 feet from the boundary of the Mojave Air and Space Port property, and over 5,000 feet from the major runway. Combined, these schools enroll a total of 801 students.[6] Due to the large size of the off-site ROI, this area contains a number of areas with a high concentration of children and also may contain environmental justice populations.

[6] Data obtained through correspondence with Kressa Coy of Mojave Junior/Senior High and Audria Kingsley of Mojave Elementary on September 22, 2011.

4. ENVIRONMENTAL CONSEQUENCES

This chapter describes the potential environmental consequences of the Proposed Action and No Action Alternative. The FAA evaluated the potential environmental consequences of the Proposed Action and the No Action Alternative in accordance with all relevant legal requirements, including 40 CFR § 1502.16 and FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures, Change 1*, which specify significance thresholds for applicable resource areas.

The 2009 FAA PEIS provided information and analyses common to most reusable suborbital rockets and analyzed the environmental impacts of the use of such rockets at specified facilities, including the Mojave Air and Space Port. As detailed in the sections below, the FAA used the 2009 FAA PEIS data and analyses, and conducted additional analysis for those launch components falling outside the scope of the 2009 FAA PEIS (see Section 1.1), to determine whether any significant potential environmental impacts would result from the Proposed Action analyzed in this EA.

4.1 Air Quality

Impacts to air quality would be considered significant if they caused or contributed to an existing or projected violation of any ambient air quality standard, or conflicted with or obstructed implementation of the air quality plans identified in Section 3.2 of this EA. One indicator of whether further analysis is needed to determine the potential for a standards violation, and thus the significance of the impacts, is the level of emissions increases calculated for General Conformity compliance. If emission increases were to exceed the General Conformity thresholds discussed in Section 3.2, then there would be potential for significant impacts, and a conformity determination would be required.

Air pollutant emissions may be generated during takeoff, launch, and landing operations; pre- and post-launch ground operations; and operational anomalies. The Proposed Action does not include any changes to the physical structure of the Mojave Air and Space Port (e.g., runways) or any construction activities. Therefore, there would be no construction vehicles or associated emissions. This analysis considers emissions in two categories: the lower atmosphere from ground level to a nominal 3,000 foot altitude, and the remainder of the atmosphere above this level. The Federal government uses a 3,000 foot altitude for air quality regulatory purposes because this is the nominal height of the atmospheric mixing layer. Emissions that occur below this altitude can be mixed to ground level by diffusion and wind transport and affect ground-level ambient air quality. Emissions that occur above this altitude are not mixed to ground level. However, they can contribute to climate change and ozone depletion effects in the troposphere above 3,000 feet and the stratosphere (collectively referred to below as the upper atmosphere).

4.1.1 Air Quality Impacts from Launch Operations

The WhiteKnightTwo carrier aircraft and the support aircraft would contribute emissions to the lower atmosphere (up to 3,000 feet) and to the upper atmosphere, and SpaceShipTwo would contribute emissions to the stratosphere. Most of the emissions generated by the Proposed Action would occur in the off-site ROI. Only emissions generated by aircraft during takeoff and landing would occur in the on-site ROI. Section 4.1.1 of the 2009 FAA PEIS contains additional discussion of potential air quality impacts from reusable launch vehicles.

4.1.1.1 Carrier and Support Aircraft Emissions

The FAA's Emissions and Dispersion Modeling System (EDMS) model (FAA 2010) was used to estimate WhiteKnightTwo emissions. WhiteKnightTwo is not included in the EDMS database, so emissions were estimated using the most similar aircraft that uses Pratt and Whitney PW308A turbofan engines (the Raytheon Hawker 4000 Horizon) and then adjusted for the number of engines (four engines on the WhiteKnightTwo and two engines on the Horizon).

EDMS was also used to estimate emissions from the two support aircraft, a Hawker/Beechcraft Starship and an Extra Flugzeugbau EA300. The Starship is powered by two Pratt and Whitney Canada PT6A-67A turboprop engines and is included in the EDMS database. The EA300 is powered by one Lycoming AEIO-540 piston engine. The EA300 is not included in the EDMS database, so emissions were estimated for the most similar aircraft that uses a Lycoming 540 series engine (the Piper PA-24 Comanche).

EDMS estimates emissions for a landing/takeoff (LTO) cycle. An LTO cycle consists of six modes: startup, taxi out (idle/taxiing to the runway), takeoff, climb out (ascent) to 3,000 feet altitude, approach (descent) starting at 3,000 feet, and landing and taxi in (taxiing/idle from the runway). For each mode for each aircraft, EDMS calculates the product of the fuel burn rate per engine (in kilograms per second), the number of engines, the duration of the mode (in seconds), and an emission factor (in grams of pollutant emitted per kilogram of fuel burned). The result is the emissions in kilograms for that aircraft and mode. EDMS sums the emissions for each mode to arrive at the emissions per LTO cycle for that aircraft and pollutant. (EDMS model output in kilograms has been converted to pounds for the exhibits below.) Exhibit 4-1 provides the estimated emissions to the lower atmosphere from WhiteKnightTwo, and the Starship and EA300 support aircraft per LTO cycle and the annual emissions for 30 LTO cycles corresponding to the projected 30 annual launches.

Exhibit 4-1. Estimated Emissions to the Lower Atmosphere from WhiteKnightTwo and Support Aircraft (pounds)[a,b,c]

Description	CO_2	CO	H_2O	VOC	NO_x	SO_x	PM_{10}	$PM_{2.5}$
Emissions per LTO cycle								
WhiteKnightTwo carrier aircraft	4,242	27.09	1,685	20.34	11.05	1.74	0.42	0.42
Beech Starship support aircraft	405	25.74	161	24.33	0.23	0.17	ND	ND
Extra EA300 support aircraft	50	23.14	20	3.18	0.02	0.02	ND	ND
Total aircraft, per LTO cycle	4,697	75.98	1,866	47.84	11.31	1.94	0.42	0.42
Annual Emissions (30 LTO cycles)	140,896	2,279.36	55,972	1,435.31	339.16	58.14	12.70	12.70

a. Source of emission factors: FAA 2010

b. Notes: Data have been rounded; LTO = landing/takeoff; CO_2 = carbon dioxide; CO = carbon monoxide; H_2O = water; VOC = volatile organic compound; NO_X = nitrogen oxides; SO_X = sulfur oxides; PM_{10} = particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = particulate matter less than 2.5 micrometers in diameter; ND = no data available; NA = not applicable.

c. The lower atmosphere refers to the troposphere below 3,000 feet altitude.

Emissions from WhiteKnightTwo and the support aircraft above 3,000 feet altitude were estimated assuming one hour to climb to the 50,000 foot release altitude (for WhiteKnightTwo) or the observation altitudes (for the support aircraft) with the engines operating at climb out power setting, and one hour for the return flight after release of SpaceShipTwo with the aircraft engines operating at approach power setting. Exhibit 4-2 provides the emissions from WhiteKnightTwo and the support aircraft for the portion of total operations above 3,000 feet on a per-launch basis and the annual emissions for 30 launches. The General Conformity requirements do not apply to emissions released above 3,000 feet.

Exhibit 4-2. Estimated Emissions to the Upper Atmosphere from WhiteKnightTwo and Support Aircraft (pounds)[a,b]

Description	CO_2	CO	H_2O	VOC	NO_x	SO_x	PM_{10}	$PM_{2.5}$
Emissions per launch								
WhiteKnightTwo carrier aircraft	50,579	26.44	20,093	266.97	200.81	20.77	5.92	5.92
Beech Starship support aircraft	834	45.93	331	14.69	0.51	0.36	ND	ND
Extra EA300 support aircraft	152	72.07	60	3.71	0.16	0.07	ND	ND
Total aircraft, per launch	51,565	144.44	20,485	285.37	201.49	21.19	5.92	5.92
Annual Emissions (30 launches)	1,546,951	4,333	614,542	8,561	6,045	636	178	178

a. Source of emission factors: FAA 2010, IPCC 1999

b. Note: Data have been rounded; CO_2 = carbon dioxide; CO = carbon monoxide; H_2O = water; VOC = volatile organic compound; NO_X = nitrogen oxides; SO_X = sulfur oxides; PM_{10} = particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = particulate matter less than 2.5 micrometers in diameter; ND = no data available

4.1.1.2 Launch Vehicle Emissions

As noted in Section 2.1.2.2 of this EA, SpaceShipTwo would use N_2O as an oxidizer and a solid organic material as fuel, such as, but not restricted to, nylon, HTPB rubber, plastic, or similar non-explosive organic material. This analysis provides emissions for both nylon and HTPB. Test data indicate that emission indices for HTPB are similar to those for nylon (Scaled Composites 2012). The emission indices for HTPB/N_2O and nylon/N_2O listed in Exhibit 4-3 were used for the SpaceShipTwo emission estimates.

Exhibit 4-3. Estimated Emission Indices for HTPB/N_2O and Nylon/N_2O Propellants (mass emitted/unit mass of propellant)[a,b]

Propellant	CO_2	CO	H_2O	VOC	NO_x	N_2	H_2
Nylon/N_2O	0.178	0.048	0.184	0.0	0.004	0.568	0.022
HTPB/N_2O	0.240	0.099	0.100	0.0	0.004	0.558	0.001

a. Source: Scaled Composites 2011

b. Note: CO_2 = carbon dioxide; CO = carbon monoxide; H_2O = water; VOC = volatile organic compound; NO_X = nitrogen oxides; N_2 = nitrogen; H_2 = hydrogen; N_2O = nitrous oxide

Emissions from launches of SpaceShipTwo would occur from the combustion of the two propellant components, N_2O and solid organic fuel. Each launch would use an estimated 13,000 pounds of N_2O and 2,500 pounds of solid organic fuel for a total propellant mass of 15,500 pounds. The emissions would begin approximately at the release altitude of 50,000 feet, well above the 3,000 foot regulatory limit, and thus are not considered with respect to compliance with ambient air quality standards or the General Conformity rule. On descent, SpaceShipTwo would have no emissions below 3,000 feet because it would glide unpowered to a horizontal landing. The propellant emission indices in Exhibit 4-3 were used to calculate SpaceShipTwo emissions. To estimate the emissions per launch, shown in Exhibit 4-4, the emission indices were multiplied by the total amount of propellant used (15,500 pounds). To estimate the total annual emissions from SpaceShipTwo, also shown in Exhibit 4-4, the emissions per launch were multiplied by the number of launches expected per year (i.e., 30 launches).

Exhibit 4-4. Estimated Emissions to the Upper Atmosphere for SpaceShipTwo (pounds)[a]

Description	CO_2	CO	H_2O	VOC	NO_x	N_2	H_2
Emissions per launch							
Using Nylon/N_2O	2,717	730.12	2,820	0.00	61.23	8,695	339.09
Using HTPB/N_2O	3,679	1,516.25	1,532	0.00	61.23	8,543	21.38
Annual Emissions (30 launches)							
Using Nylon/N_2O	81,505	21,904	84,590	0.00	1,837	260,859	10,173
Using HTPB/N_2O	110,374	45,488	45,946	0.00	1,837	256,276	642

a. Note: CO_2 = carbon dioxide; CO = carbon monoxide; H_2O = water; VOC = volatile organic compound; NO_X = nitrogen oxides; N_2 = nitrogen; H_2 = hydrogen; N_2O = nitrous oxide

4.1.1.3 Total Emissions from Launch Operations

Exhibit 4-5 lists the total estimated emissions from SpaceShipTwo, WhiteKnightTwo, and support aircraft to all layers of the atmosphere. Exhibit 4-5 represents the sum of the emissions listed in Exhibits 4-1, 4-2, and 4-4.

Under the Proposed Action, the emissions from operations of WhiteKnightTwo, support aircraft, and SpaceShipTwo in the upper atmosphere could affect global climate change. CO_2 and H_2O are greenhouse gases (GHGs), and the SO_x and $PM_{2.5}$ from WhiteKnightTwo and the support aircraft can have radiative forcing effects. Based on Exhibit 4-5, the total CO_2 emissions due to the Proposed Action would be approximately 900 short tons per year or 400 metric tons per year. These emissions are a very small fraction of national and global emissions and in this context

Exhibit 4-5. Estimated Emissions from SpaceShipTwo, WhiteKnightTwo, and Support Aircraft to All Layers of the Atmosphere (pounds)[a]

Description	CO_2	CO	H_2O	VOC	NO_x	SO_x	PM_{10}[b]	$PM_{2.5}$[b]	N_2	H_2
Emissions per launch										
Using Nylon/N_2O	58,978	950.54	25,170	333.21	274.02	23.13	6.34	6.34	8,695.29	339.09
Using HTPB/N_2O	59,941	1,736.67	23,882	333.21	274.02	23.13	6.34	6.34	8,542.54	21.38

Exhibit 4-5. Estimated Emissions from SpaceShipTwo, WhiteKnightTwo, and Support Aircraft to All Layers of the Atmosphere (pounds)[a]

Description	CO_2	CO	H_2O	VOC	NO_x	SO_x	PM_{10}[b]	$PM_{2.5}$[b]	N_2	H_2
Annual Emissions (30 launches)										
Using Nylon/N_2O	1,769,352	28,516	755,105	9,996	8,221	694	190	190	260,859	10,173
Using HTPB/N_2O	1,798,221	52,100	716,460	9,996	8,221	694	190	190	256,276	642

a. Note: Data have been rounded; CO_2 = carbon dioxide; CO = carbon monoxide; H_2O = water; VOC = volatile organic compound; NO_X = nitrogen oxides; SO_X = sulfur oxides; PM_{10} = particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = particulate matter less than 2.5 micrometers in diameter; N_2 = nitrogen; H_2 = hydrogen; N_2O = nitrous oxide
b. Includes WhiteKnightTwo only. PM emissions data for SpaceShipTwo propellants and support aircraft are not available.

would have a negligible impact on global climate change. By comparison, U.S. GHG emissions were estimated at 6,633 million metric tons (MMT) of carbon dioxide equivalent (CO_2e)[7] in 2009 (EPA 2011b). Global GHG emissions were estimated at 43,183 $MMTCO_2e$ in 2005 (WRI 2011). The CO_2 emissions under the Proposed Action would represent about one hundred-thousandth of one percent of U.S. GHG emissions and two millionths of one percent of global GHG emissions.

4.1.2 Emissions from Ground Operations

Emissions can occur from support equipment used during ground operations, including trucks and equipment. The 2004 FAA EA estimated the emissions from truck deliveries of Jet A fuel, N_2O, and the rocket motor case, throat, and nozzle containing HTPB. The analysis presented in Exhibit 4-3 of the 2004 FAA EA, which remains valid, can be used to estimate the total emissions from aircraft below 3,000 feet altitude and ground operations under the Proposed Action, as listed in Exhibit 4-6.

4.1.3 Total Emissions and Air Quality Impacts to the Lower Atmosphere

Exhibit 4-6 lists the total emissions from aircraft below 3,000 feet altitude and ground operations under the Proposed Action.

Exhibit 4-6. Estimated Emissions from WhiteKnightTwo, Support Aircraft, and Ground Operations to the Lower Atmosphere (pounds per year)[a]

Description	CO_2	CO	H_2O	VOC	NO_x	SO_x	PM_{10}[b]	$PM_{2.5}$[b]
Aircraft (from Exhibit 4-1)	140,896	2,279.36	55,972	1,435.31	339.16	58.14	12.70	12.70
Ground Operations (from Exhibit 4-3 of 2004 FAA EA, adjusted from 6 to 30 launches)	Not estimated in 2004 EA	35.5	Not estimated in 2004 EA	5.5	36.5	Not estimated in 2004 EA	3.0[c]	3.0[c]
Total Annual Emissions (pounds)	140,896	2,314.86	55,972	1,440.81	375.66	58.14	15.70	15.70

[7] Each greenhouse gas has a different level of radiative forcing ability, that is, the ability to trap heat. To compare their relative contributions, gases are converted to carbon dioxide equivalent using their unique global warming potentials (GWPs). Each gas has a unique GWP value which represents its radiative forcing ability relative to that of CO_2 (IPCC 2007).

Exhibit 4-6. Estimated Emissions from WhiteKnightTwo, Support Aircraft, and Ground Operations to the Lower Atmosphere (pounds per year)[a]

Description	CO_2	CO	H_2O	VOC	NO_x	SO_x	PM_{10}[b]	$PM_{2.5}$[b]
Total Annual Emissions for Conformity Evaluation (tons)	NA	NA	NA	0.72	0.19	NA	0.01	NA
General Conformity Threshold (tons per year)	NA	NA	NA	100	100	NA	70	NA

a. Note: Data have been rounded; CO_2 = carbon dioxide; CO = carbon monoxide; H_2O = water; VOC = volatile organic compound; NO_X = nitrogen oxides; SO_X = sulfur oxides; PM_{10} = particulate matter less than 10 micrometers in diameter; $PM_{2.5}$ = particulate matter less than 2.5 micrometers in diameter; N_2 = nitrogen; H_2 = hydrogen; N_2O = nitrous oxide

b. Aircraft PM includes WhiteKnightTwo only. PM emissions data for support aircraft are not available.

c. The 2004 FAA EA did not specify size classifications of PM. Results are shown above assuming that all PM could be either PM_{10} or $PM_{2.5}$.

Exhibit 4-6 demonstrates that the total emissions from aircraft and ground operations under the Proposed Action would be small. Emissions from LTO operations of WhiteKnightTwo and the support aircraft and from ground operations would have negligible impacts on local air quality, as these impacts would be intermittent and temporary. The air quality impacts would be insignificant and would not be distinguishable from the impacts of the other flight and ground operations at the Mojave Air and Space Port. Emissions from WhiteKnightTwo, the support aircraft, and ground operations would not create a new violation or worsen any existing violations of any NAAQS or state ambient air quality standard for which the area is designated nonattainment, and would not lead to pollutant concentrations in excess of any NAAQS or state ambient air quality standard for which the area is designated attainment or unclassifiable.

Exhibit 4-6 shows that the annual emissions of NO_x, VOC, and PM_{10} below 3,000 feet would be substantially below the General Conformity *de minimis* levels (100 tons of NO_x or VOC, or 70 tons of PM_{10}) for this area. Thus, the Proposed Action would not require a General Conformity determination for launch events at the Mojave Air and Space Port.

4.1.4 Air Quality Impacts from Aborted Launches

If a flight were aborted after release of SpaceShipTwo from WhiteKnightTwo, it might be necessary to jettison the N_2O oxidizer before SpaceShipTwo glides to a landing. A worst-case scenario for emissions would occur if the engine failed to ignite soon after release. In that event the entire supply of approximately 13,000 pounds of N_2O might have to be jettisoned and could be emitted to the stratosphere or to both the stratosphere and the upper troposphere, depending on the vehicle's altitude. The global warming potential of N_2O is 298, meaning a pound of N_2O has the same effect on global climate as 298 pounds of CO_2 (IPCC 2007). The worst-case scenario of 13,000 pounds of N_2O emissions would be equivalent to 3,874,000 pounds (1,937 short tons or 879 metric tons) of CO_2. Atmospheric impacts from aborted flights would depend on the frequency of such incidents and the amount of N_2O actually jettisoned. All reasonable and feasible measures would be taken by Mojave Air and Space Port operators and the FAA to minimize aborted launches. Aborted flights are expected to be rare and, consequently, their impacts on air quality and climate are expected to be minimal.

4.2 Biological Resources (Including Fish, Wildlife, and Plants)

Sections 4.1.2 and 4.6.2 of the 2009 FAA PEIS discuss the general and site-specific (i.e., the Mojave Air and Space Port) impacts, respectively, on biological resources from operation of reusable suborbital rockets. The 2009 FAA PEIS concluded there would be no significant adverse impacts on biological resources as a result of operating reusable suborbital rockets at the Mojave Air and Space Port. Therefore, this discussion focuses on those aspects of the Proposed Action that are outside the scope of the 2009 FAA PEIS and have the potential to affect biological resources (namely, use of solid-organic fuel and a larger off-site ROI).

4.2.1 Fish and Wildlife

Proposed activities would use existing ground support facilities and would not require ground disturbance. Because SpaceShipTwo is air-launched 50,000 feet above the ground, no adverse impacts on animals within the off-site ROI are expected from exhaust heat and atmospheric deposition of emissions from burning the fuel (nylon or other solid organic material as noted in Section 2.1.2.2 of this EA).

In the event of a launch failure, terrestrial and aquatic animals within the off-site ROI could be affected by falling debris or direct impact of the WhiteKnightTwo, SpaceShipTwo, or support aircraft, potentially causing injury or death. However, because the probability of a crash is low, and animals are widely dispersed throughout the 20,000 square mile off-site ROI, it is highly unlikely that debris would impact any terrestrial or aquatic animals.

The greatest potential impact to fish and wildlife associated with the Proposed Action is engine noise generated by the WhiteKnightTwo and support aircraft during takeoff and flight, and noise generated by SpaceShipTwo when sonic booms are produced during reentry (see Section 4.8 for a discussion of noise). Thus, potential impacts to fish and wildlife would likely be limited to noise-induced effects.

Noise impacts on wildlife may be categorized as primary, secondary, or tertiary (Manci et al.1988). Primary effects are direct physical auditory changes, such as eardrum rupture, ossicle shattering, temporary and permanent hearing threshold shifts, and the masking of auditory signals from other individuals or the environment. Secondary effects of noise on wildlife include such non-auditory effects such as stress, behavioral changes, interference with mating, and detrimental changes in the ability to obtain sufficient food, water, and cover. Tertiary effects are the cumulative result of both primary and secondary effects, and may include population declines, destruction of important habitat and, in extreme cases, potential species extinction.

Animals differ in their hearing sensitivity and susceptibility to noise impacts. For example, at mid-range frequencies, birds have a level of hearing sensitivity similar to that of the more sensitive mammals, but at lower and higher frequency extremes, birds tend to be less sensitive than mammals. Reptile hearing is less sensitive than that of either birds or mammals. Many species have shown an ability to acclimate to high noise levels, including sonic booms, with no adverse primary, secondary, or tertiary impacts. This finding is supported by research conducted by USAF (1999) on the effects of jet noise (including sonic booms) from aircraft on the desert tortoise. The results of this study confirmed field observations that desert tortoises acclimate to aircraft-related noise exposure and do not exhibit significant adverse effects related to their hearing, behavior, or heart rate. In general, reptiles have shown little startle response to aircraft noise indicating possible low sensitivity to aircraft noise levels. Other species, including falcons,

bighorn sheep, and wild horses, are known to successfully and consistently reproduce throughout ranges where aircraft operations occur. Aircraft noise may cause a startle response to Mohave ground squirrels, but published information to suggest adverse impacts on the species is not available.

Adverse impacts from WhiteKnightTwo and support aircraft engine noise, as well as SpaceShipTwo launches, are not likely both because of the high flight altitude of the aircraft and because operation of other aircraft already occurs regularly in the off-site ROI with similar noise effects. Any noise effects generated from the aircraft would be indistinguishable from the ambient noise levels already present within the off-site ROI. Similarly, adverse impacts from SpaceShipTwo sonic booms are not likely because sonic booms would occur at a higher altitude than many sonic booms created by existing operations within the off-site ROI. Studies have shown that due to the low intensity and duration, as well as limited occurrence of the sonic booms, significant impacts on wildlife would not be expected to occur (USAF 2008b).

Activities under the Proposed Action would not present a new noise impact to wildlife, but would be consistent with the existing noise environment to which resident species have already acclimated. Although the number of sonic booms produced within the R-2508 Complex would increase under the Proposed Action (up to 30 annual launches and reentries), no potential primary impacts (direct physical impacts) would be anticipated. Potential temporary and minimal secondary impacts of a startle response might occur for resident individuals of some species during the initial proposed flight activities, but adaptation to the potential change in noise would be expected based on previous environmental documentation. Tertiary effects would not be anticipated, as most species present within R-2508 Complex have already adapted to living with aircraft noise.

For the reasons stated above, noise impacts from the WhiteKnightTwo, SpaceShipTwo, and support aircraft under the Proposed Action would have no effect on fish and wildlife populations, including the Mohave ground squirrel, desert tortoise, or any other state or federally listed species potentially present in the on- or off-site ROIs.

4.2.2 Plants

Because the SpaceShipTwo is launched 50,000 feet above the ground, no adverse impacts on terrestrial or aquatic plants (including protected species) within the off-site ROI are expected from exhaust heat and atmospheric deposition of emissions from burning the solid organic fuel. In the event of a launch failure, for which the probability is low, terrestrial and aquatic plants within the off-site ROI could be affected by falling debris or direct impact of the WhiteKnightTwo or SpaceShipTwo. Potential impacts include scorching and destruction (death) of the plant. Regarding protected species, because the probability of a crash is low, and protected species are rare throughout the 20,000 square mile off-site ROI, it is unlikely that debris would impact state or federally listed terrestrial or aquatic plants. Therefore, the Proposed Action would have no effect on state or federally listed plant species that might occur in the off-site ROI.

4.3 Historical, Architectural, Archaeological, and Cultural Resources

Section 4.1.3 of the 2009 FAA PEIS provides a general discussion of the potential impacts of launching reusable suborbital rockets on historical, architectural, archaeological, and cultural

resources. Section 4.6.3 of the 2009 FAA PEIS provides a discussion of the potential impacts on historical, architectural, archaeological, and cultural resources within the on-site ROI, and Section 5.4 of the 2004 FAA EA provide a discussion of potential impacts on these resources in the on-site ROI and surrounding area.

Potential impacts to cultural resources would generally be associated with the noise produced during flights (sonic booms) and could include physical damage to buildings, structures or rock features through accident or vibration, visual or audible impacts to the setting of cultural resources, and disturbance of traditional activities, such as religious ceremonies or subsistence hunting. Impacts to cultural resources from airspace use would most likely be related to alterations in setting from visual or aural disturbance, and the remote possibility of debris falling. Potential impacts are assessed by applying the Criteria of Adverse Effect as defined in 36 CFR § 800.5a and are considered significant if the action (or undertaking) would result in a substantial change in the significance of a historic or archeological resource, or disturb any human remains, including those interred outside of formal cemeteries.

Based on these criteria, in the 2004 FAA EA, the FAA determined that the action (or undertaking) would have no adverse effect on historic properties, and the State Historic Preservation Officer (SHPO) concurred with the FAA's determination (see Chapter 10 of the 2004 FAA EA for the consultation letters). Similarly, in the 2009 FAA PEIS, the FAA concluded there would be no significant adverse impacts on cultural resources as a result of operating reusable suborbital rockets from the Mojave Air and Space Port.

Issuing experimental permits or launch licenses to operate SpaceShipTwo reusable suborbital rockets and WhiteKnightTwo carrier aircraft at the Mojave Air and Space Port is considered a Federal undertaking per the Section 106 regulations (36 CFR § 800.16(y)). Based on the SHPO's concurrence in 2004 for similar activities, and because there are no historic properties located at the Mojave Air and Space Port, the FAA is making a finding of no historic properties affected. Thus, the proposed undertaking is a type of activity that does not have the potential to cause effects on historic properties, and the FAA has no further obligations under Section 106 (36 CFR § 800.3(a)(1)).

The remaining discussion focuses on those aspects of the Proposed Action that are outside the scope of the 2009 FAA PEIS and could have the potential to affect historical, architectural, archaeological, and cultural resources (namely, larger off-site ROI).

The Proposed Action would be an activity consistent with the present use of the on-site ROI and off-site ROI, and would therefore not result in an alteration in setting constituting an effect on cultural resources.

The operation of WhiteKnightTwo, SpaceShipTwo, and support aircraft would include a low probability of falling debris from a catastrophic failure of either vehicle. If falling debris collided with cultural resources on the ground, those resources would likely be damaged or destroyed. However, because the probability of a crash is low, and cultural resources are widely dispersed throughout the region, it is highly unlikely that debris would impact a cultural site.

Assuming that the SpaceShipTwo would break the sound barrier at an altitude of approximately 80,000 feet during reentry, the estimated sonic boom magnitude at ground level would be at most 1 pound per square foot (psf) (see Section 4.8 below). Based on the minimal noise impacts

discussed in Section 4.8 below, the Proposed Action would not lead to structural damage on historic buildings and other cultural resources.

The Proposed Action is not anticipated to result in adverse impacts on cultural resources in the off-site ROI, because the operation of the WhiteKnightTwo, SpaceShipTwo, and support aircraft would result in a low probability of falling debris landing on cultural sites, would not result in an alteration in setting, would result in a relatively low overpressure generated by sonic booms, and launches would occur in areas authorized by the R-2508 CCB.

4.4 Hazardous Materials, Pollution Prevention, and Solid Waste

Section 4.1.5 of the 2009 FAA PEIS provides a general discussion of the potential impacts of using hazardous materials and generating hazardous and solid waste as a result of operating reusable suborbital rockets. Section 4.6.5 of the 2009 FAA PEIS provides a site-specific (i.e., Mojave Air and Space Port) discussion of the potential impacts for this resource area.

Under the Proposed Action, the amount of hazardous material, hazardous waste, and solid waste generated at the Mojave Air and Space Port would increase. Hazardous materials that would be used to support the operations associated with the Proposed Action are similar to materials already handled at the Mojave Air and Space Port. In addition, procedures are currently in place to accommodate additional fuel and other launch-related and maintenance-related hazardous materials, including paint, oils, lubricants, and solvents. All hazardous pre-flight ground operations, including nitrous loading, would take place in a specified location which has established appropriate safety clear zones in accordance with the Mojave Air and Space Port's launch site operator license. All fuels and other hazardous materials would be stored and used in compliance with the regulations applicable to their storage and use, and already in place at Mojave Air and Space Port. In the event of a spill, EKAD is ready to respond quickly. Spill response kits, which include barrier pads, are located throughout the fuel storage tank farm. Because activities associated with the Proposed Action would comply with all relevant and applicable Federal, state, and local regulations related to hazardous materials and hazardous waste, there are no significant impacts anticipated.

4.5 Health and Safety

Section 4.1.6 of the 2009 FAA PEIS provides a general discussion of the potential impacts of operating reusable suborbital rockets on public health and safety. Section 4.6.6 of the 2009 FAA PEIS provides a site-specific (i.e., Mojave Air and Space Port) discussion of the potential impacts on public health and safety.

Prior to the issuance of an experimental permit or launch license, the FAA would review the hazard analysis to evaluate the potential hazards and reduce the associated risk to an acceptable level. Access to launch and support areas would be limited to essential Mojave Air and Space Port and launch personnel. Furthermore, as stated in Section 2.1.1, after takeoff from the Mojave Air and Space Port, aircraft would enter the R-2508 Complex under control of either High Desert TRACON or SPORT Radar Control Facility located at Edwards AFB, or the Mojave Air Traffic Control Tower. All flights would be conducted under control of one of these facilities to ensure appropriate integration with other aircraft operations in the special use airspace.

The probability of an operational anomaly is low. In terms of impact, for a nominal trajectory, the ground track does not include flights over populated areas. Additionally, any hazardous

materials that are not burned up prior to crashing on the ground could contaminate surface waters in the off-site ROI, if surface waters were present at the crash site. Potential impacts to surface waters would be addressed by emergency response and clean-up procedures. At the Mojave Air and Space Port, the on-site fire department could respond, secure the site, but stay clear of the immediate area until the danger of explosions is diminished. It is expected that any fires resulting from a crash landing could be contained and extinguished by the fire department. Additional off- site emergency response capability also could be used if necessary.

Based on the health and safety measures described above and in Section 4.1.6 of the 2009 FAA PEIS, operational anomalies are unlikely, and therefore no significant impacts to health and safety are anticipated.

4.6 Land Use (Including U.S. Department of Transportation Section 4(f) Properties)

Section 4.1.7 of the 2009 FAA PEIS provides a general discussion of the potential impacts of operating reusable suborbital rockets on land use. Section 4.6.7 of the 2009 FAA PEIS provides a site-specific (i.e., Mojave Air and Space Port) discussion of the potential impacts on land use.

No impacts to on- or off-site ROI land uses, including Section 4(f) properties, would occur as a result of the Proposed Action. No new construction would take place, and the proposed operations are consistent with existing land use at the Mojave Air and Space Port. Although SpaceShipTwo is larger than other previously analyzed launch vehicles for the site, and may use a new fuel (e.g., nylon), these differences would not result in a change to existing land uses at the Mojave Air and Space Port. Further, the Proposed Action would not result in a physical use of Section 4(f) properties because there is no proposed construction, and there is no constructive use of Section 4(f) properties because the proximity impacts do not result in a substantial impairment to 4(f) properties.

The Mojave Air and Space Port is a highly developed, non-sensitive area, and habitat conservation plans are not applicable to the facility. All runways used for takeoff and landing operations have orientations that would route WhiteKnightTwo, SpaceShipTwo, and support aircraft over commercial, industrial, and resource management land uses as defined in the Mojave Specific Plan, and away from sensitive land uses in the Mojave community such as residential and school areas.

4.7 Light Emissions and Visual Resources

Section 4.1.8 of the 2009 FAA PEIS provides a general discussion of the potential impacts of operating reusable suborbital rockets on light emissions and visual resources. Section 4.6.8 of the 2009 FAA PEIS provides a site-specific (i.e., Mojave Air and Space Port) discussion of the potential impacts on light emissions and visual resources.

The Proposed Action would have no significant light emissions or visual impacts to the on-site or off-site ROI. The visual landscape at the Mojave Air and Space Port and the R-2508 Complex already includes airplanes in flight, including advanced concept and experimental aircraft. WhiteKnightTwo, SpaceShipTwo, and support aircraft would leave a visual contrail, but these contrails would be similar in visual impact to contrails from existing operations at the Mojave Air and Space Port and within the R-2508 Complex. The Proposed Action would not

substantially degrade the existing visual character or quality of the site and its surroundings and would have no adverse effect on a scenic vista or scenic resources.

The Proposed Action would not create a new source of substantial light or glare to adversely affect day or nighttime views in the area. Operation of SpaceShipTwo, WhiteKnightTwo, and support aircraft would occur only during daytime hours.

4.8 Noise and Compatible Land Use

The FAA considers there would be a significant noise impact if the analysis shows that the Proposed Action would cause noise-sensitive areas to experience a noise increase of 1.5 dBA or more at or above DNL 65 noise exposure when compared to the No Action Alternative for the same period (FAA Order 1050.1E, Change 1). Activities associated with the Proposed Action that would affect ambient noise levels include noise generated by the WhiteKnightTwo and support aircraft during takeoff, flight, and landing; noise from launches of SpaceShipTwo; and sonic booms generated by SpaceShipTwo during reentry. Noise levels generated within the on-site ROI from WhiteKnightTwo and support aircraft operation would fall within the noise levels analyzed in the 2009 FAA PEIS, which concluded no significant impacts (see Section 4.6.10 of the 2009 FAA PEIS). The Proposed Action would not cause noise-sensitive areas to experience a noise increase of 1.5 dBA or more at or above DNL 65. The following paragraphs describe the potential impacts from noise generated by operating the WhiteKnightTwo, support aircraft, and SpaceShipTwo in the off-site ROI.

4.8.1 WhiteKnightTwo and Support Aircraft

In the off-site ROI, the WhiteKnightTwo and support aircraft would be expected to operate at high altitudes (approximately 50,000 feet) and would operate in compliance with airspace agreements for use of the R-2508 Complex. For example, flights must adhere to overflight restrictions for sensitive and populated areas and maintain a minimum altitude of 3,000 feet above ground level and a lateral distance of 3,000 feet from Death Valley National Park, Domeland, and John Muir Wilderness Areas (USAF 2011a). The proposed 30 flights per year of the WhiteKnightTwo and support aircraft would not be significant compared with the number of existing aircraft operations within the R-2508 Complex. In addition, the WhiteKnightTwo and support aircraft would produce noise levels similar to that of existing aircraft operations. Therefore, noise from the WhiteKnightTwo and support aircraft would not significantly increase overall noise levels within the R-2508 airspace and underlying communities.

4.8.2 SpaceShipTwo

SpaceShipTwo would launch from the WhiteKnightTwo at an altitude of 50,000 feet. At that altitude, due to the small size and the relatively low thrust of the vehicle, SpaceShipTwo engine noise may be audible at times at the Earth's surface, but would not be significant due to substantial distance attenuation and atmospheric absorption.

SpaceShipTwo operation would create sonic booms within the off-site ROI during reentry, at the point at which SpaceShipTwo is no longer supersonic (around 80,000 feet).[8] The SpaceShipTwo

[8] A sonic boom would also be produced during the launch of SpaceShipTwo, when the vehicle reaches supersonic speed during ascent; however, because of the very high altitude (more than 300,000 feet) at which the boom would be generated and the fact that the vehicle would be near vertical, the sonic boom would be directed vertically and would not impinge on the earth's surface. For this reason, sonic booms during the launch phase would be a non-issue.

vehicle would be expected to produce sonic booms with overpressures up to 1 psf. This value is based on a number of calculations including the vehicle "shape factor" which takes into account how vehicle shape and size affects the magnitude of the sonic boom (NASA 1978). In general, larger vehicles generate greater sonic booms than do smaller vehicles. A sonic boom of 1 psf is a relatively low magnitude with respect to other commercial space launch vehicles and is comparable to sonic booms of military jets (e.g., an F-15 fighter jet) produced in the off-site ROI. Historically, the supersonic corridors at Edwards AFB have hosted an average of 650 supersonic flights per year since 1980. During the 1990s, supersonic flights at Edwards AFB occurred at an average rate of 663 per year, while from 2000–2004, this average rate increased to 831 supersonic flights per year (USAF 2004). From 2006–2011, BMSSC flights at Edwards Air Force Base occurred at an average rate of 800 supersonic flights per year (USAF 2011b).

Sonic booms can sound like a sharp thunderclap and typically contain substantial low frequency sound energy which can rattle windows and other loose objects. In general, as altitude increases, air temperature decreases, and the resulting layers of temperature change cause sonic booms to be turned upward as they travel toward the ground. Sonic boom models take such meteorological factors into effect when predicting sonic boom overpressures experienced by listeners on the ground.

For impulsive sounds such as sonic booms, it has been found that its impact correlates well with CDNL values. C-weighting excludes sound energy below 25 hertz and above 10,000 hertz. Exhibit 4-7 shows the relation between noise level metrics DNL, CDNL, and annoyance (Finegold et al. 1994, CHABA 1981). Assuming up to 30 sonic booms per year, the Proposed Action would result in an annual CDNL of 42. As shown in Exhibit 4-7, 65 DNL is equivalent to 61 CDNL; therefore the predicted 42 CDNL resulting from sonic booms produced by the SpaceShipTwo is substantially below the FAA's established significance threshold.

Exhibit 4-7. Relation between Noise Level Metrics DNL, CDNL, and Annoyance[a]

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

a. Sources: Finegold et al. 1994, CHABA 1981

Based on the factors described above, noise and sonic booms associated with SpaceShipTwo launches would not constitute a significant increase in noise level to the communities beneath the R-2508 airspace, and would not cause significant adverse noise impacts.

4.9 Socioeconomics, Environmental Justice, and Children's Environmental Health and Safety

Section 4.1.11 of the 2009 FAA PEIS provides a general discussion of the potential impacts of operating reusable suborbital rockets on socioeconomics, environmental justice, and children's environmental health and safety. Section 4.6.11 of the 2009 FAA PEIS provides a site-specific

(i.e., Mojave Air and Space Port) discussion of the potential impacts on socioeconomics and environmental justice.

No new development would be required to support the Proposed Action; only existing personnel would be used to conduct launch activities; and the Proposed Action would not induce substantial population growth or add or eliminate jobs at the Mojave Air and Space Port or in the communities within the R-2508 Complex. There would not be any socioeconomic impacts to areas within the on- or off-site ROIs. The WhiteKnightTwo and support aircraft would produce noise levels similar to that of existing aircraft operations at the Mojave Air and Space Port and within the R-2508 Complex. Therefore, noise from the WhiteKnightTwo and support aircraft would not significantly increase overall noise levels within the R-2508 airspace and underlying communities. The operation of SpaceShipTwo would produce launch noise and sonic booms during reentry, which could be heard by communities in the R-2508 Complex, potentially including environmental justice populations. As described in Section 4.8, the predicted 42 CDNL resulting from sonic booms produced by SpaceShipTwo is substantially below the significance threshold for noise impacts. Currently, aircrews flying within the R-2508 Complex are required to maintain a minimum altitude of 3,000 feet above ground level over populated areas such as small towns and recreation areas (USAF 2011a). The noise produced by WhiteKnightTwo, SpaceShipTwo, and support aircraft would occur infrequently over the course of a year, and these short-term noise impacts would be less than significant for environmental justice groups.

There are no significant adverse impacts from the Proposed Action for any resource area; therefore, no potential impact would disproportionately adversely affect environmental justice populations or children's environmental health and safety.

4.10 No Action Alternative

Under the No Action Alternative, the FAA would not issue experimental permits or launch licenses for the operation of SpaceShipTwo reusable suborbital rockets and WhiteKnightTwo carrier aircraft from the Mojave Air and Space Port. The Mojave Air and Space Port would continue its existing operations.

The potential environmental effects of the Proposed Action as described in Sections 4.1 through 4.9 would not occur. With the exception of socioeconomics, the existing conditions in the on- and off-site ROIs would remain unchanged and would be as described in Chapter 3. Without obtaining the necessary experimental permits or launch licenses from the FAA, SpaceShipTwo and WhiteKnightTwo operations would potentially need to relocate to a new site, possibly resulting in an adverse impact to socioeconomics due to a loss of existing jobs at the Mojave Air and Space Port.

5. CUMULATIVE IMPACTS

In accordance with FAA Order 1050.1E, Change 1, and the CEQ NEPA implementing regulations, the FAA analyzed the potential cumulative impacts to the resources that would be adversely affected by implementation of the Proposed Action or the No Action Alternative. Based on the findings and potential impacts described in Chapter 4, the cumulative impacts analysis focuses on air quality, which would be expected to be the most affected resource area. The FAA has determined that the potential impacts for all other resource areas described in Chapter 4 of this EA would not meaningfully interact in time and space with the potential effects of other projects. Therefore, no cumulative impacts are anticipated on resource areas other than air quality.

Past, present, and reasonably foreseeable actions at the Mojave Air and Space Port and the surrounding area include current and future aircraft operations at the airport, rocket launches, rocket engine testing, development in the local area related to activities at the Mojave Air and Space Port, and any other development that may occur as a result of economic growth in the area. Recently, a 68,000 square foot hangar was constructed at the Mojave Air and Space Port next to one of the runways. The hangar is referred to as the Final Assembly, Integration, and Test Hangar. The hangar is LEED-certified and will host commercial space vehicle assembly, integration, and testing activities, as well as vehicle maintenance. These actions, considered in conjunction with the Proposed Action, formed the basis for the cumulative impacts analysis.

The Proposed Action could result in a minor increase in air pollutant emissions in the vicinity of the Mojave Air and Space Port as a result of the LTO cycles of WhiteKnightTwo and the support aircraft. These emissions would be infrequent due to the small number of aircraft operations under the Proposed Action, and when combined with emissions from existing and potential future aircraft and rocket operations in the area, would not be likely to affect local air pollutant concentrations and would not be likely to hinder attainment of the NAAQS in the region. When the air quality impacts from the Proposed Action are added to the likely impacts from past, current, and future projects and activities, it is likely that the cumulative impact would not be significant.

Cumulative impacts of emissions from launches have the potential to affect global climate change. The total CO_2 emissions for the Proposed Action would be approximately 900 short tons or 400 metric tons per year. U.S. GHG emissions were estimated at 6,633 $MMTCO_2e$ in 2009 (EPA 2011b). Global GHG emissions were estimated at 43,183 $MMTCO_2e$ in 2005 (WRI 2011). Emissions from the Proposed Action would constitute a negligible addition to national and global emissions and the cumulative impact on global warming from launches would not be significant.

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APPENDIX A:

STATE AND FEDERALLY PROTECTED SPECIES POTENTIALLY OCCURING IN THE OFF-SITE ROI

The list of state and federally listed species potentially occurring in the off-site ROI was derived by accessing the California Department of Fish and Game's website (http://www.dfg.ca.gov/biogeodata/cnddb/mapsanddata.asp) and the U.S. Fish Wildlife Service's Information, Planning, and Conservation System (http://ecos.fws.gov/ipac/). The list of protected species is displayed in Exhibits A-1 (animals) and A-2 (plants).

Exhibit A-1. State and Federally Listed Animal Species Potentially Occurring in the Off-Site ROI

Common Name	Scientific Name	Federal Status	State Status
Invertebrates			
Vernal pool fairy shrimp	*Branchinecta lynchi*	Threatened; Critical Habitat	Not Listed
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	Threatened	Not Listed
Vernal pool tadpole shrimp	*Lepidurus packardi*	Endangered; Critical Habitat	Not Listed
Nevares spring naucorid bug	*Ambrysus funebris*	Candidate	Not Listed
Conservancy fairy shrimp	*Branchinecta conservatio*	Endangered	Not Listed
Longhorn fairy shrimp	*Branchinecta longiantenna*	Endangered	Not Listed
Kern primrose sphinx moth	*Euproserpinus euterpe*	Threatened	Not Listed
Riverside fairy shrimp	*Streptocephalus woottoni*	Endangered	Not Listed
Fish			
Little Kern golden trout	*Oncorhynchus (=Salmo) aquabonita whitei*	Threatened	Not Listed
Bonytail chub	*Gila elegans*	Endangered	Rare
Colorado pikeminnow	*Ptychocheilus lucius*	Endangered	Endangered
Mohave Tui chub	*Gila bicolor mohavensis*	Endangered	Endangered
Razorback sucker	*Xyrauchen texanus*	Endangered	Endangered
Owens Tui chub	*Gila bicolor snyderi*	Endangered	Endangered
Owens pupfish	*Cyprinodon radiosus*	Endangered	Endangered
Paiute cutthroat trout	*Oncorhynchus clarki seleniris*	Threatened	Not Listed
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	Threatened	Not Listed
Central Valley steelhead	*Oncorhynchus mykiss*	Threatened	Not Listed
Unarmored threespine stickleback	*Gasterosteus aculeatus williamsoni*	Endangered	Endangered
Cotton marsh pupfish	*Cyprinodon salinus milleri*	Not Listed	Threatened

Exhibit A-1. State and Federally Listed Animal Species Potentially Occurring in the Off-Site ROI (continued)

Common Name	Scientific Name	Federal Status	State Status
Amphibians and Reptiles			
California tiger salamander	*Ambystoma californiense*	Threatened; Critical Habitat	Threatened
California red-legged frog	*Rana draytonii*	Threatened	Not Listed
Blunt-nosed leopard lizard	*Gambelia (=Crotaphytus) sila*	Endangered	Endangered
Giant garter snake	*Thamnophis gigas*	Threatened	Threatened
Mountain yellow-legged frog	*Rana muscosa*	Candidate	Candidate
Arroyo toad	*Bufo californicus*	Endangered	Not Listed
Desert tortoise	*Gopherus agassizii*	Threatened	Threatened
Yosemite toad	*Anaxyrus canorus*	Candidate	Not Listed
Black toad	*Anaxyrus exsul*	Not Listed	Threatened
Kern Canyon slender salamander	*Batrachoseps simatus*	Not Listed	Threatened
Tehachapi slender salamander	*Batrachoseps stebbinsi*	Not Listed	Threatened
Birds			
California condor	*Gymnogyps californianus*	Endangered	Endangered
Inyo California towhee	*Pipilo crissalis eremophilus*	Threatened	Endangered
Southwestern willow flycatcher	*Empidonax traillii extimus*	Endangered	Endangered
Yuma clapper rail	*Rallus longirostris yumanensis*	Endangered	Threatened
Least Bell's vireo	*Vireo bellii pusillus*	Endangered	Endangered
Western snowy plover	*Charadrius alexandrinus nivosus*	Threatened	Not Listed
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	Candidate	Endangered
Coastal California gnatcatcher	*Polioptila californica californica*	Threatened	Not Listed
California least tern	*Sterna antillarum browni*	Endangered	Endangered
Marbled murrelet	*Brachyramphus marmoratus*	Threatened	Endangered
Bald eagle	*Haliaeetus leucocephalus*	Not Listed	Endangered
Swainson’s hawk	*Buteo swainsoni*	Not Listed	Threatened

Exhibit A-1. State and Federally Listed Animal Species Potentially Occurring in the Off-Site ROI (continued)

Common Name	Scientific Name	Federal Status	State Status
Great gray owl	*Strix nebulosa*	Not Listed	Endangered
Willow flycatcher	*Empidonax traillii*	Not Listed	Endangered
Bank swallow	*Riparia riparia*	Not Listed	Threatened
California black rail	*Laterallus jamaicensis coturniculus*	Not Listed	Threatened
Belding's savannah sparrow	*Passerculus sandwichensis beldingi*	Not Listed	Endangered
Elf owl	*Micrathene whitneyi*	Not Listed	Endangered
Gila woodpecker	*Melanerpes uropygialis*	Not Listed	Endangered
Arizona bell's vireo	*Vireo bellii arizonae*	Not Listed	Endangered
Mammals			
Giant kangaroo rat	*Dipodomys ingens*	Endangered	Endangered
Fresno kangaroo rat	*Dipodomys nitratoides exilis*	Endangered; Critical Habitat	Endangered
Tipton kangaroo rat	*Dipodomys nitratoides nitratoides*	Endangered	Endangered
Sierra Nevada bighorn sheep	*Ovis canadensis californiana*	Endangered	Endangered
San Joaquin kit fox	*Vulpes macrotis mutica*	Endangered	Threatened
Fisher	*Martes pennanti*	Candidate	Candidate
Amargosa vole	*Microtus californicus scirpensis*	Endangered	Endangered
Buena Vista Lake shrew	*Sorex ornatus relictus*	Endangered	Not Listed
Nelson's antelope squirrel	*Ammospermophilus nelsoni*	Not Listed	Threatened
Sierra Nevada red fox	*Vulpes vulpes necator*	Not Listed	Threatened

Exhibit A-2. State and Federally Listed Plant Species Potentially Occurring in the Off-Site ROI

Common Name	Scientific Name	Federal Status	State Status
Hoover's spurge	*Chamaesyce hooveri*	Threatened	Not Listed
Springville clarkia	*Clarkia springvillensis*	Threatened	Endangered
San Joaquin Valley orcutt grass	*Orcuttia inaequalis*	Threatened; Critical Habitat	Endangered
San Joaquin adobe sunburst	*Pseudobahia peirsonii*	Threatened	Endangered
Keck's checker-mallow	*Sidalcea keckii*	Endangered; Critical Habitat	Not Listed
Ramshaw sand-verbena	*Abronia alpina*	Candidate	Not Listed
Amargosa niterwort	*Nitrophila mohavensis*	Endangered	Endangered
Bear Valley sandwort	*Arenaria ursina*	Threatened	Not Listed
Cushenbury buckwheat	*Eriogonum ovalifolium var. vineum*	Endangered	Not Listed
Cushenbury milk-vetch	*Astragalus albens*	Endangered	Not Listed
Cushenbury oxytheca	*Oxytheca parishii var. goodmaniana*	Endangered	Not Listed
Lane Mountain milk-vetch	*Astragalus jaegerianus*	Endangered	Not Listed
Parish's daisy	*Erigeron parishii*	Threatened	Not Listed
San Fernando Valley spineflower	*Chorizanthe parryi var. fernandina)*	Candidate	Endangered
Triple-ribbed milk-vetch	*Astragalus tricarinatus*	Endangered	Not Listed
Ash Meadows gumplant	*Grindelia fraxino-pratensis*	Threatened	Not Listed
Eureka Valley evening-primrose	*Oenothera avita ssp. eurekensis*	Endangered	Rare
Fish Slough milk-vetch	*Astragalus lentiginosus var. piscinensis*	Threatened	Not Listed
Spring-loving centaury	*Centaurium namophilum*	Threatened	Not Listed
California jewelflower	*Caulanthus californicus*	Endangered	Endangered
Kern mallow	*Eremalche kernensis*	Endangered	Not Listed
San Joaquin woolly-threads	*Monolopia congdonii*	Endangered	Not Listed
Bakersfield cactus	*Opuntia treleasei*	Endangered	Endangered
Marsh sandwort	*Arenaria paludicola*	Endangered	Endangered
Mariposa pussy-paws	*Calyptridium pulchellum*	Threatened	Not Listed

Exhibit A-2. State and Federally Listed Plant Species Potentially Occurring in the Off-Site ROI (continued)

Common Name	Scientific Name	Federal Status	State Status
San Benito evening-primrose	*Camissonia benitensis*	Threatened	Not Listed
Succulent (=fleshy) owl's-clover	*Castilleja campestris ssp. succulenta*	Threatened; Critical Habitat	Endangered
Palmate-bracted bird's-beak	*Cordylanthus palmatus*	Endangered	Endangered
Hartweg's golden sunburst	*Pseudobahia bahiifolia*	Endangered	Endangered
Hairy orcutt grass	*Orcuttia pilosa*	Critical Habitat	Endangered
Braunton's milk-vetch	*Astragalus brauntonii*	Endangered	Not Listed
Coastal dunes milk-vetch	*Astragalus tener var. titi*	Endangered	Endangered
Conejo dudleya	*Dudleya abramsii ssp. parva*	Threatened	Not Listed
Gambel's watercress	*Rorippa gambellii*	Endangered	Threatened
Lyon's pentachaeta	*Pentachaeta lyonii*	Endangered	Endangered
Marcescent dudleya	*Dudleya cymosa ssp. marcescens*	Threatened	Rare
Nevin's barberry	*Berberis nevinii*	Endangered	Endangered
Salt marsh bird's-beak	*Cordylanthus maritimus ssp. maritimus*	Endangered	Endangered
San Fernando Valley spineflower	*Chorizanthe parryi var. fernandina)*	Candidate	Endangered
Santa Monica Mountains dudleyea	*Dudleya cymosa ssp. ovatifolia*	Threatened	Not Listed
Slender-horned spineflower	*Dodecahema leptoceras*	Endangered	Endangered
Spreading navarretia	*Navarretia fossalis*	Threatened	Not Listed
Ventura marsh milk-vetch	*Astragalus pycnostachyus var. lanosissimus*	Endangered	Endangered
Verity's dudleya	*Dudleya verityi*	Threatened	Not Listed

APPENDIX B:

AGENCY CONSULTATION

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:
3259.4928.6899

February 15, 2007

Tom Weil
East Kern Airport District
1434 Flightline
Mojave, California 93501

Subject: Water Line and Tank Project and Other Mojave Airport Projects, Kern County, California

Dear Mr. Weil:

We have reviewed your letter in which you request our concurrence that the installation of a new water line and water tank at Mojave Airport will not affect the federally threatened desert tortoise (*Gopherus agassizii*). The funding for the project will be provided by the U.S. Economic Development Agency, which, as a Federal agency, is required by section 7(a)(2) of the Endangered Species Act of 1973, as amended, to ensure that any action it funds, implements, or permits does not jeopardize the continued existence of listed species or adversely modify their critical habitat. Pursuant to the implementing regulations for section 7(a)(2) of the Endangered Species Act (50 *Code of Federal Regulations* 402), the Economic Development Agency has designated the East Kern Airport District as its non-federal agent to conduct this consultation. We received your letter on January 24, 2007.

The East Kern Airport District proposes to construct an extension of a water line and a new water tank adjacent to a taxiway and existing water tanks, respectively. The areas in which the work would occur have been disturbed for many years. Although several surveys have been conducted in the past, no desert tortoises have been observed within the boundaries of the 3,000-acre airport property. The airport is not within the boundaries of critical habitat of the desert tortoise or any other federally listed species. We do not expect that any other federally listed species is likely to occur at Mojave Airport.

Section 7(a)(2) of the Endangered Species Act and its implementing regulations do not provide the U.S. Fish and Wildlife Service (Service) with the authority to concur with a Federal agency's findings that an action will not affect a listed species or its critical habitat. In fact, the implementing regulations state that, if the Federal agency makes such

Tom Weil 2

a determination, compliance with section 7(a)(2) is complete. The implementing regulations also state that a Federal agency may determine that an action is "not likely to adversely affect" a listed species or its critical habitat; in such a case, if the Service agrees with the determination of the Federal agency (or its designated agent), the Service concurs in writing and consultation is complete.

Desert tortoises have not been detected within Mojave Airport during surveys conducted over several years. The airport supports a high level of human activity and large amounts of disturbed land. It is also surrounded by a fence that desert tortoises generally would be unable to cross. For these reasons, we expect that desert tortoises are not present within the boundaries of Mojave Airport at this time and do not expect them to reoccupy the area and have no reason to dispute your conclusion that the proposed action will not affect desert tortoises.

We are aware that desert tortoises persist in the general vicinity of Mojave Airport and note that fences occasionally develop openings. Consequently, some possibility exists that a desert tortoise may enter airport property in the future. However, we consider this possibility to be remote. We encourage you to be alert for desert tortoises and their sign during surveys you may conduct for future projects and to alert us if you find indications that they may be present. Until such time, however, we conclude that desert tortoises are not present within the boundaries of Mojave Airport and will not be affected by this project or future activities you undertake within the airport's boundaries. We recommend that you retain this letter to assist you in complying with the Endangered Species Act in regard to future Federal actions.

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

Sincerely,

Carl T. Benz

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