Federal Aviation Administration

Environmental Assessment for Space Florida Launch Site Operator License at Launch Complex-46

September 2008

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Environmental Assessment for Space Florida Launch Site Operator License

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

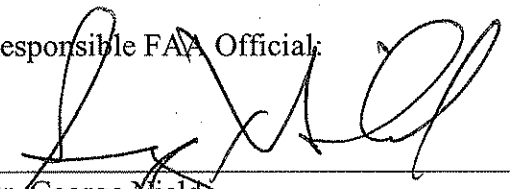
ABSTRACT: The Environmental Assessment (EA) for the Space Florida Launch Site Operator License addresses the potential environmental impacts of the Proposed Action, where the FAA would issue a Launch Site Operator License to Space Florida to operate a launch facility at Launch Complex 46 (LC-46) at Cape Canaveral Air Force Station (CCAFS) in Brevard County, Florida. This EA evaluates the impacts of launching several types of vertical launch vehicles, including Athena-1 and Athena-2, Minotaur, Taurus, Falcon 1, Alliant Techsystems small launch vehicles (AKT SLV), and launches of other Castor® 120-based or Minuteman-derivative booster vehicles. Space Florida proposes to support a maximum of 24 annual launches, including 12 solid propellant launches and 12 liquid propellant launches.

Potential impacts of the Proposed Action and Alternatives were analyzed in the EA. Potential environmental impacts of successful launches include impacts to air quality; biological resources (fish, wildlife, plants, and special status species); water resources (surface water, ground water, floodplains, and wetlands); noise; compatible land use (section 4(f) resources, light emissions and visual resources, and coastal resources); socioeconomic resources; and hazardous materials, solid waste, and pollution prevention. Potential cumulative impacts of the proposed action are also addressed in the EA.

CONTACT INFORMATION: Questions regarding the Proposed Action and EA for the Space Florida Launch Site Operator License can be addressed to Ms. Stacey M. Zee, Environmental Specialist, Federal Aviation Administration, 800 Independence Ave., SW, Washington, DC 20591; e-mail stacey.zee@faa.gov; or fax (202) 267-5463.

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

Responsible FAA Official:



9/2/08

Dr. George Nield
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Commercial Space Transportation

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FAA
Commercial Space Transportation

Environmental Assessment for Space Florida Launch Site Operator License at Launch Complex-46

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ACRONYMNS AND ABBREVIATIONS

AFB	Air Force Base
Al	Aluminum
Al_2O_3	Aluminum Oxide
AST	Office of Commercial Space Transportation
AKT SLV	Alliant Techsystems Small Launch Vehicle
CAA	Clean Air Act
CCAFS	Cape Canaveral Air Force Station
CDNL	C-weighted Day-Night Average Sound Level
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CEQ	Council on Environmental Quality
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CWA	Clean Water Act
dB	Decibel
dBA	A-weighted Sound Level
DoD	Department of Defense
DOI	Department of the Interior
DOT	Department of Transportation
DNL	Day-Night Average Sound Level
EA	Environmental Assessment
EIS	Environmental Impact Statement
ELV	Expendable Launch Vehicle
EPA	United States Environmental Protection Agency
EPRCA	Environmental Planning and Community Right to Know Act
EO	Executive Order
FAA	Federal Aviation Administration
FDEP	Florida Department of Environmental Protection
FONSI	Finding of No Significant Impact
FFWCC	Florida Fish and Wildlife Conservation Commission
GHG	Greenhouse Gas
HCl	Hydrochloric Acid
IRP	Installation Restoration Program
KSC	Kennedy Space Center
LC-46	Launch Complex 46
LOX	Liquid Oxygen
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NO_2	Nitrogen Dioxide
NOx	Nitrous Oxide
NPDES	National Pollutant Discharge Elimination System
NWR	National Wildlife Refuge
O_3	Ozone
ODS	Ozone Depleting Substance
OSHA	United States Occupational Safety and Health Administration

PEIS	Programmatic Environmental Impact Statement
$PM_{2.5}$	Particulate Matter 2.5 microns in diameter
PM_{10}	Particulate Matter less than 10 micros in diameter
ppm	Parts Per Million
psf	Pounds Per Square Foot
RCRA	Resource Conservation and Recovery Act
ROI	Region of Influence
RP-1	Rocket Propellant
SEL	Sound Exposure Level
SO_2	Sulfur Dioxide
SpaceX	Space Exploration Technologies
SSP	Space Shuttle Program
USAF	United States Air Force
U.S.C.	United States Codes
USFWS	United States Fish and Wildlife Service
VOC	Volatile Organic Compound
$\mu g/m^3$	Microgram Per Cubic Meter

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1.0 INTRODUCTION

Space Florida (previously known as the Florida Space Authority and Spaceport Florida Authority) has applied to the Federal Aviation Authority (FAA) for a launch site operator license. The FAA prepared this Environmental Assessment (EA) to evaluate the potential environmental impacts of activities associated with issuing a launch site operator license to Space Florida for the operation of a commercial launch site at Launch Complex 46 (LC-46) at Cape Canaveral Air Force Station (CCAFS) in Florida. Issuing a launch site operator license is considered a major Federal action that is subject to review as required by the National Environmental Policy Act (NEPA).

1.1 Background

Space Florida is a public-private aerospace development organization. It was created by the State legislature to strengthen Florida's position as a leader in aerospace research, investment, exploration, and commerce. In 1994, the 45th Space Wing of the U.S. Air Force (USAF) approved Space Florida's proposal to modify and use the existing LC-46 on CCAFS, for its Commercial Launch Vehicle Program (USAF, 1994). Space Florida has operated at LC-46 since 1996 through a real property license issued by the USAF 45th Space Wing and a Memorandum of Agreement with the Naval Ordnance Test Unit, which maintains its own launch tower at the pad. In December 1996, Space Florida was granted USAF funds to redesign LC-46.

In December 1996, Space Florida submitted an application to the FAA to operate a commercial launch site at LC-46, and the FAA issued a launch site operator license on May 22, 1997. As part of the environmental review for the license application, the FAA issued a Finding of No Significant Impact (FONSI) adopting the USAF's *Finding of No Significant Impact and Environmental Assessment of the Proposed Space Florida Authority Commercial Launch Program at Launch Complex-46 at the Cape Canaveral Air Station, Florida*, October 1994 (USAF, 1994). The complex supported its first space launch, an Athena-2 carrying the Lunar Prospector spacecraft, in January 1998. Space Florida's license to operate a launch site at LC-46 was renewed in 2002 and expired on May 22, 2007.

In March 2008, Space Florida submitted an application to the FAA for a launch site operator license for LC-46. The site is currently operated cooperatively with the 45th Space Wing, USAF Space Command under an agreement dated June 8, 2007. LC-46 would be used for both government and commercial space vehicle launches. The listed payload capacities of the vehicles proposed by Space Florida are the weight classes designated as "small" and "medium" per Table 1 of §420.19(a)(2). The current application is similar to the previous license, although the new license would also allow Space Florida to offer LC-46 for launches of liquid-fueled launch vehicles.

This EA evaluates the potential environmental impacts associated with issuing a launch site operator license to Space Florida for LC-46 at CCAFS in Brevard County, Florida, approximately 60 miles east of Orlando. The FAA is the lead agency in preparing the EA, and the USAF is a cooperating agency. The USAF has leased the LC-46 facility to Space Florida.

1.2 Purpose and Need

Purpose

The Proposed Action is to issue a launch site operator license to Space Florida for operations at LC-46 at CCAFS. The Proposed Action would allow Space Florida to offer the launch site to customers conducting launch operations.

The purpose of the FAA's action in issuing the launch site operator license is to ensure compliance with international obligations of the United States and to protect the public health and safety, safety of property, and national security and foreign policy interest of the United States during commercial launch or reentry activities; to encourage, facilitate, and promote commercial space launches and re-entries by the private sector; and to facilitate the strengthening and expansion of the United States space transportation infrastructure, in accordance with the requirements of the Commercial Space Launch Amendments Act of 2004, the Commercial Space Transportation Act of 2000, Executive Order (EO) 12465, *Commercial Expendable Launch Vehicle Activities*, 14 Code of Federal Regulations (CFR) Parts 400-450, the National Space Transportation Policy, and the National Space Policy.

Need

The Proposed Action is needed to meet the demand for lower cost access to space. Less expensive space launch capability, such as more cost-effective commercial, governmental, and scientific satellite launches, is necessary to support rising industries. Given the infrastructure and development costs associated with constructing launch facilities, the Federal government has been the owner/operator or has leased/sold unused or excess infrastructure and provided expertise to commercial launch operators for the majority of commercial launches. The Secretary of Transportation has assigned the FAA Office of Commercial Space Transportation (AST) responsibility, under the Commercial Space Launch Amendment Acts and EO 12465, for oversight of commercial space launch activities, including licensing of launch and reentry sites.

2.0 DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

2.1 Proposed Action

Space Florida is applying for a launch site operator license for LC-46 at CCAFS in Brevard County, Florida (See Exhibit 2-1). Under the Proposed Action, the FAA would issue a launch site operator license for LC-46 to Space Florida. The USAF's 45th Space Wing owns LC-46. Space Florida and the 45th Space Wing have a Memorandum of Agreement and Joint Operating Procedures, which allow Space Florida to conduct launch activities at the site. A launch site operator license, which is valid for five years, would allow Space Florida to offer the site for launches of solid- and liquid-propellant launch vehicles. Potential commercial launch vehicle operators would be required to obtain a launch license from the FAA to conduct launch operations at LC-46 on CCAFS.

Exhibit 2-1. Map of Cape Canaveral Air Force Station and Surrounding Areas

Under the Proposed Action, Space Florida would offer the launch site to launch operators for several types of vertical launch vehicles, including Athena-1 and Athena-2, Minotaur, Taurus, Falcon 1, Alliant Techsystems small launch vehicles (AKT SLV), and launches of other Castor® 120-based or Minuteman-derivative booster vehicles. Space Florida proposes to support a maximum of 24 annual launches, including 12 solid propellant launches and 12 liquid propellant launches. The proposed launch vehicles and their payloads would be launched into low earth orbit or geostationary orbit. All vehicles are expected to carry payloads, including satellites.

The Proposed Action does not include any construction or modification to the site. Launches would be conducted using existing infrastructure. Periodic maintenance, such as mowing or repairs, would occur on the site to ensure launch safety. To ensure the safety of all launch activities, the site would require minor repairs.

LC-46 is the easternmost launch complex at CCAFS, which is located at the tip of Cape Canaveral. The site, which includes 70 acres, is located approximately 60 miles east of Orlando, Florida. The site is operated cooperatively with the 45th Space Wing, USAF Space Command under an agreement dated June 8, 2007.

The existing infrastructure on the site includes a 38,000-square foot concrete launch pad with flame ducts; a transporter; break-over stand; a Mobile Access Structure; an umbilical tower; a captive rail system; service trenches and conduits; utility aprons; launch support buildings, such as ordnance checkout building and utility room; an access road, and a 7-foot high perimeter fence. Access to the site is controlled through the main entrance along the northwest perimeter.

2.1.1 Proposed Launch Vehicles

Space Florida proposes to offer the site for launches of the following launch vehicles: Lockheed Martin's Athena-1 and Athena-2 vehicles, Orbital Sciences Corporation's Minotaur and Taurus vehicles, Space Exploration Technologies (SpaceX) Falcon 1 vehicle, and ATK SLV. Other vehicles of similar size (i.e., CASTOR® 120-based vehicles or vehicles using Minuteman-derivative boosters) would be included under the conditions of the license. All of the proposed vehicles, except Falcon 1, would use solid propellant systems; Falcon 1 would use liquid propellants. The listed payload capacities of the vehicles proposed by Space Florida are categorized in the "small" and "medium" weight classes in Table 1 of §420.19(a)(2). The proposed vehicles have a vertical launch orientation. Following ignition, launches would have an eastward flight plan over the Atlantic Ocean.

In 1994, the USAF published an EA and FONSI for the Proposed *Space Florida Authority Commercial Launch Program at Launch Complex-46 at the Cape Canaveral Air Station, Florida* (USAF, 1994). This EA and FONSI examined the impacts of two concept vehicles, the Baseline and Growth vehicles, to illustrate the range of vehicles proposed for launch at LC-46. Because the Growth vehicle had the largest configuration, the potential environmental impacts from the Growth vehicle were analyzed to establish the upper limit of potential impacts.

For this EA, Space Florida proposes to offer the launch site for launches of up to 12 solid propellant launch vehicles and 12 liquid propellant launch vehicles per year. The Athena-2 has the largest payload capacity of the solid propellant vehicles that would be launched from this site. To provide a conservative assumption, this EA analyzes the environmental impacts of 12 Athena-2 launches per year. In addition, this EA analyzes the impacts of the 12 launches per year of the Falcon 1, which is the only liquid propellant rocket considered under the Proposed Action.

Exhibit 2-2 shows five of the proposed vehicles – the Athena-1, Athena-2, Minotaur, Taurus, and Falcon 1 vehicles. No photos are available of the ATK SLV.

Exhibit 2-2. Photos of Proposed Launch Vehicles[1]

Athena-1 *Athena-2* *Minotaur* *Taurus* *Falcon 1*

Sections 2.1.1.1 through 2.1.2.2 provide a brief description of each of the launch vehicles.

2.1.1.1 Launch Vehicle Characteristics

Space Florida proposes to offer LC-46 at CCAFS for orbital launches. Exhibit 2-3 provides vehicle characteristics of the proposed expendable launch vehicles.

In the event that the launch varies from the planned trajectory, all of the proposed vehicles contain a termination system. For vehicles with solid propellants, the flight termination system would destroy the vehicle in flight, if activated. The Falcon 1 contains two termination systems, namely a flight thrust termination system and destructive termination system. Once activated, the flight thrust termination system would shut down the thrust and leave the vehicle without power. The vehicle would then return to the surface intact; however, the vehicle may break up upon impact with the surface. The vehicle also contains a destructive termination system that would rupture the vehicle tanks when commanded to destruct, causing the vehicle to break apart. If the termination systems were activated, it is expected that the Falcon 1 vehicle would fall and sink in the Atlantic Ocean due to the proposed launch trajectory.

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[1] Photo Credits:
Athena-1 – www.aerospace-technology.com/projects/kodiak/
Athena-2 – http://science.ksc.nasa.gov/payload/missions/prospector/images/captions/KSC-98EC-0101.html
Minotaur – www.orbital.com/NewsInfo/Images/SpaceLaunch/index.html
Taurus – www.orbital.com/NewsInfo/Images/SpaceLaunch/index.html
Falcon 1 - www.spacex.com/photo_gallery.php
ATK SLV – no image available

Exhibit 2-3. Characteristics of Proposed Expendable Vehicles

	Athena-1	Athena-2	Minotaur	Taurus	ATK SLV	Falcon 1
Company	Lockheed Martin	Lockheed Martin	Orbital Sciences Corporation	Orbital Sciences Corporation	ATL Launch Systems	SpaceX
Stages	2	3	4	4	2	2
Propellant Type	Solid	Solid	Solid	Solid	Solid	Liquid (LOX and RP-1)
Height	65 feet	95 feet	63 feet	89 feet	Unknown	70 feet
Payload Capacity	1,755 pounds	4,180 pounds	1,410 pounds	3,505 pounds	3,000 pounds	1,050 pounds
Recoverable	No	No	No	No	No	Stage 1 only
Motor Stages						
1st Stage	CASTOR® 120 solid rocket motor	CASTOR® 120 solid rocket motor	Minuteman 2	Peacekeeper rocket motor	CASTOR® 120 solid rocket motor	Merlin rocket engine
2nd Stage	Orbus® 21D boost motor	CASTOR® 120 solid rocket motor	Minuteman 2	Pegasus-based motor	CASTOR® 120 solid rocket motor	Kestrel engine
3rd Stage	NA	Orbus® 21D motor	Pegasus-based motor	Pegasus-based motor	NA	NA
4th Stage	NA	NA	Pegasus-based motor	Pegasus-based motor	NA	NA

2.1.2 Vehicle Processing and Launch Operations

All launches originating from LC-46 must comply with CCAFS environmental and safety standards. To comply with such standards, Space Florida has developed a Quality Assurance Plan to assess vehicles, propellants, and payloads upon delivery to CCAFS. The Quality Assurance Plan provides a written description of delivery condition, compliance activities, and onsite repairs completed on the proposed vehicles. Space Florida would coordinate launch activities with CCAFS personnel, including environmental, engineering, and safety staff to ensure compliance. An emergency response team would be established and spills would be contained and cleaned up per the procedures. Hazardous materials would be handled per CCAFS environmental standards and safety standards. Spills of hazardous materials are covered under the 45 SW Full Spectrum Threat Response Plan 10-2, Volume II, Hazardous Material Emergency Planning and Response, applicable to CCAFS.

Prior to finalizing a launch date, proposed launch activities must be scheduled through the 45th Space Wing master scheduling pursuant to 45th SW Instruction 13-206, Space, Missile, Command and Control Eastern Range Scheduling. This procedure ensures that no two hazardous operations are conducted simultaneously. Space Florida would provide launch site scheduling requirements to all launch and reentry vehicle operators prior to launch operations. At least two days prior to a launch, Space Florida would notify appropriate parties, including local officials and the 45th Space Wing. Space Florida would comply with all CCAFS requirements.

Vehicle processing and launch operation activities are dependent on the type of propellant. The description below provides details regarding the vehicle processing and launch operations for the Athena-2 and Falcon 1 launch vehicle.

2.1.2.1 Athena-2 Processing and Launch Operations

The stages for the Athena-2, and other solid propellant rockets, would be transported to CCAFS by rail or truck following Department of Transportation (DOT) guidelines. The various stages would be checked upon arrival and temporarily transferred to the Titan III Integrate-Transfer-Launch complex for further inspection. Once ready for assembly, the motors, which would be pre-loaded with solid propellant, would be transferred by flat bed truck to LC-46. At LC-46, the Athena-2 would be assembled on the launch pad in a vertical orientation. No fueling activities would occur at the launch site.

The payloads would be integrated at a different facility. Once the payloads are loaded, they would be transferred via truck to the launch site for mating with the assembled vehicle. Once the vehicles are in place on the launch pad, a series of system and operational tests would be preformed to ensure launch preparedness. Upon successful completion of these tests, the vehicle would be cleared for launch. Similar to the other proposed solid propellant vehicles, Athena-2 stages would not be recovered.

2.1.2.2 Falcon 1 Vehicle Processing and Launch Operations

For the Falcon 1 vehicle, the stages would be transported to CCAFS separately by aircraft, rail, or truck following DOT guidelines. Upon arrival at CCAFS, the stages would be placed in a processing facility for inspection. The stages would be mated and payload added prior to arrival at the launch site. No assembly would occur at LC-46. The Falcon 1 vehicle would be fueled on the launch pad. Liquid Oxygen (LOX) would be trucked in for individual launches, while Rocket Propellant (RP-1) and helium (used to pressurize the second stage fuel and oxidizer tanks) would be contained in onsite tanks. A standard zero-leak quick disconnect fitting would be used to fuel liquid propellant vehicles to minimize propellant spills at the site. All onsite tanks would be American Society of Mechanical Engineers certified and fueling would occur in compliance with environmental and safety standards. Once the vehicles are in place on the launch pad, a series of system and operational tests would be preformed to ensure launch preparedness. Upon successful completion of these tests, the vehicle would be cleared for launch.

Stage 1 of the Falcon 1 launch vehicle would be recoverable. Once this stage is expended, it would detach and fall into the Atlantic Ocean. A parachute that would be deployed once the stage has been safely detached would slow its descent. The stage would land approximately 490 nautical miles downrange of the launch site. A salvage ship would recover the floating stage by using a homing system. The salvage ship would collect the stage and deliver it to Port Canaveral. The second stage would continue into orbit with the payload. Once the payload is released, the second stage would burn upon reentry into the atmosphere. The severely damaged second stage is expected to fall into the Atlantic Ocean approximately 550 nautical miles east of the Florida coastline. Upon impact, Stage 2 of the launch vehicle may break up. The stage is expected to sink into the ocean and would not be recovered.

2.1.3 Launch Trajectory

The azimuths for the proposed launch site are between 47 degrees northeast and 110 degrees southeast. Using the allowable azimuths, the vehicles would have an inclination between 34 and 50 degrees north or south of the equator.

2.1.4 Frequency of Launches

Space Florida proposes to host up to 24 orbital launches per year starting in 2008. The launches would include up to 12 launches of solid propellant-fueled vehicles and 12 launches of liquid-fueled vehicles.

2.1.5 Payloads

The payload capacity of the vehicles ranges from approximately 1,050 to 4,180 pounds. The Athena-2 vehicle offers the largest payload capacity. Proposed launch vehicles would carry a variety of communication and experimental payloads for a variety of missions, including low earth orbit and small geostationary satellites Comsat, International Space Station re-supply, Earth sensing, Earth-escape trajectory, and Operationally Responsive Space of the Department of Defense (DoD) missions. All payloads would be non-radioactive. The payloads for the Falcon 1 vehicle may consist of small amounts of hazardous propellants to fuel on-board maneuvering.

Payloads would be processed prior to arrival at CCAFS. It is not anticipated that CCAFS buildings would be needed for processing. Payloads would be temporarily stored at a separate payload facility until loaded onto the launch vehicle.

2.2 No Action Alternative

Under the No Action Alternative, the FAA would not issue the launch site operator license to Space Florida. Launch operators may be able to conduct launch activities at LC-46; however, the 45th Space Wing of the USAF would control operations. Other activities, such as military exercises at CCAFS would not be impacted. Under the No Action Alternative, LC-46 would not be used by Space Florida to meet the National Space Transportation Policy's goal of providing low-cost and reliable access to space. The Commercial Space Launch Act's goal to encourage the use of underutilized government infrastructure and resources to promote commercial investment and use of space would also not be realized at LC-46.

2.3 Scope and Outline of the Environmental Analysis

The FAA reviewed all resources covered under FAA Order 1050.1E, Change 1 and determined those that would be impacted by the Proposed Action. These resource areas are described in Section 2.3.1 and are discussed in further depth in Sections 3 through 9. Those resources not impacted by the project, or those that are covered by other review documents related to the Proposed Action, are not described in detail in this EA, as discussed in Section 2.3.2.

2.3.1 Organization of the EA

Sections 3 through 9 provide an analysis of the environmental resources that could be impacted by the Proposed Action, as shown below:

- Section 3 – Air Quality
- Section 4 – Biological Resources (Fish, Wildlife, Plants, and Special Status Species)
- Section 5 – Water Resources (Surface Water, Ground Water, Floodplains, and Wetlands)
- Section 6 – Noise
- Section 7 – Land Use (Section 4(f), Visual Resources, and Coastal Resources)
- Section 8 – Socioeconomic Resources
- Section 9 – Hazardous Materials, Solid Waste, and Pollution Prevention

For each resource analyzed in detail (Sections 3 to 9), this EA presents the region of influence (ROI), resource definition, the regulatory setting, the baseline conditions, the existing conditions, and environmental consequences.

The existing conditions sections describe the environmental characteristics that may be affected by the Proposed Action and alternatives. The affected environment is described succinctly to provide a context for understanding potential impacts. The level of detail provided for each research area is commensurate with the potential for impact on that resource area.

The environmental consequences sections describe the potential environmental impacts associated with the Proposed Action and the No Action Alternative. The environmental consequences were reviewed in accordance with all relevant legal requirements, including 40 CFR Part 1502.16 and the FAA Policies and Procedures (FAA Order 1050.1E, Change 1) for complying with NEPA, which specify significance thresholds by resource. Both construction (direct) impacts and secondary (induced) impacts (impact categories listed in FAA Order 1050.1E, Change 1) are addressed under environmental consequences, although not in separate sub-sections, because the Proposed Action and No Action Alternative involve no construction activities, and secondary (indirect) impacts are considered with the direct impacts for each impact category as necessary.

Section 10 discusses the cumulative impacts from the vehicles that would be launched under Space Florida's license and the past, present, and reasonably foreseeable future activities that would affect the resources impacted by the Proposed Action.

Section 11 evaluates the short-term benefits of the proposed alternatives compared to the long-term productivity derived from not pursuing the proposed alternatives.

Section 12 evaluates whether the Proposed Action would result in the irreversible and irretrievable commitments of resources.

Section 13, 14, and 15 include a list of preparers, the distribution list, and references, respectively.

2.3.2 Resources Not Analyzed in Detail

Construction impacts from all resources are not analyzed in detail because the Proposed Action does not include any construction or modification of existing facilities.

Natural Resources and Energy Supply is not analyzed in detail because the Proposed Action would not result in any measurable effect on local supplies of energy or natural resources. In addition, the Proposed Action does not use unusual materials or materials in short supply, so the use of natural resources other than propellants was not examined.

Because the Proposed Action would not require any construction or modification of LC-46, no impacts on cultural resources are anticipated. In addition, the facilities to be used under the Proposed Action are not listed or eligible for listing on the National Register of Historic Places. Additionally, the launch site does not contain a historic or tribal site of significance.

Farmlands are not located on CCAFS, and therefore, would not be impacted by the Proposed Action.

Wild and Scenic Rivers are not analyzed in detail because there are no Wild and Scenic Rivers located on or near CCAFS (National Wildlife and Scenic Rivers System, 2008).

Environmental Justice is not analyzed in detail because the Proposed Action would not disproportionately affect minority communities. CCAFS is approximately 14.5 miles northeast of Cocoa City, Florida and approximately 19.5 miles southeast of Titusville, Florida. U.S.

Census data indicate that these communities have a lower percentage of minorities than the U.S. and Florida averages.

The closest school to the launch site is Cape View Elementary School in the City of Cape Canaveral. The school is located approximately 6.3 miles southwest of LC-46 along the Atlantic shoreline. At this distance, the children would experience a slight increase in noise during launches. However, the noise impacts would be short-term and infrequent. Additionally, launch activities would be contained to the launch site. Because there is sufficient distance between the school and LC-46, children's health and safety is not analyzed in detail in this EA.

A detailed analysis of the potential safety impacts is not included in this EA. FAA conducts a separate safety review as part of the license application review process. Pursuant to 14 CFR Part 414.19(a), the FAA would determine whether Space Florida is eligible for a safety approval by assessing the effect on public health and safety, and safety of public property in terms of the following performance-based criteria: (1) FAA or other appropriate Federal regulations, (2) government-developed or adopted standards, (3) industry consensus performance-based criteria or standard, and (4) applicant-developed criteria, such as design and minimum performance, quality assurance system requirements, production acceptance test specifications, and continued operational safety monitoring system characteristics. In addition, Space Florida must allow the FAA to make its proposed safety approval criteria available to the public as part of the approval process.

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3.0 AIR QUALITY

3.1 Region of Influence

The ROI for air quality consists of Brevard County, Florida. Although emissions from launch vehicles would occur only at and near LC-46, the ROI includes all of Brevard County, Florida because ground-level air quality is regulated on a countywide or airshed basis. The ROI also includes the airspace above Brevard County, Florida and the airspace at higher altitudes down-range along the trajectories of the launch vehicles.

3.2 Resource Definition

3.2.1 Pollutants of Concern

The type and concentration of pollutants in the atmosphere, the size and topography of the air basin, and the prevailing meteorological conditions determine air quality in a given location. The significance of a pollutant concentration in a region or geographical area is determined by comparing it to Federal and State ambient air quality standards. The main pollutants of concern considered in the air quality analysis include volatile organic compounds (VOCs), ozone (O_3), carbon monoxide (CO), nitrogen oxides (NO_X), and particulate matter less than 10 microns in diameter (PM_{10}) and 2.5 microns in diameter ($PM_{2.5}$), and greenhouse gases (GHGs) such as carbon dioxide (CO_2). Although neither VOCs nor NO_X (other than nitrogen dioxide or NO_2) have established ambient standards, they are important because they are precursors to O_3 formation.

The atmosphere is composed of layers that differ in meteorology, chemical composition, and air quality concerns. The next sections discuss these layers and their relevance for this air quality assessment.

3.2.2 Lower Troposphere

The lower troposphere or atmospheric boundary layer extends from the ground level up to the inversion height or mixing height. Rapid mixing due to wind and turbulence within this layer insures that pollutants released within it quickly mix throughout the atmospheric boundary layer. For regulatory purposes, the mixing height often is assumed to lie at a nominal 3,000 feet altitude, although the atmospheric boundary layer can extend from ground level to a mixing height of 6,600 feet altitude. The atmospheric boundary layer, where people live and work, is where most air quality regulatory concern and monitoring is directed. The lower troposphere experiences removal of pollutant emissions during rainfall events and by vertical air movement that draws the emissions from the atmosphere to the ground. These effects may, under some conditions, contribute to deposition of air pollutants onto soil or waterbodies.

3.2.3 Upper Troposphere and Upper Atmosphere

The upper, or free, troposphere ranges from the top of the atmospheric boundary layer (nominally 3,000 feet) to approximately 6 miles. The upper troposphere is characterized by vigorous mixing driven by winds, turbulence, and mesoscale (tens to hundreds of miles) transport of pollutants. This layer does not contain any uniquely important atmospheric

constituents and it does not generally influence air quality in the lower troposphere (i.e., atmospheric boundary layer). However, GHGs emitted into the upper troposphere are of concern for climate change impacts.

The stratosphere extends from 6 to 31 miles altitude. The stratosphere contains 90 percent of the atmospheric ozone and includes the area known as the ozone layer, which is located between 12 to 19 miles above the Earth. The two potential air quality impacts of concern in the stratosphere are ozone depletion and climate change. GHGs emitted into the stratosphere can contribute to climate change.

The mesosphere is located between 31 to 50 miles above the Earth. The air composition in this layer includes lighter gases that are stratified according to their molecular weight due to gravitational separation (FAA, 2005). The ionosphere (also known as the thermosphere) is located above the mesosphere and begins between 50 and 65 miles above the Earth and extends to around 1,200 miles, although the upper boundary of this region is not well defined. This portion of the atmosphere is known as the ionosphere because radiation causes the scattered gas molecules in this layer to become electrically charged (i.e., they become ions) (FAA, 2005).

3.3 Regulatory Setting

Under the authority of the Clean Air Act (CAA), the U.S. Environmental Protection Agency (EPA) has established nationwide air quality standards, known as the National Ambient Air Quality Standards (NAAQS). The NAAQS represent the maximum allowable atmospheric concentrations of seven "criteria pollutants": O_3, CO, PM_{10}, $PM_{2.5}$, NO_2, Sulfur Dioxide (SO_2), and lead (see Exhibit 3-1). The primary NAAQS are set at a level to protect public health with an adequate margin of safety; the secondary NAAQS are set at a level to protect the public welfare from any known or anticipated adverse effects of a pollutant (e.g., damage to crops and materials). Under the CAA, State and local agencies may establish Ambient Air Quality Standards of their own, provided these are at least as stringent as the Federal requirements. Florida standards are similar to the NAAQS as shown in Exhibit 3-1.

EPA designates areas of the U.S. as having air quality equal to or better than the NAAQS (attainment) or worse than the NAAQS (nonattainment). EPA has designated Brevard County, Florida as an "attainment area" for all State and Federal air quality standards. The "attainment" designation indicates that the ambient criteria pollutant concentrations are below the NAAQS. A Federal agency cannot support an action (e.g., fund, license) unless the Federal lead agency has determined that the activity will conform to the EPA-approved State Implementation Plan for the region (40 CFR Part 51, General Conformity Rule). The General Conformity Rule applies only to nonattainment or maintenance areas. Since Brevard County is an attainment area, a conformity determination is not required.

Exhibit 3-1. Florida and National Ambient Air Quality Standards

Pollutant	Averaging Time	Florida Standards (a,b)	National Primary Standards (a,b)	National Secondary Standards (a,b)
O_3	8 Hours	157 μg/m^3 (0.08 ppm)	0.08 ppm (157 μg/m^3)	0.08 ppm (157 μg/m^3)
	1 Hour	235 μg/m^3 (0.12 ppm)	–	–
CO	8 Hours	10,000 μg/m^3 (9.0 ppm)	(9.0 ppm) 10,000 μg/m^3	–
	1 Hour	40,000 μg/m^3 (35 ppm)	(35 ppm) 40,000 μg/m^3	–
NO_2	Annual	100 μg/m^3 (0.05 ppm)	0.053 ppm (100 μg/m^3)	0.053 ppm (100 μg/m^3)
SO_2	Annual	60 μg/m^3 (0.02 ppm)	0.03 ppm (80 μg/m^3)	–
	24 Hours	260 μg/m^3 (0.1 ppm)	0.14 ppm (365 μg/m^3)	–
	3 Hours	1,300 μg/m^3 (0.5 ppm)	–	0.5 ppm (1300 μg/m^3)
PM_{10}	Annual	50 μg/m^3	50 μg/m^3	50 μg/m^3
	24 Hours	150 μg/m^3	–	–
$PM_{2.5}$	Annual	15 μg/m^3	15 μg/m^3	15 μg/m^3
	24 Hours	35 μg/m^3	35 μg/m^3	35 μg/m^3
Lead	Quarterly	1.5 μg/m^3	1.5 μg/m^3	1.5 μg/m^3

(a) μg/m^3 = micrograms per cubic meter. ppm = parts per million.

(b) Florida standards for ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide and PM_{10} are values that are not to be exceeded. The lead value is not to be equaled or exceeded.

(c) National standards other than ozone and those based on annual averages or annual arithmetic means are not to be exceeded more than once a year. The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standards, averaged over three years, is equal to or less than one. The lead and annual sulfur dioxide standards are not to be exceeded in a calendar year.

Source: National – 40 CFR 50. Florida – Florida Administrative Code, Rule 62-204.240.

3.4 Existing Conditions

3.4.1 Regional Climate and Meteorology

Brevard County, Florida has one of the most diverse ecosystems in North America due to the rare combination of climates. Brevard County is exposed to a temperate climate to the north and a warm subtropical climate to the south, combining the habitat and environmental needs for a wide variety of animal life. Summers are hot and humid with temperatures in the mid-to-upper 90s. Winters are mild with daytime temperatures in the 60 to 70 degree Fahrenheit range. Short periods of cold weather dipping down to the freezing mark can be expected in January and February. Hurricane season runs from June through November, and is normally most active between August and October. The Florida Peninsula is surrounded by oceanic currents of the Gulf Stream that modify the state's weather, which is punctuated by thunderstorms, lightning, and hurricanes. The principal meteorological conditions that control dispersion are winds and

turbulence (or mixing ability) of the atmosphere. The wind direction determines which locations would be affected by a given source. The wind speed, along with the degree of turbulence, controls the volume of air available for pollutant dilution. Atmospheric stability is a measure of the mixing ability of the atmosphere and, therefore, its ability to disperse pollutants. Greater turbulence and mixing are possible as the atmosphere becomes less stable, and thus pollutant dispersion increases. In general, stable conditions occur most frequently during the nighttime and early morning hours.

3.4.2 Regional Air Quality

The Florida Department of Environmental Protection (FDEP) measures ambient pollutant levels using a network of monitoring stations located throughout the State. Exhibit 3-2 presents the most recent three years of available data measured at the monitoring stations located nearest to LC-46. For some pollutants, the nearest station with three full years of data is located many miles away from the Proposed Action (e.g., the Winter Park station is about 50 miles from LC-46). Data from those stations are illustrative of general attainment conditions in Central Florida rather than of local air quality in the area around LC-46. Exhibit 3-2 shows that ground-level concentrations of criteria pollutants in the region around LC-46 are within the NAAQS and Florida standards.

Exhibit 3-2. Measured Ambient Air Concentrations of Criteria Pollutants in the Region

Pollutant	Averaging Time	Nearest Monitoring Station	Maximum Measured Concentration (ppm, except PM in µg/m^3)		
			2005	2006	2007
O_3	1 Hour	Cocoa Beach	0.080 (4th max.)(a)	0.081 (4th max.)	0.077 (4th max.)
	8 Hours	Cocoa Beach	0.068 (4th max.)	0.074 (4th max.)	0.067 (4th max.)
CO	8 Hours	Winter Park	2.0	1.7	1.0
	1 Hour	Winter Park	2.2	2.5	1.6
NO_2	Annual	Winter Park	0.009	0.009	0.007
SO_2	Annual	Winter Park (2005-2007), Cocoa (2007)	0.001	0.001	Winter Park 0.001, Cocoa 0.001
	24 Hours	Winter Park (2005-2007), Cocoa (2007)	0.004	0.004	Winter Park 0.003, Cocoa 0.006
	3 Hours	Winter Park (2005-2007), Cocoa (2007)	0.011	0.010	Winter Park 0.009, Cocoa 0.029
PM_{10}	Annual	Titusville (2005), Cocoa (2006-2007)	16	14	16
	24 Hours (b)	Titusville (2005), Cocoa (2006-2007)	60	27	74
$PM_{2.5}$	Annual	Melbourne	8.3	9.0	7.3
	24 Hours	Melbourne	40	36	24

Pollutant	Averaging Time	Nearest Monitoring Station	Maximum Measured Concentration (ppm, except PM in µg/m^3)		
			2005	2006	2007
Lead	Quarterly	No lead monitors are located within 100 miles of LC-46	–	–	–

(a) The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standards, averaged over three consecutive years, is equal to or less than one. By this statistic, the standard is met when the fourth-highest average concentration in each of the three years is less than the value of the standard.

(b) The 24-hour $PM_{2.5}$ standard is attained when the standard value is not exceeded on more than an average of one day per year over a three-year period. By this statistic, the 24-hour $PM_{2.5}$ standard was attained in 2005-2007 despite maximum concentrations that exceeded the value of the standard (35 µg/m3) in 2005 and 2006.

Source: EPA, 2007c.

3.5 Environmental Consequences

3.5.1 Proposed Action

3.5.1.1 Emissions

The Falcon 1 uses RP-1 and LOX as propellants. The primary emission products from RP-1/LOX engines are CO_2, CO, water vapor, and small amounts of NO_x and PM. The Athena-2 uses solid rocket propellant composed of 68 percent ammonium perchlorate, 18 percent powdered aluminum (Al), and 14 percent hydroxyl-terminated polybutadiene. The primary emission products from the Athena-2 are CO_2, CO, water vapor, NO_X, PM (as aluminum oxide, Al_2O_3), and hydrogen chloride. Nearly all the emitted CO oxidizes rapidly to CO_2. Additionally, gaseous hydrogen chloride combines with moisture in the atmosphere to form hydrochloric acid (HCl).

Emissions were calculated based on the total burn time of each rocket stage and estimated time of rocket operation in each atmospheric layer. Using this data, the approximate percentage of propellant burned from each stage within each atmospheric layer was determined. Exhibit 3-3 presents the assumptions used to calculate emissions from the Falcon 1 and Athena-2 vehicles.

Using the mass of propellant in each rocket stage and the percentage of stage propellant burned in each atmospheric layer, the total propellant mass burned in each layer was determined. Emission factors were applied to the propellant mass burned in each layer to determine launch vehicle emissions associated with the Proposed Action. Exhibit 3-4 presents the emissions per launch for the Falcon 1 and Athena-2 vehicles and the total emissions for all 24 projected launches per year (up to 12 launches of each rocket) with the Proposed Action.

Exhibit 3-3. Falcon 1 and Athena-2 Estimated Flight Profiles and Propellant Consumption per Atmospheric Layer

Atmospheric Layer	Operating Stage No.	Estimated Flight Time (seconds)	Approximate Percentage of Stage Propellant Burned [a]
Falcon 1			
Lower Troposphere	1	15	9 %
Upper Troposphere	1	60	36 %
Stratosphere	1	75	44 %
Mesosphere	1	19	11 %
Ionosphere	2	378	100 %
Athena-2			
Lower Troposphere	1	15	18 %
Upper Troposphere	1	45	4 %
Stratosphere	1	23	28 %
Stratosphere	2	83	100 %
Mesosphere	3	90	60 %
Ionosphere	3	60	40 %

[a] At average burn rate

Exhibit 3-4. Launch Vehicle Emissions with the Proposed Action

Vehicle	CO_2	CO	H_2	H_2O	N_2	NO_X	THC	SO_X	PM	Cl_2	HCl
Emissions per Launch (tons)											
Falcon 1	14.4	5.9	0.1	8.8	0.0	(a)	0.0	0.0	(a)	0.0	0.0
Athena-2	54.6	0.0	0.0	32.1	0.0	3.0	0.0	0.0	45.1	0.2	24.9
Annual Emissions from All Launches (tons/year)											
Falcon 1	172.3	70.3	1.5	105.5	0.0	(a)	0.0	0.0	(a)	0.0	0.0
Athena-2	655.7	0.0	0.0	384.8	0.0	35.6	0.0	0.0	541.6	2.1	299.3
Total	828.0	70.3	1.5	490.3	0.0	35.6	0.0	0.0	541.6	2.1	299.3

(a) Minor emissions are expected. Data are not available to quantify mass emissions.
Source for emission factors used to calculate emissions: FAA, 1996; FAA, 2001; USAF, 2007.

3.5.1.2 Impacts on the Atmosphere with the Proposed Action

3.5.1.2.1 Lower Troposphere

Annual emissions to the lower troposphere from the Proposed Action are shown in Exhibit 3-5.

Exhibit 3-5. Annual Emissions to the Lower Troposphere from the Proposed Action (tons/year)

Vehicle	CO_2	CO	H_2	H_2O	N_2	NO_X	THC	SO_X	PM	Cl_2	HCl
Falcon 1	13.1	5.3	0.1	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Athena-2	53.9	0.0	0.0	31.6	0.0	2.9	0.0	0.0	44.5	0.2	24.6
Total	**67.0**	**5.3**	**0.1**	**39.6**	**0.0**	**2.9**	**0.0**	**0.0**	**44.5**	**0.2**	**24.6**

Emissions of any criteria pollutants under the Proposed Action would be well below Federal *de minimis* levels and would not be expected to cause exceedences of the NAAQS or the Florida Ambient Air Standards. The emissions within the lower atmosphere would be of very short duration and would be rapidly dispersed due to the mechanical and thermal turbulence of the exhaust gases, the movement of the vehicle, and wind action. The flight path for all launches would be directly over the Atlantic Ocean. The prevailing wind patterns would tend to disperse launch exhaust over the ocean and away from population centers, minimizing the impact on the public and the environment. The annual emissions to the lower troposphere from the Proposed Action would have a negligible impact on air quality below 3,000 feet.

3.5.1.2.2 Upper Troposphere and Upper Atmosphere

Annual emissions to the upper troposphere and upper atmosphere from the Proposed Action are presented in Exhibit 3-6.

Exhibit 3-6. Annual Emissions to the Upper Troposphere and Upper Atmosphere from the Proposed Action (tons/year)

Vehicle	CO_2	CO	H_2	H_2O	N_2	NO_X	THC	SO_X	PM	Cl_2	HCl
Upper Troposphere											
Falcon 1	52.3	21.4	0.4	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Athena-2	161.6	0.0	0.0	94.9	0.0	8.8	0.0	0.0	133.5	0.5	73.8
Sum	**213.9**	**21.4**	**0.4**	**126.9**	**0.0**	**8.8**	**0.0**	**0.0**	**133.5**	**0.5**	**73.8**
Stratosphere											
Falcon 1	65.4	26.7	0.6	40.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Athena-2	380.7	0.0	0.0	223.4	0.0	20.7	0.0	0.0	314.5	1.2	173.8
Sum	**446.1**	**26.7**	**0.6**	**263.5**	**0.0**	**20.7**	**0.0**	**0.0**	**314.5**	**1.2**	**173.8**
Mesosphere											
Falcon 1	16.6	6.8	0.1	10.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Athena-2	35.7	0.0	0.0	21.0	0.0	1.9	0.0	0.0	29.5	0.1	16.3
Sum	**52.3**	**6.8**	**0.1**	**31.1**	**0.0**	**1.9**	**0.0**	**0.0**	**29.5**	**0.1**	**16.3**
Ionosphere											
Falcon 1	24.9	10.1	0.2	15.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Athena-2	23.8	0.0	0.0	14.0	0.0	1.3	0.0	0.0	19.7	0.1	299.3
Sum	**48.7**	**10.1**	**0.2**	**29.2**	**0.0**	**1.3**	**0.0**	**0.0**	**19.7**	**0.1**	**299.3**

Emissions of GHGs and Ozone Depleting Substances (ODS) are of concern in the upper atmosphere. The potential emissions that may affect global climate change directly include CO_2, H_2O, and carbon particles, which are a component of PM. Under the Proposed Action, the estimated annual emissions of CO_2 to the stratosphere would be 446.1 tons. By comparison, CO_2 emissions for the United States in 2003 totaled 6,305.78 million tons (WRI, 2008a). The incremental contribution of emissions under the Proposed Action would be extremely small and would result in a negligible impact on global climate change. Emissions of H_2O to the stratosphere under the Proposed Action would also have an insignificant effect on global climate change due to the large number of natural and anthropogenic sources of H_2O. Carbon particle emissions are of concern because surfaces of individual particles enable important reactions that would not proceed otherwise, and because the properties of the particles in absorbing and reflecting sunlight and infrared radiation can have climate change effects. The Falcon 1 engine

would produce very small amounts of carbon PM, but these emissions have not been detected in tests (USAF, 2007) and are not quantified in Exhibits 3-5 through 3-6. Because of their small quantities, any PM emissions from the Falcon 1 would have negligible climate change impacts.

The PM emitted by the Athena-2 engine consists primarily of Al_2O_3, with only very small amounts of carbon particles. Aluminum oxide particles provide reactive surfaces for free radical formation and other chemical reactions that can increase the formation of ODS or other pollutants. Based on studies of the Space Shuttle and Titan-IV rockets (WMO, 1995, as cited in FAA, 1996), which have far greater emissions of Al_2O_3, impacts of the Athena-2 launches on ozone depletion would be negligible.

A small fraction of Athena-2 rocket engine emissions consists of HCl that can dissociate in the atmosphere to produce atomic chlorine and chlorine monoxide, which are part of a class of highly reactive radicals that attack and deplete ozone in the plume wake immediately following launch. However, under the Proposed Action, launches would occur infrequently, with a maximum of one launch of the Athena-2 per month. Therefore, negligible impacts on ozone would be anticipated.

Rockets launched under the Proposed Action would also emit CO and NO_X, two important photochemical pollutants that can influence the creation and destruction of greenhouse gasses. Under the Proposed Action, the estimated annual emissions of CO and NO_X to the stratosphere would be 26.7 and 2.7 tons, respectively. The contributions of these pollutants would be extremely small relative to U.S. annual emissions, which numbered approximately 85.66 million tons of CO and 21.37 million tons of NO_X in 2000 (WRI, 2008b; WRI, 2008c). As a result, the presence of these chemicals in rocket emissions associated with the Proposed Action would have a negligible impact on global climate change.

3.5.2 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to Space Florida; therefore, no additional impacts on air quality would occur. Under the No Action Alternative, similar to current operating procedures, military operations and other launch activities may occur at LC-46 as controlled by the 45th Space Wing of the USAF.

4.0 BIOLOGICAL RESOURCES (FISH, WILDLIFE, PLANTS, AND SPECIAL STATUS SPECIES)

4.1 Region of Influence

The ROI for biological resources includes the area within and immediately surrounding LC-46, within CCAFS, and the surrounding marine environment that could be affected by the detachment and recovery of launch vehicles stages. Impacts on biological resources may include exposure to launch emissions, noise, hazardous material or waste, and physically harm or mortality due to a strike.

4.2 Resource Definition

Biological resources are valued for their intrinsic, aesthetic, economic, and recreational aspects and they are described as native or naturalized vegetation and wildlife and their respective habitats. In this EA, these resources are categorized as vegetation (invasive and native terrestrial species), wildlife (birds, small mammals, etc.), marine species (fish, marine mammals, etc.), special status species (threatened, endangered, species of concern). Special status species include threatened and endangered species, and species of special concern that occur or could potentially occur at CCAFS, and could be affected by the effects of launch operations. Sensitive and protected biological resources include plant and animal species listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS) and the Florida Fish and Wildlife Conservation Commission (FFWCC).

4.3 Regulatory Setting

4.3.1 Vegetation, Wildlife, and Marine Species

Federal agencies must follow regulations and guidance in the protection of migratory and special status species of birds. The Migratory Bird Treaty Act of 1981 (16 United States Codes (U.S.C.) 703-712) protects against the taking, killing, possession, transportation, and importation of migratory birds, their eggs, and nests except for authorized permits granted by the Department of the Interior (DOI). The Bald and Golden Eagle Protection Act prohibits the taking or possession of, and commerce in, bald and golden eagles.

The Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2901-2912) promotes the conservation of non-game fish and wildlife and their habitats from Federal actions. EO 13112, Invasive Species, requests that actions taken by Federal agencies that affect the status of invasive species use relevant programs to prevent introducing invasive species and provide means through which to restore native species and habitat conditions to their original state.

The Marine Mammal Protection Act of 1972 prohibits the taking of marine mammals, including harassing them, and may require consultation with the National Marine Fisheries Service. The National Marine Fisheries Service is also responsible for evaluating potential impacts on Essential Fish Habitat and enforcing the provisions of the 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (50 CFR 600.905 et seq.).

4.3.2 Special Status Species

The Endangered Species Act (16 U.S.C. 1531-1544) provides for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend, both through Federal action and by encouraging the establishment of State programs. Section 7 of the Endangered Species Act requires Federal agencies to insure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of listed species or modify their critical habitat.

The State of Florida's Endangered Species Protection Act prohibits the intentional wounding or killing of any fish or wildlife species designated by the FFWCC as "endangered," "threatened," or of "special concern." This prohibition also extends to the intentional destruction of the nests of any such species.

4.4 Existing Conditions

4.4.1 Terrestrial Vegetation and Wildlife

The primary vegetative communities that exist within LC-46 and the surrounding area include coastal dunes, coastal strand, freshwater marsh, freshwater swamp, and developed/maintained areas dominated by terrestrial grasses and weeds. In addition, invasive species make up a portion of the herbaceous and woody vegetation, as discussed below. Most vegetative areas are highly fragmented due to modifications at CCAFS, such as roads, utility corridors, buildings, and launch complexes.

Cape Canaveral is situated along a major flyway route for migratory birds and home to numerous birds listed on the USFWS migratory bird list, all of which are protected at the Federal level by the Migratory Bird Treaty Act. Black skimmers, least terns, and Wilson's plover have been observed nesting on the beach adjacent to LC-46 and are known to nest along other portions of the station beaches (A. Chambers, Personal Communication, July 22, 2008). Other birds commonly occurring near LC-46 include gulls, red-winged blackbirds, mockingbirds, and southeast American kestrel. The Florida Northern Bobwhite is known to occur in Brevard County; however, it is not common at CCAFS (FFWCC, 2008a) (A. Chambers, Personal Communication, July 22, 2008). More than 30 species of mammals inhabit the lands and waters at Cape Canaveral, including armadillo, white-tailed deer, bobcat, raccoon, and the cotton rat (USAF, 1994). Several reptile species also occur in the area, including the Eastern diamondback rattlesnake, Florida pine snake, and several protected sea turtle species. Special status species are discussed in Section 4.4.3.

The coastal dunes, coastal strand, freshwater marsh, and freshwater swamp habitats are summarized in Exhibit 4-1 below.

Exhibit 4-1. Primary Vegetative Communities Occurring at the LC-46 and Surrounding Areas

Habitat Type	General Location	Dominant Vegetation	Mammals	Reptiles and Amphibians	Birds	LC-46 Habitat Alteration
Coastal Dunes	Along the coastline	Sea oats and other grasses; small shrubs, such as beach berry, marsh elder, and silver-leaf croton; and some herbs	Armadi1los, cotton rat, feral hogs, Florida mouse, Florida white-tailed deer, rabbit, and the Southern beach mouse	Few snakes and sea turtles	Brown pelican, Florida scrub jay, mockingbird, mourning dove, sandpipers, terns, and gulls	No major habitat alteration at LC-46
Coastal Strand	Inland from coastal dunes	Dense shrub layer dominated by saw palmetto; Other vegetation include sea grape, wax myrtle, snowberry, and nakedwood	Armadillo, cotton rat, feral hogs, Florida mouse, raccoon, rabbits, Southern beach mouse, and white-tailed deer	Gopher tortoise and Eastern diamondback rattlesnake	American crow, American robin, Black vulture, cardinal, common barn owl, Coopers hawk, Florida bobwhite, mockingbird, mourning dove, red-headed woodpecker, red-tailed hawk, red-winged blackbird, sparrows, and turkey vulture	LC-46 was constructed primarily within this habitat
Freshwater Marsh	Within interdunal swales in coastal strand	Cattails (in disturbed areas), Sand cordgrass and leather fern (in non-disturbed areas)	Raccoon, Florida white-tailed deer, marsh rabbit, rice rat, and river otter	Alligator, Florida water snake, soft shelled turtle, southern leopard frog, and water moccasin	Red-winged blackbird, belted kingfisher, common Gallinule, great blue heron, great egret, marsh hawk, and wood stork	This habitat has been significantly altered at LC-46 for drainage purposes and to build various facilities
Freshwater Swamp	Within interdunal swales in coastal strand	Willow vegetation is dominant; Other vegetation include cordgrass, saltbush, and Brazilian pepper	Same as freshwater marsh	Same as freshwater marsh	Same as freshwater marsh	Same as freshwater marsh

Sources: USAF, 1994; CCAFS, 1994

4.4.1.1 Developed/Maintained Areas

LC-46 includes approximately 70 acres of semi-improved grounds that consist of grasses (primarily common Bermuda grass or bahia grass) and herbs that are regularly mowed. These grounds provide a 475 to 2,000 foot buffer between the launch pad and the native habitats surrounding LC-46. Fauna common to this habitat are the same as those listed for the coastal strand and coastal dune community types.

4.4.1.2 Invasive Species

LC-46 and CCAFS are highly disturbed areas, which include roads, utility corridors, and launch complexes. A large portion of the vegetation in this area is inhabited by invasive species. Brazilian pepper predominates the invasive flora at CCAFS with six other invasive weeds present in lower densities (USAF, 2007). Australian pine is also widespread and grows singly or as small, dense groves scattered across CCAFS (USAF, 2007). Other common invasive species include cogon grass, melaleuca, mistletoe, and small populations of thistles and nettles are present (CCAFS, 2004).

4.4.2 Marine Habitats and Species

Shallow, near-shore waters and deeper waters further from land provide important habitat for marine species. Animals that can swim freely in the ocean include fish, squids, sea turtles, and marine mammals. Benthic communities are made up of marine organisms that live on or near the sea floor, such as bottom dwelling fish, shrimp, worms, snails, and starfish. Essential Fish Habitat includes the waters and substrates necessary for marine species to reach all stages of their life cycle. The waters of the Banana River to the west of LC-46 provide habitat for the West Indian manatee. LC-46 is located adjacent to the Atlantic Ocean, which is home to the numerous aquatic species, including the Hawksbill and Kemp's Ridley sea turtles and West Indian manatees.

4.4.3 Special Status Species

Special status animal species observed at the LC-46 are described in Exhibit 4-2. No federally-listed threatened or endangered plant species are found on CCAFS.

Exhibit 4-2. Special Status Species Occurring at the LC-46 and Surrounding Areas

Common Name	Scientific Name	Federal Status	Florida Status
Birds			
Florida scrub jay	*Aphelocoma coerulescens*	T	T
Least tern	*Sterna antillarum*	MB	T
Piping plover	*Charadrius melodus*	T	T
Reptiles			
American alligator	*Alligator mississippienisis*	T(S/A)	SC
Eastern indigo snake	*Drymarchon corais couperi*	T	T
Gopher tortoise	*Gopherus polyphemus*	-	T
Leatherback sea turtle	*Dermochelys coriacea*	E	E
Green sea turtle	*Chelonia mydas*	E	E
Loggerhead sea turtle	*Caretta caretta*	T	T
Hawksbill sea turtle	*Eretmochelys imbricata*	E	E
Kemp's ridley sea turtle	*Lepidochelys kempi*	E	E
Mammals (includes near-shore waters)			
Southeastern beach mouse	*Peromyscus polionotus niveiventris*	T	T
West Indian Manatee	*Trichechus manatus*	E	E

Notes:
E = Endangered
T = Threatened
T(S/A) = Similarity of Appearance to a Threatened Taxon in the Entire Range
MB = Protected under the Migratory Bird Treaty Act
SC = Species of Concern

Sources: FFWCC, 2007; USAF, 2006; USFWS, 2000b.

4.4.3.1 Birds

In the vicinity of LC-46, the federally-threatened Florida scrub jay occupies coastal strand vegetation adjacent to the site. In addition, the birds are sometimes seen along nearby grassed road shoulders and in other mowed areas within and outside LC-46. A survey conducted in 2007 identified one group of scrub jays residing/nesting in the area to the south of LC-46 (A. Chambers, Personal Communication, July 22, 2008). The USFWS has determined that CCAFS is a core Florida scrub jay area and is highly valuable to the recovery of the species.

In 2008, a colony of least terns nested on the beach adjacent to LC-46 (A. Chambers, Personal Communication, July 22, 2008). Nests generally occur within the transition zone between beach dune and coastal grassland, if the vegetation is sparse. Nesting typically occurs between April and August (USAF, 2001).

Though rare in this area, piping plovers may occur on CCAFS beaches during the non-breeding season, July through March (EDCFSC/PAFB, 2005). They would likely be found foraging along the coast.

4.4.3.2 Reptiles

Of the five sea turtles observed in the waters offshore at CCAFS (Exhibit 4-1), all but the Hawksbill and Kemp's Ridley sea turtles are known to nest on station beaches, including those beach areas adjacent to LC-46. In 2007, between May and August, more than 1,100 loggerhead turtle nests are deposited on the station beaches. The 2007 nesting season was a record year for green turtle nesting activity, with over 150 nests recorded. During the 2007 nesting season, four leatherback nests were recorded by station biologists (FFWCC, 2008b). At CCAFS, the beach areas from mean low tide to just behind the leading dune are considered protected nesting habitat for federally-listed sea turtles (USAF, 1998).

The American alligator is federally-listed as threatened because of its similarity in appearance to another endangered species, the American crocodile (*Crocodylus acutus*), which is not found in Brevard County. The American alligator has made a strong recovery in Florida and there have been increased sightings at CCAFS. Alligators inhabit and reproduce in all CCAFS waters. Several alligators have been observed in the drainage canals located north and west of LC-46.

Federally and State listed as a threatened species, the Eastern indigo snake has been identified throughout CCAFS and may occur around LC-46. These snakes are strongly associated with high, dry, well-drained sandy soils, closely paralleling the dune habitat preferred by gopher tortoises. Though not documented on CCAFS, the snakes have been found to co-inhabit gopher tortoise burrows.

The gopher tortoise, State-listed as threatened, is found in high densities on CCAFS, including the areas in and around LC-46 (FFWCC, 2008c) (A. Chambers, Personal Communication, July 22, 2008). The gopher tortoise prefers open habitats that have herbaceous plants for forage, including disturbed areas such as recent burn areas, road shoulders, fence lines, and launch complexes. Gopher tortoise burrows and other subterranean cavities are commonly used as dens and for egg laying. Up to 20 active burrows have been observed in the coastal strand and coastal dune habitats east of LC-46.

4.4.3.3 Mammals

The southeastern beach mouse is found along the entire reach of coastline on CCAFS, mostly within areas of coastal dune and coastal strand vegetation. Prior trapping studies have confirmed the presence of beach mice in areas adjacent to LC-46, in the coastal dune and coastal strand habitats, as well as the maintained area within the perimeter fence.

The endangered Florida manatee can be found in the Banana River along the western boundary of CCAFS (USAF, 2001). The Banana River and Indian River Lagoon supports an important spring habitat for manatee populations in Florida (USFWS, 2001). Sections of the Upper Banana River are designated as state Manatee Protection Areas. Manatees have also been observed in the shallow waters along the Atlantic coast adjacent to CCAFS.

4.5 Environmental Consequences

4.5.1 Proposed Action

4.5.1.1 Terrestrial Vegetation and Wildlife

Heat and emissions from rocket exhaust can result in localized foliar scorching and spotting. However, recent studies from launch systems larger than the Athena-2 and Falcon 1 have indicated that such effects are localized, temporary, and not of sufficient intensity to cause long-term damage to vegetation (National Aeronautics and Space Administration [NASA], 2002; USAF, 2000). As previously mentioned, the vegetation immediately around launch pads is regularly mowed in order to minimize the risk of brush fires. For the reasons described above, these impacts would not exceed the applicable threshold of significance.

During launches at LC-46, it is possible that birds in the immediate area would be startled by launch noise and temporarily leave the immediate area, which could disrupt feeding and nesting activities. Monitoring of sea and shore birds by USAF has shown no interruption of activities, or any evidence of abnormal behavior or injury (USAF, 2006). The continued presence of migratory, sea, and shore birds at CCAFS suggests that rocket launches over the past few decades have not significantly inhibited the populations of the species currently present. During launch events, a bird strike could occur, although there would be a low probability of such an event. Prior launches from CCAFS have not resulted in animal mortalities (USAF, 2001). In the unlikely event of a migratory or special status bird strike, the appropriate agency would be consulted. The 45SW holds a Federal Depredation Permit, which allows removal of active migratory bird nests when their presence impedes launch-related activities. Under the Migratory Bird Act, nest removal must be conducted in accordance with the permit, which is renewed annually.

Launches of solid propellant vehicles would create ground exhaust plume containing hydrogen chloride. In the presence of water vapor, hydrogen chloride produces HCl. HCl would precipitate out of the air around the launch pad. Athena-2 launches are estimated to deposit 0.427 gram HCl per square meter of surface area over 4 square miles (Whimpey, 1995). Direct impacts as a result of acid deposition to vegetation could include discoloration, partial or complete loss of foliage, and a decline in seedling survivorship, seed germination response, and seedling emergence. Studies conducted in conjunction with Delta II launches, which is approximately twice as large as the proposed Athena-2, have observed no visible impact on the surrounding vegetation outside a 298.6-foot radius from the launch pad (Gillespie, 1996). Much of the near-field vegetation (i.e., 475 to 2,000 feet) has been removed to create a buffer. Therefore, HCl deposition is not expected to have adverse impacts on vegetation.

Terrestrial mammals in close proximity to a launch might suffer startle responses. The increased noise could also result in temporary threshold shift effects, or temporary hearing loss for mammal or reptile species close enough to the launch pad. However, these effects would be temporary and would not have a significant effect on local populations. The low frequency of launches (approximately twice a month) further suggests that the Proposed Action would not have an adverse effect on wildlife.

4.5.1.2 Marine Species

The acidification of surface waters in some of the areas close to the launch sites could present harmful conditions for near-shore, shallow fisheries and aquatic vegetation. Fish kills were observed in a small lagoon and impoundment at KSC following Space Shuttle launches. These fish kills were the direct result of rapid pH decreases for up to 5.0 pH units in the water bodies resulting from high levels of HCl (Schmalzer et al., 1993). The maximum HCl deposited during a Space Shuttle launch is 127 grams per square meter (NASA 1992). In comparison, the Athena-2 vehicle is expected to create a fraction (0.427 grams per square meter) of HCl. Additionally, the area is subjected to wind-blown salt spray and mixing with the open ocean (see Section 5.5). Therefore, little or no adverse effects on aquatic habitats from the Proposed Action are expected.

In the unlikely event of a failure during launch, or an early termination of flight, the launch vehicle would most likely fall into the ocean, along with some scattered debris. Propellants and other chemicals could be released, although they would be quickly diluted within the ocean. The probability of an early termination of a flight is extremely low, and it is even more unlikely that a terminated launch vehicle or debris would strike a marine mammal, turtle, or fish. As a result, no adverse effects on marine species from the Proposed Action are expected.

Sonic booms created by launches from CCAFS launch complexes occur over the open Atlantic Ocean. The effects of a sonic boom on whales or other open ocean species are not known. Because these sonic booms are infrequent, the marine species in the ocean's surface waters are present in low densities (although spring and fall migration would see periodic groups of migrating whales that follow the coastline), and the sonic boom footprint lies over 30 miles from CCAFS, the sonic booms from launches are not expected to negatively affect the survival of any marine species (USAF, 1998).

4.5.1.3 Special Status Species

The Proposed Action is anticipated to have minimal impacts on endangered and threatened species (USAF, 1994). As described above for wildlife and marine species, no native habitats would be required to be cleared or directly impacted. In addition, the majority of effects from launch activities would be short-term, of relatively low intensity, and would occur relatively infrequently due to the low launch rate.

4.5.1.3.1 Birds

Individual launches may disturb or startle a few individual scrub jays due to excessive noise and vibration levels. These impacts would be temporary (less than one minute), occur approximately twice per month, and would be limited to individual birds close to the launch site during launch activities. The behavior of scrub jays observed after Delta, Atlas, and Titan launches has been normal, which suggests limited noise-related effects (Schmalzer, 1998). Impacts on scrub-jay habitat are not anticipated. Space Florida would conduct all activities in accordance with the Scrub jay Management Plan for CCAFS. Impacts on piping plovers and least terns would be similar. For the reasons discussed above, any impacts on special status birds would be relatively infrequent and temporary.

4.5.1.3.2 Reptiles

At CCAFS, the beach areas from mean low tide to just behind the leading dune are considered protected nesting habitat for federally-listed sea turtles (USAF, 1998). To minimize impacts on turtles, and specifically to prevent facility lighting from potentially affecting the behavior and movement of adult sea turtles and hatchlings at night, the USAF initiated a Sea Turtle Preservation Program for the conservation of nesting sea turtles at the CCAFS (NASA/45 SW/Authority, 2002). Space Florida would conduct all activities in accordance with this program. For example, Space Florida would develop a light management plan, which could include the use of low-pressure sodium light fixtures, shielding of lights, and special light management steps where lights are visible from the beach.

Other protected reptile species in the LC-46 areas, such as the gopher tortoise, American alligator, and the Eastern indigo snake could be startled during a launch, and might experience some levels of temporary hearing loss if close enough to a launch, but no lasting effects are expected. As mentioned above, prior launches from CCAFS have not resulted in animal mortalities (USAF, 2001).

4.5.1.3.3 Mammals

The intense heat and high concentrations of HCl associated with launches would directly impact approximately 10 acres of semi-improved areas within 400 feet of the launch pad (USAF, 1994). The soil conditions in this area do not appear to be suitable burrowing habitat for Southeastern beach mice. As a result, long-term impacts on the Southeastern beach mouse are not expected. Temporary impacts could include being startled during the launch and some levels of temporary threshold shift, as discussed above for other mobile species.

Because LC-46 is at some distance from the Banana River, where the West Indian Manatee may occur during launch activities, noise impacts would be less than those from other launch pads closer to the Banana River. Though the hearing sensitivity of manatees has not been well studied, manatees have shown to be relatively unresponsive to anthropogenic noise (USAF, 1998). Since manatees spend most of the time submerged, and since they do not startle readily, launch noise from LC-46 is not expected to affect the animals. A common source of mortality for manatees is boat-strikes, especially in shallow water. While a salvage boat would be used to recover the first phase of the Falcon 1, the recovery efforts would occur approximately 540 nautical miles off the Atlantic coast. Therefore, the possibility of a manatee strike relating to the Proposed Action is extremely low.

4.5.2 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to Space Florida.; therefore, no additional impacts on biological resources would occur. Under the No Action Alternative, similar to current operating procedures, military operations and other launch activities may occur at LC-46 as controlled by the 45th Space Wing of the USAF.

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5.0 WATER RESOURCES (Surface Water, Ground Water, Floodplains, and Wetlands)

5.1 Region of Influence

The ROI for surface water is the drainage system/watershed in which CCAFS is located. The ROI for ground water includes the local aquifers that are directly or indirectly used by CCAFS. The ROI for wetlands and floodplains include LC-46 and the immediate area surrounding the site.

5.2 Resource Definition

Water resources include surface water and ground water, and their physical, chemical, and biological characteristics. Surface water resources consist of lagoons, rivers, and streams. Ground water is defined as water, both fresh and saline, that is stored below the Earth's surface in pores, cracks, and crevices below the water table.

A floodplain is defined as the lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of offshore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year (42 F.R. 26951).

Wetlands are defined as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands usually include swamps, marshes, bogs, and similar areas (40 CFR 230.3(t)).

5.3 Regulatory Setting

Water resources are regulated by the Clean Water Act (CWA), which regulates all discharges into "waters of the United States" and sets water quality standards for all contaminants in surface waters. The goal of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Section 404 of the CWA requires consultation prior to the dredging or disposing of fill materials into navigable waters, and most activities require permits.

Under Section 402, the CWA also requires that all point sources discharging pollutants into waters of the U.S. must obtain a National Pollution Discharge Elimination System (NPDES) permit. A water quality certificate must be obtained under Section 401 if a project is required to apply for a Section 404 Permit or a NPDES Permit (USAF, 2006). FDEP issues NPDES industrial storm water permits, storm water construction permits, and wastewater construction permits. The St. Johns River Water Management District issues applicable Environmental Resource Permits.

EO 11988, *Floodplain Management*, requires Federal agencies to take action to reduce the risk of flood damage; minimize the impacts of floods on human safety, health, and welfare; and to restore and preserve the natural and beneficial values served by floodplains. Federal agencies are directed to consider the proximity of their actions to or within floodplains.

The CWA, Order DOT 5660.1A, the Rivers and Harbors Act of 1899, and EO 119900, *Protection of Wetlands*, address activities in wetlands. Activities occurring in or near wetlands are subject to Section 404 of the CWA and require a permit from the U.S. Army Corps of Engineers. EO 119900 requires Federal agencies to ensure their actions minimize the degradation, destruction, or less of wetlands (FAA Order 1050.1E, Change 1).

5.4 Existing Conditions

5.4.1 Surface Water

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

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

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

5.4.2 Ground Water

The surficial and Floridian aquifer systems underlie CCAFS (USAF, 1998). Within the project area, depth to ground water in the surficial aquifer is typically not greater than three feet below land surface. The bottom of the surfical aquifer at CCAFS occurs at a depth of about 100 feet below land surface. Ground water in the surficial aquifer flows to the east towards the Atlantic Ocean (Reynolds, Smith and Hills, Inc., 2006). The Floridian Aquifer is overlain by confining beds 80 to 120 feet thick that will not readily transmit water (Reynolds, Smith and Hills, Inc., 2006; USAF, 1998).

A below-grade water supply line supplies potable water for the LC-46 facilities. Because of the current lack of activity at LC-46, water quality is currently not being monitored for drinking water standard compliance. From 1954 to 1965, a firefighting training pit, designated as Solid Waste Management Unit 32 (Fire Training Area No. 1), existed 200 feet southeast of the current launch pad. During that time, petroleum oil and lubricant waste, halogenated and non-halogenated solvents, and contaminated fuels were applied to the soil and ignited. Installation Restoration Program (IRP) investigations conducted in 2004 found arsenic contamination in the ground water. The Installation Restoration Program is a program designed to evaluate potential contamination at DoD installations throughout the country. Several of the launch complexes at CCAFS have been found, preliminarily, to have surface and subsurface contamination from past operational practices (USAF, 1994).

A 1997 Remedial Investigation/Feasibility Study was finalized recommended a long-term ground water monitoring plan. This plan was initiated in 1997 and is ongoing. The 45th Space Wing issued its final Statement of Basis summarizing the final remedy selection process for the site in 2001, and these recommendations were approved by EPA and FDEP in 2002. LC-46 has been classified as a Category 3 property. A Category 3 designation indicates that contamination exists at a site, but not in concentrations that would warrant removal. Long-term ground water monitoring will continue until arsenic concentrations fall below FDEP's current Ground water Cleanup Target Level of 10 micrograms per liter for two consecutive sampling rounds. Institutional controls are in place to restrict contact and use of ground water at this location (Reynolds, Smith and Hills, Inc., 2006).

5.4.3 Floodplains and Wetlands

The 100-year floodplain is located within the boundary of LC-46 (USAF, 2007). Several large palustrine, emergent wetland areas are located approximately 750 feet from the LC-46 launch pad (USAF, 2006).

5.5 Environmental Consequences

5.5.1 Proposed Action

5.5.1.1 Surface Water

There would be no ground disturbance associated with the Proposed Action; therefore, existing surface drainage patterns would not be impacted.

Water quality in the area of LC-46 could be affected as a result of contamination of surface waters by the launch exhaust cloud. Liquid propellant is rapidly combusted during a launch and almost completely burned. Therefore, very little propellant would be deposited on the launch pad or in the surrounding area. Combustion of solid propellant may emit hydrogen chloride vapor and aluminum oxide in the vicinity of the launch pad. Aluminum oxide particulates are known to gather water vapor and fall to the surface. Hydrogen chloride gas reacts with atmospheric water vapor to form acidic droplets of HCl that fall to the surface in the immediate vicinity of the pad. The launch of the Athena-2 vehicle is expected to 0.427 grams per square meter of HCl create a minimal amount of acidic deposition. Should a storm event occur soon after launch, the potential for strongly acidic storm water runoff from the pad area exists.

However, the small quantity of acidic storm water would be diluted in the event of a storm. Therefore, the impacts from acidic storm water after a launch are small.

There are two small freshwater habitats located south of Camera B Road, which is west of the launch site. Prevailing winds are expected to carry the launch exhaust cloud eastward away from the waterbodies and population centers. In the event that the waterbodies were exposed to the launch exhaust cloud, the small amount of contamination may result in a slight decrease in pH levels. Studies conducted at KSC indicated that waterbodies exposed to launch exhaust clouds have a decline in pH levels, but return to baseline conditions within hours of the event (McCaleb, 1989 as cited in USAF, 1994). Therefore, the launch cloud is expected to have little to no impact on these waterbodies due to their direction relative to the launch site and quantity of possible deposition. The nearby drainage system may experience a slight drop in pH due to the launch exhaust cloud. Given the relatively high salinities of estuarine and ocean waters, along with predictable pH stabilities of those waters, major short-term and long-term adverse impacts on surface water quality resulting from the launch exhaust cloud are not expected.

Launch anomalies could result in impacts on local waterbodies due to contamination from rocket propellant. In the unlikely occurrence of a launch anomaly, spilled liquid propellant could enter waterbodies close to the launch pad, including the Atlantic Ocean and the Banana River. Unspent RP-1, which is insoluable, may create a thin film along the water surface near the impact area. However, the small quantity is expected to dissipate within one to two days due to a combination of wave moment, oxygen exposure, and sunlight (NASA, 1997). Potential contamination could occur from solid rocket motor propellant in the form of aluminum oxide deposition. However, aluminum oxide is relatively insoluble because of the high salinity of local surface waters. Therefore, it is not expected to cause elevated aluminum levels (USAF, 1998). Debris and unspent fuel would be removed from near-shore ocean and/or river environments and treated as hazardous waste in accordance with Federal, State, and local regulations. Short-term impacts on the near-shore environments may result, but long-term impacts would be negligible, due to the buffering capacity of the Atlantic Ocean and Banana River.

In the unlikely event of a launch anomaly, perchlorate from solid propellant rockets could slowly leach out in water and would be toxic to plants and animals. In freshwater at 20°C (68°F), it is likely to take over a year for the perchlorate contained in solid propellant to leach out into the water (MDA, 2003). Lower water temperatures and more saline waters would likely slow the leaching of perchlorate from the solid propellant into the water. Over this time, the perchlorate would be diluted in the water and would not reach toxic concentrations (MDA, 2003).

Upon impact with the ocean, the Falcon 1 first stage would release approximately 5 gallons of residual RP-1 propellant. The propellant would be expected to dissipate within hours (USAF, 2007). Due to the small volume of this release into the open ocean, impacts on water quality in the ocean would be negligible.

5.5.1.2 Ground Water

Perchlorate from launch emissions has the potential to affect ground water. However, the small amount of leached perchlorate would be diluted in the large ground water aquifers under CCAFS. Therefore, perchlorate would have little to no impact on ground water resources.

In the event of an on-pad accidental or emergency release of small quantities of propellants, primarily the surficial aquifer would be affected. However, in areas where deep wells or geologic features (i.e., sinkholes and faulting) are present, deeper aquifers could possibly be affected. Emergency response and clean-up procedures would reduce the magnitude and duration of any impacts.

Normal operations would not impact ongoing ground water monitoring at LC-46. In the event of a launch mishap, Installation Restoration Program sites in the vicinity of LC-46 could be affected by debris. However, the probability of a launch mishap is extremely low, and if one did occur, the probability of debris landing at any one specific site is very low.

5.5.1.3 Floodplains and Wetlands

As discussed in Section 5.5.1.1, minimal solid propellant from the launch exhaust would be deposited in the surrounding area, but hydrogen chloride and aluminum oxide could be deposited in the immediate vicinity of the launch pad. Floodplains and wetlands in the area of LC-46 could be contaminated as a result of the launch exhaust cloud. These waterbodies could be affected by HCl deposition caused by wind or storm water runoff. Wind-driven deposition of HCl droplets is not expected due to the prevailing east wind and westerly direction of the waterbodies. The potential for acidic storm water runoff also exists, but the chances of a storm event after a launch are small. In the event of acidic storm water runoff into the waterbodies, a slight drop in pH may be experienced. However, the impacts would not be long-term. Therefore, major short-term and long-term adverse impacts floodplains and wetlands resulting from the launch exhaust cloud are not expected.

As discussed in 4.5, heat and emissions from rocket exhaust can result in localized, temporary foliar scorching and spotting on nearby vegetation, such as wetlands. Recent studies have indicated that such effects are localized, temporary, and not of sufficient intensity to cause long-term damage to vegetation (NASA, 2002; USAF, 2000).

Launch anomalies could result in impacts on floodplains and wetlands due to contamination from rocket propellant. In the unlikely occurrence of a launch anomaly, spilled propellant could enter waterbodies close to the launch pad, including the palustrine, emergent wetland areas in the vicinity of LC-46. Potential contamination would primarily occur from solid rocket motor propellant. Solid propellant would cause contamination in the form of acidification from hydrochloric acid, created by the launch by-product, hydrogen chloride and water vapor, and the deposition of aluminum oxide. Emergency response and clean-up procedures would reduce the magnitude and duration of any impacts.

5.5.2 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to Space Florida.; therefore, no additional impacts on water resources would occur. Under the No Action Alternative, similar to current operating procedures, military operations and other launch activities may occur at LC-46 as controlled by the 45th Space Wing of the USAF.

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6.0 NOISE

6.1 Region of Influence

The ROI for noise includes the area around CCAFS and extends to the closest populated areas of Cape Canaveral and Cocoa Beach to the south and Merritt Island to the east-southeast.

6.2 Resource Definition

Noise is usually defined as unwanted sound. The decibel (dB) is the accepted standard unit for the measurement of sound, and is a logarithmic unit that accounts for the large variation in sound pressure amplitudes. A-weighted (dBA) sound levels have been adjusted to correspond to the frequency response of the human ear.

A number of descriptors have been developed that account for changes in noise level with time and provide a cumulative measure of noise exposure. The most widely used cumulative measure is the Day Night Average Sound Level (DNL). This is essentially an average of sound levels over a 24-hour period with a 10 dB penalty applied at night. The FAA significant impact threshold is an increase in 1.5 dB or more from a baseline of a DNL of 65 dBA (FAA Order 1050.1E, Change 1). The DNL is used to evaluate the human annoyance effects of noise. Exhibit 6-1 shows typical DNL values for residential areas.

Exhibit 6-1. Typical Day–Night Average Sound Level for Residential Areas

Source: EPA, 1974

With respect to potential hearing damage, according to the U.S. Occupational Safety and Health Administration (OSHA) noise standards, no worker shall be exposed to noise levels higher than 115 dBA. The exposure level of 115 dBA is limited to 15 minutes or less during an 8 hour work shift. The OSHA standards are the maximum allowable noise levels for the personnel in the vicinity of the launch pad.

The maximum level during a noise event is called L_{max}.

In order to compare noise events with different magnitudes and durations, the Sound Exposure Level (SEL) was developed which normalizes the sound energy of the event into one second.

Sonic boom is a shock wave generated by vehicle moving at or faster than the speed of sound. Once the wave reaches the ground, a boom is perceived. Sonic booms have historically been evaluated in terms of impacts on structures, and their magnitudes are typically presented in terms of pounds per square foot (psf).

6.3 Regulatory Setting

Noise impact criteria are based on land use compatibility guidelines and on factors related to the duration and magnitude of noise level changes. Annoyance effects are the primary consideration for most noise impact assessments on humans. Noise impacts on wildlife are discussed in Section 4.

In order to evaluate the annoyance effects of sonic booms, C-weighted DNL (CDNL) is calculated, where DNL 65 is equivalent to CDNL 61. C-weighting includes more low frequency energy compared with A-weighting.

6.4 Existing Conditions

6.4.1 Ambient Noise Levels

Ambient noise levels around facilities at CCAFS are similar to those of any urban industrial area, reaching levels of 60 to 80 dBA (USAF, 2007). Additional on-site sources of noise are the aircraft landing facilities at the CCAFS Skid Strip and the Kennedy Space Center (KSC) Shuttle Landing Facility. Other less frequent but more intense sources of noise in the region are launches from CCAFS and KSC. The relative isolation of these facilities reduces the potential for noise to affect adjacent communities. The closest residential areas to CCAFS are to the east-southeast and to the south in the cities of Merritt Island and Cape Canaveral, respectively. Each is approximately 7 miles from LC-46. Expected sound levels in these areas are normally low, with higher levels occurring in industrial areas (Port Canaveral) and along transportation corridors. Residential areas and resorts along the beach would be expected to have low overall noise levels, normally about 45 to 55 dBA similar to a suburban residential neighborhood. Infrequent aircraft fly-overs and rocket launches from CCAFS and KSC would be expected to increase noise levels for short periods of time.

6.4.2 Operations-Related Noise

The highest recorded noise levels are those produced by launches of the Space Shuttle, which in the launch vicinity can exceed 160 dBA. Space Shuttle launch noise at Port Canaveral (approximately 6.5 miles southwest) would be expected to be typical of those at an industrial facility, reaching levels of 60 to 80 dBA (USAF, 1998).

The launch is the major source of operational noise; all other noise sources in the launch area are considered minor compared to launch noise. Generally, four types of noise occur during a launch: (1) combustion noise from the launch vehicle chambers, (2) jet noise generated by the interaction of the exhaust jet and the atmosphere, (3) combustion noise from afterburning of combustion products, and (4) sonic booms. The initial loud, low frequency noise heard in the immediate vicinity of the launch pad is a result of the first three types of noise combined. Example engine noise sound levels measured at CCAFS are shown in Exhibit 6-2.

Exhibit 6-2. Measured Delta II Sound Levels, July 1992

Distance from Pad (feet)	Measured L_{max} (dBA)	Measured SEL (dBA)
1500	120.2	127.5
2000	117.7	125.5
3000	115.1	123.0

Source: USAF, 1998

Three distinct noise events are associated with launch and ascent of a launch vehicle: on-pad engine noise, in-flight engine noise, and sonic booms, as described in the following sections.

6.4.1.2 Engine Noise

On-Pad Noise

On-pad engine noise occurs when engines are firing but the vehicle is still on the pad. The engine exhaust is usually diverted horizontally by deflectors or an exhaust tunnel. Noise is highly directional with maximum levels in lobes that are about 45 degrees from the main direction of the deflected exhaust. Noise levels at the vehicle and within the launch complex are high. Because the sound source is at or near ground level, propagation from the launch vehicle to off-site locations is along the ground, with significant attenuation over distance. On-pad noise levels are typically much lower than in-flight noise levels because of greater ground attenuation.

In-Flight Noise

In-flight noise occurs when the vehicle is in the air, clear of the launch pad, and the engine exhaust plume is in line with the vehicle. The in-flight sound source is well above the ground, so there is less ground attenuation than with on-pad noise. The emitted acoustic power from a rocket engine and the frequency spectrum of the noise can be calculated from the number of engines, their size and thrust, and their flow characteristics. Normally, the largest part of the total acoustic energy is contained in the low-frequency end of the spectrum (1 to 100 hertz).

6.4.2.2 Sonic Booms

Launch vehicles typically reach supersonic (faster than the speed of sound) speeds and would generate sonic booms. A sonic boom, the shock wave resulting from the displacement of air in supersonic flight, differs from the other launch sounds in that it is impulsive (less than 1 second for aircraft and up to several seconds for launch vehicles). Sonic booms may affect local communities and are generally described by their peak overpressure in psf. Sonic booms very rarely cause structural damage, and the annoyance associated with sonic booms can be evaluated on the basis of DNL or CDNL.

Because a sonic boom is not generated until the vehicle reaches supersonic speeds some time after launch, the launch site itself does not experience a sonic boom. The entire boom footprint is down track, and the portions of the footprint to the side of the trajectory represent the overpressures caused as the shock wave expands radially from the line of travel of the launch vehicle. Sonic booms produced during vehicle ascent occur over the Atlantic Ocean and are directed in front of the vehicle and do not impact land areas.

6.5 Environmental Consequences

6.5.1 Proposed Action

Noise generated during operation of the Proposed Action is discussed below in terms of engine and sonic boom noise.

6.5.1.2 Engine Noise

For the purposes of this EA, previously modeled noise levels of Falcon 1 (USAF, 2007) and modeled noise levels of Athena-2 are compared with measured noise levels from the Atlas II (SRS Technologies 2000, 2001). The Athena-2 noise levels are based on a simple rocket thrust model. The Atlas II is a much larger vehicle than either the Falcon 1 or Athena-2 and thus provides a realistic upper bound to noise levels. Comparisons of these noise levels are shown in Exhibit 6-3.

Exhibit 6-3. Comparison of Atlas IIAS, Falcon 1, and Athena-2, Noise Levels

Distance from Pad (miles)	Measured Noise Levels from September 2001 Atlas IIAS Launch (dB)	Modeled Noise Levels for the Falcon 1 Vehicle (dB)	Modeled Noise Levels for the Athena-2 Vehicle (dB)
1	158.2	113.3	119
3	141.6	96.7	102
5	130.1	85.2	91
7	120.1	75.2	81
9	110.8	65.9	71

On average, modeled engine noise levels from the Falcon 1 are approximately 39 to 45 dB lower than the Atlas IIAS noise levels. The data shown in Exhibit 6-3 are overall linear unweighted values in decibels, and when converted to an A-weighted value (by subtracting 34.4 dB) the modeled noise level for the Falcon 1 vehicle is estimated to be 41 dBA in the City of Cape Canaveral (at 7 miles from the launch pad) and 90 dBA at the launch site (approximately 2,000 feet from the launch pad). Noise at this level would effectively continue for approximately 20 seconds and then decrease significantly to levels below 85 dBA. Assuming noise levels from the noisier Atlas IIAS and 24 launches per year, the annual DNL of the Proposed Action at the City of Cape Canaveral would be substantially lower than 65 DNL. Likewise, the annual DNL associated with Falcon 1 and Athena-2 noise levels would be even lower. It is assumed that workers on site would be within buildings and would also have adequate hearing protection to meet OSHA noise limits.

Based on the above information, the Proposed Action is not expected to have noise impacts on the surrounding areas in excess of applicable thresholds of significance.

6.5.2.2 Sonic Booms

Sonic booms associated with the Proposed Action would take place down track and over the ocean. The magnitude of sonic booms associated with the Falcon 1 is estimated to be lower than

2.3 psf (USAF, 2007). Assuming a similar magnitude for the Athena-2, and 24 launches per year, the annual CDNL would be substantially lower than 61 CDNL. Therefore, with respect to human annoyance, noise impacts due to sonic booms are expected to be below applicable thresholds of significance.

With regard to the potential for structural damage, at 10 psf, the probability of breakage of glass windows is between one in a hundred and one in a thousand (Haber and Nakaki, 1989). Since sonic boom magnitudes associated with the Proposed Action would be substantially lower than 10 psf, and would occur over the ocean, no structural damage impacts are expected.

6.5.2 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to Space Florida.; therefore, no additional noise impacts would occur. Under the No Action Alternative, similar to current operating procedures, military operations and other launch activities may occur at LC-46 as controlled by the 45th Space Wing of the USAF.

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7.0 COMPATIBLE LAND USE (Section 4(f) Resources, Light Emissions and Visual Resources, and Coastal Resources)

7.1 Region of Influence

The ROI for Section 4(f) resources includes lands contained within CCAFS as well as those in the surrounding vicinity. Surrounding areas are included in the ROI because the Proposed Action may potentially impact these areas.

The ROI for visual resources includes the viewshed around LC-46, such as adjacent lands at and surrounding CCAFS that would be able to view the launch pad and/or vehicles during launches, such as off-station lands within launch safety clear zones.

The ROI for coastal resources at CCAFS encompasses the station boundaries and potentially affected adjacent lands, including off-station lands within launch safety clear zones or land uses that may be affected by activities on the station.

7.2 Resource Definition

Compatible land use is achieved when the Proposed Action fits within the land use patterns (residential, commercial, industrial, recreational), land ownership (Federal, State, private), and land use management plans. Zoning, management plans, and policies regulate how land is used.

According to FAA Order 1050.1E, Change 1, DOT Act of 1966 Section 4(f) matters relate to the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance or land from an historic site of national as determined by the officials having jurisdiction over the land.

Visual resources are any naturally occurring or man-made feature that contributes to the aesthetic value of an area. Proposed changes to visual resources can be assessed in terms of 'visual dominance' and 'visual sensitivity.' Visual dominance describes noticeable physical changes in an area. The magnitude of visual dominance may vary depending on the degree of change in an area. Visual sensitivity is attributed to a particular setting and the desire to maintain the current visual resources in a viewshed. Areas such as coastlines and national parks are usually considered to have high visual sensitivity. When evaluating visual impact, the ability of the general public to view the area where the proposed action or change to the visual resource would occur must also be taken into account.

The term coastal zone is defined as the coastal waters (including the lands therein and thereunder) and the adjacent shorelands (including the waters therein and thereunder) strongly influenced by each other and in proximity to the shorelines of the several coastal States, and includes islands, transitional and intertidal areas, salt marshes, wetlands, and beaches (16 U.S.C. 1453).

7.3 Regulatory Setting

Brevard County and the City of Cape Canaveral are the local planning authorities for incorporated and unincorporated areas near CCAFS. Neither Brevard County nor the City of

Cape Canaveral has land use or zoning authority over CCAFS land because it is federally owned. CCAFS designates its own land use and zoning regulations. The general plans of Brevard County and the City of Cape Canaveral designate compatible land uses and zoning around CCAFS.

Section 4(f) of the DOT Act of 1966 was recodified and renumbered as Section 303(c) of 49 U.S.C. The regulation stipulates that the Secretary of Transportation may not approve any Federal action that requires the use of any publicly owned land, unless there is no feasible and prudent alternative to the use of such land and such program, and the project includes all possible planning to minimize harm resulting from the use. Impacts on the land caused by Federal actions must be substantial. Substantial impacts are defined as those that significantly reduce the resource's enjoyment or significance, which may result from increased noise or air pollution or destruction of vegetation or wildlife habitat. Part 150 of 14 CFR provides land use guidelines for determining constructive uses under Section 4(f) (FAA Order 1050.1E, Change 1).

No specific Federal, State, or local regulatory standards for light emission for visual impacts apply to the Proposed Action area.

Federal activity in, or affecting, a coastal zone requires preparation of a Coastal Zone Consistency Determination, in accordance with the Federal Coastal Zone Management Act of 1972, as amended (P.L. 92-583), and implemented by the National Oceanic and Atmospheric Administration. This act was passed to preserve, protect, develop, and, where possible, restore or enhance the nation's natural coastal zone resources, which include wetlands, floodplains, estuaries, beaches, dunes, barrier islands, coral reefs, and fish, and wildlife and their habitat. The Act also requires the management of coastal development to minimize the loss of life and property caused by improper development in a coastal zone. Responsibility for administering the Coastal Zone Management Program has been delegated to states that have developed State-specific guidelines and requirements. A Federal agency must ensure that proposed activities within the coastal zone are consistent with that state's Coastal Zone Management Program.

In Brevard County, the Florida Coastal Management Program, formed by the Florida Coastal Management Act, applies to activities occurring in or affecting the coastal zone. The entire State of Florida is defined as being within the coastal zone. FDEP is the state's lead coastal management agency.

The Coastal Barrier Resources Act prohibits, with some exceptions, Federal financial assistance for development within the Coastal Barrier Resources System that contains undeveloped coastal barriers along the Atlantic and Gulf coasts and Great Lakes.

7.4 Existing Conditions

7.4.1 Section 4(f) Resources

There are no designated public parks, recreation areas, or wildlife refuges within the boundaries of CCAFS. There are numerous public parks, recreation areas, and wildlife refuges located outside of CCAFS. The nearest public park, Jetty Park, is located about 5 miles southwest of LC-46 in the City of Cape Canaveral. Other public parks within 15 miles south and west of the launch site, including: Kelly Park, Kars Park, Kings Park, and Manatee Cove Park. The Merritt

Island Wildlife Refuge is located north of CCAFS. Additionally, the St. John's NWR and Tosohatchee State Game Preserve are located west of the launch site.

The Merritt Island Wildlife Refuge overlaps the northwestern portion of the KSC. The refuge was established by an agreement between NASA and the USFWS and is cooperatively managed. While the area is designated as a refuge, the area's priority relates to the space operation. The Cape Canaveral National Seashore is adjacent to the Merritt Island Wildlife Refuge and is operated by the National Park Service.

7.4.2 Visual Resources

The area surrounding LC-46 is flat scrub with no unique natural landscape features. Open space is dispersed throughout the station. There are no public beaches located on CCAFS, but it does abut a coastal landscape. The area is already extensively developed with both active and inactive launch complexes, roads, and launch support facilities. Port operations south of the facilities include commercial and industrial facilities. There are also industrial support facilities for CCAFS west of LC-46 along the Banana River.

There are no sensitive receptor areas near LC-46. The closest residential areas to CCAFS are approximately 7 miles from the launch site, and have low light sensitivity to launches due to the frequent rocket launches in the area. Current light sources at LC-46 include security lighting on the grounds. Light is also generated from existing nighttime aircraft operations.

7.4.3 Coastal Resources

As discussed in Section 4.3, the entire State of Florida is defined as being part of a coastal zone; therefore, the Proposed Action is subject to the requirements of the Federal Coastal Zone Management Act. The Proposed Action does not involve funding for development; therefore, it is not subject to the requirements of the Coastal Barrier Resources Act.

7.5 Environmental Consequences

7.5.1 Proposed Action

Implementation of the Proposed Action would be in conformance for its designated use at CCAFS. The Proposed Action would not change any planned or existing land use designations.

The Proposed Action would not result in any direct or constructive use of nearby Section 4(f) resources. All pre-launch activities and effects would be contained within the boundaries of LC-46. Due to the vehicle trajectory, the vehicles would accelerate over the Atlantic Ocean and away from Section 4(f) lands. The recoverable stage of the Falcon 1 would not impact Section 4(f) lands since it is expected to fall over 500 nautical miles off shore and away from such sensitive areas. Additionally, nearby parks of recreation areas would not need to close during launch events. Therefore, no impacts are anticipated on Section 4(f) resources in the vicinity. No change to existing infrastructure would be required to accommodate launches under the Proposed Action and there would not be any additional construction impacts on visual resources. Additionally, new launches and associated activities (e.g., ground equipment loading, propellant loading, transporting) are similar to activities that already occur at LC-46 and would not result in

new or additional visual resource impacts. Further, the nearest light-sensitive receptors would be unlikely to see the launches. These communities are acclimated to frequent launches of similar or larger size and have low sensitivity. These visual impacts would be temporary and relatively infrequent, up to 24 launches per year. Launches would not result in any light emissions.

The Proposed Action does not involve construction or development; therefore, coastal resources would not be affected. Light impacts on reptiles, namely nesting sea turtles are discussed in Section 4.5.1.3.2.

7.5.2 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to Space Florida.; therefore, no additional impacts on compatible land use would occur. Under the No Action Alternative, similar to current operating procedures, military operations and other launch activities may occur at LC-46 as controlled by the 45th Space Wing of the USAF.

8.0 SOCIOECONOMIC RESOURCES

8.1 Region of Influence

The ROI for socioeconomic resources is Brevard County, Florida.

8.2 Resource Definition

Socioeconomic resources consist of social and economic indicators. Social indicators provide statistical information of the population, diversity, educational level, family size, and household makeup. Economic indicators provide information on poverty level, employment opportunities and household income. Federal actions may change the population diversity or employment within the ROI.

8.3 Regulatory Setting

Under the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, the Federal government must consider the socioeconomic impacts of a proposed action resulting in the relocation of people or businesses. The law requires that relocated or displaced persons be treated in a fair and consistent manner.

8.4 Existing Conditions

CCAFS is located in eastern Brevard County, Florida; approximately 14.5 miles northeast of Cocoa City, Florida and approximately 19.5 miles southeast of Titusville, Florida. Brevard County has an estimated population of 552,109 people in 2007, which is an estimated increase of 21.9 percent population increase since 1997 (University of Florida, 2007).

In Brevard County, Florida, the available work force (persons over the age of 16) consists of approximately 256,701 persons. Over 39,000 persons are employed in the educational services, and health care and social assistance fields followed by the professional, scientific, and management and administrative, and waste management service industry (34,146) and retail trade (33,985). The adjusted median household income for 2006 in Brevard County was $46,335, which is slightly less than the U.S. average of $48,451. Unemployment rates have steadily declined since 1992 from 7.8 percent to 4.4 percent in 2007 (Florida Agency for Workforce Innovation, 2007).

The population of Cocoa, Florida is 16,412 people. Approximately 65 percent of the population is over the age of 25. Of those, approximately 81 percent have obtained a high school diploma or equivalent. The average family size in the city is 2.97 persons, which is smaller than the U.S. family average of 3.14 persons. The median family income is $31,243 per year.

According to 2006 data, the estimated population for the City of Titusville, Florida is 40,670 people, of which, 52.4 percent are female. The median age in Titusville is 41 years old. More than 28,000 people are over the age of 25. Approximately 84 percent of the population over 25 years of age has obtained a high school education or higher. The average family size is 2.86 persons. This is smaller than the family size in Cocoa City, Florida, but larger than the Brevard

County average family size (2.84 persons). According to the 2000 Census, the median household income is $35,607.

8.5 Environmental Consequences

8.5.1 Proposed Action

Launch activities related to the Athena-2 vehicle require 15 non-local professionals. As stated in the 1994 EA, the 15 member staff would be required onsite for approximately two months to prepare for the first launch. Subsequent launches would require the staff to be onsite for one month.

The Falcon 1 vehicle requires up to 25 staff members to conduct launch activities. For pre-launch activities, up to 15 members would be required onsite for a period of four to eight weeks. The week preceding the launch would require a maximum of 25 personnel at CCAFS.

The additional personnel would not increase the demand for existing services, including hotels, restaurants, and transportation. Brevard County is a popular vacation destination, which hosts tourists and visitors throughout the year. Additionally, hotels near the launch site have experienced short-term increases in demand due to launches of the space shuttle at the adjacent KSC.

The Proposed Action would not necessitate the relocation of local residents or businesses. Launch activities under the Proposed Action may have a slight impact on traffic on roads leading to CCAFS on launch days due to tourism. However, this impact would occur in isolated areas over a short time frame (i.e., the day of a launch). Traffic in the county would not be materially affected during pre- and post-launch activities.

The impacts of additional launches would affect the area outside of LC-46 and CCAFS. Additional launches at LC-46 would increase the demand for lodging, restaurants, emergency care, and transportation-based services during launch activities. The launches may indirectly increase the demand for such services through increased tourism. Short-term increases in tourism would be experienced if launches are unique (i.e., first launch of a vehicle configuration or payload type). These services would be provided by a range of establishments in the vicinity of CCAFS, particularly in the nearby cities of Titusville, Cape Canaveral, Cocoa, and Cocoa Beach, Florida. The increase in tourism is not anticipated to exceed that of the space shuttle launches. Therefore, there may be a slight short-term positive impact on socioeconomic resources from additional tourism. The overall socioeconomic impacts on the ROI are anticipated to be negligible.

8.5.2 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to Space Florida.; therefore, no additional impacts on socioeconomic resources would occur. Under the No Action Alternative, similar to current operating procedures, military operations and other launch activities may occur at LC-46 as controlled by the 45th Space Wing of the USAF.

9.0 HAZARDOUS MATERIALS, SOLID WASTE, AND POLLUTION PREVENTION

9.1 Region of Influence

The ROI for potential impacts from hazardous material, solid waste, and pollution prevention includes the areas within and around LC-46.

9.2 Resource Definition

Hazardous materials are any substance or material that has been determined to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce (49 CFR 172). This includes hazardous substances and hazardous wastes. Hazardous substances are any element, compound, mixture, solution, or substance defined as a hazardous substance under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and listed in 40 CFR 302. If released into the environment, hazardous substances may pose substantial harm to human health or the environment (FAA Order 1050.1E, Change 1).

Hazardous wastes have characteristics as defined by the Resource Conservation and Recovery Act (RCRA) in 40 CFR 261 which "… may (a) cause, or significantly contribute to, an increase in mortality or an increase in…illness or (b) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of or otherwise managed." Hazardous waste is further defined as any solid waste that possesses hazardous characteristics of toxicity, ignitability, corrosivity, or reactivity, or is specifically listed as a hazardous waste in Subpart D of 40 CFR Part 261.

Solid waste, more commonly known as trash or garbage, consists of everyday items such as product packaging, grass clippings, furniture, clothing, bottles, food scraps, newspapers, appliances, paint, and batteries (EPA, 2008a).

Pollution prevention is reducing or eliminating waste at the source by modifying production processes, promoting the use of non-toxic or less-toxic substances, implementing conservation techniques, and re-using materials rather than putting them into the waste stream (EPA, 2008b).

9.3 Regulatory Setting

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

EO 12088, *Federal Compliance with Pollution Control Standards*, directs Federal agencies to comply with "applicable pollution control standards" in prevention, control, and abatement of environmental pollution and to consult with EPA, State, and local agencies concerning the best techniques and methods available for prevention, control, and abatement of environmental

pollution (FAA Order 1050.1E, Change 1). The Council on Environmental Quality (CEQ) Memorandum on Pollution Prevention and NEPA encourages early consideration of opportunities for pollution prevention (CEQ, 1993).

Municipal solid waste is regulated and managed at the State and community level (EPA, 2008b).

9.4 Existing Conditions

Numerous types of hazardous materials are currently used at CCAFS to support the various missions and general maintenance operations. Categories of hazardous materials used in support of current lift vehicle system activities include petroleum products, oils, lubricants, volatile organic compounds, corrosives, refrigerants, adhesives, sealants, epoxies, and propellants (USAF, 2000).

At CCAFS, hazardous materials are managed using a HazMat Pharmacy. Management of hazardous materials, excluding hazardous fuel, is the responsibility of each individual or organization. The Joint Propellants Contractor on station controls the purchase, transport, and temporary storage of hazardous propellants. Space Florida would be responsible for developing its own Hazardous Waste Management Plan for LC-46 in accordance with the 45th Space Wing Hazardous Management Plan to document how Space Florida would control hazardous wastes for LC-46. The primary method of purchasing or obtaining hazardous materials is the Patrick Air Force Base supply system (USAF, 2007; USAF, 2006).

Individual contractors and organizations maintain their own hazardous waste satellite accumulation points and 90-day hazardous waste accumulation areas, in accordance with RCRA. There is no limit to the volume of hazardous waste that can be stored at a 90-day hazardous waste accumulation area, but wastes must be disposed of offsite within 90 days. Space Florida would be responsible for the collection and transport of hazardous wastes (including propellant waste) from the satellite accumulation areas to a 90-day hazardous waste accumulation area, then to an offsite permitted treatment, storage, and disposal facility (USAF, 2007; USAF, 2006).

Contractors are responsible for developing and implementing their own Pollution Prevention Management Plans to comply with all State, Federal, and local regulations. As specified under lease agreements and contracts, the contractors are under contract to reduce, where possible, the use of Class II Ozone-Depleting Substance and Environmental Planning and Community Right-to-Know Act (EPRCA) 313 chemicals.

There are no sites at CCAFS listed or under consideration for listing on the National Priorities List (EPA, 2007b). There is one known underground storage tank and two aboveground storage tanks at the LC-46 Support Building. Future improvements include the removal and replacement of the underground storage tank and the installation of secondary containment structures for the aboveground storage tanks (Reynolds, Smith and Hills, Inc., 2006).

As mentioned in Section 5.4.2, an IRP investigation has identified arsenic contamination in the ground water near LC-46. The principal area of concern is a former fire training area. Remediation efforts are ongoing at the site.

9.5 Environmental Consequences

9.5.1 Proposed Action

The primary hazardous materials used under the Proposed Action would be propellants. As described in Section 2.1.2, Space Florida would use LOX, RP-1, and helium to support launches of the Falcon 1 launch vehicle, and solid propellant to support other vehicle launches. All propellants would be stored and used in compliance with Federal regulations 14 CFR §420.65 and 14 CFR §420.67 for solid and liquid propellants, respectively. In addition to the propellants, other hazardous materials (e.g., various composites, synthetics, and metals) may be used for rocket operation.

All hazardous materials and hazardous waste would be handled and disposed of in accordance with the CCAFS Environmental Standards and Safety Standards and Space Florida's Hazardous Waste Management Plan. In the event of a spill, clean up procedures detailed in the 45 Full Spectrum Threat Response Plan 10-2, Volume II, Hazardous Materials Emergency Planning and Response would be enacted. Space Florida would be responsible for compliance with all applicable State and EPA reporting requirements.

Hazardous waste streams anticipated to be generated by the Proposed Action are typical of other hazardous waste streams in Florida. The Proposed Action would not be expected to generate more hazardous waste than can be safely handled by CCAFS and existing hazardous waste management plans would not be expected to change. Space Florida would adhere to all applicable Federal, State, local, and Air Force rules and regulations concerning the storage, handling, usage, and disposal of hazardous materials and hazardous wastes; therefore, no impacts on hazardous waste management would be expected.

Solid waste would be expected to increase slightly with the increase in launches. The amount of solid waste generated would be handled under existing collection and disposal operations.

Space Florida would develop a Pollution Prevention Management Plan, in coordination with CCAFS' pollution prevention plans and goals, to comply with all local, State, and Federal regulations. Space Florida would track the usage of all EPRCA-listed chemicals and report emissions to the responsible government organization at CCAFS.

9.5.2 No Action Alternative

Under the No Action Alternative, the FAA would not issue a launch site operator license to Space Florida; therefore, no additional impacts on hazardous material, solid waste, and pollution prevention would occur. Under the No Action Alternative, similar to current operating procedures, military operations and other launch activities may occur at LC-46 as controlled by the 45th Space Wing of the USAF.

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10.0 CUMULATIVE IMPACTS

10.1 Introduction

According to 40 CFR § 1508.7, cumulative impacts are defined as "…the incremental impact of the actions when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions." Cumulative impacts include impacts from the vehicles that would be launched under Space Florida's license and the past, present, and reasonably foreseeable future activities that would affect the resources impacted by the Proposed Action.

10.2 Other Actions

This section describes the present and reasonably foreseeable actions at CCAFS and in the surrounding areas, including KSC and Merritt NWR. Sections 10.2.1 through 10.2.3 provide an overview of present and reasonably foreseeable actions that would potentially affect the same resources as the Proposed Action within the life of the Proposed Action (2008-2013). Resource-specific cumulative analyses follow in sections 10.3.1 through 10.3.7 and take into account the past, present, and reasonably foreseeable actions described below.

10.2.1 Actions at Cape Canaveral Air Force Station

CCAFS is an active military instillation and is a detachment of Patrick Air Force Base (AFB). The 45th Space Wing is headquartered at Patrick AFB and manages the Eastern Launch and Test Range. CCAFS is the East Coast space launch facility for the Department of Defense (USAF, 2006). The USAF and U.S. Navy, as well as NASA and private industry contractors use CCAFS (FAA, 2008). The Eastern Launch and Test Range supports Space Shuttle launches from KSC (FAA, 2008). CCAFS also supports U.S. Navy submarine ballistic missile testing (FAA, 2008).

Space Florida is constructing a quadra-axial static rocket motor test stand at LC-47. This system is expected to be delivered in spring 2008 (FAA, 2008). In April 2008, the launch complex mobile service tower at LC-40 was demolished (Millerchip, 2008). As discussed in the 2007 USAF EA for Falcon 1 and Falcon 9 at CCAFS, SpaceX plans to transform LC-40 into a launch facility for its Falcon 1 and Falcon 9 launch vehicles. Starting in 2008, SpaceX plans to launch up to six Falcon 1 and six Falcon 9 vehicles from LC-40 per year for five years.

As of April 2008, there are four active launch licenses at CCAFS. Lockheed Martin has a launch license for the Atlas V vehicle; Boeing Launch Services has two launch licenses for the Delta II vehicle and one launch license for the Delta VI. Orbital Science Corporation has a launch license for the Pegasus vehicle. These licenses expire in 2011. The Evolved Expendable Launch Vehicle Environmental Impact Assessment (EIS) (1998) and the Final Supplemental EIS for the Evolved Expendable Launch Vehicle (2000) analyzed the launch of the Atlas V system from LC-41 and the Delta IV system from LC-37 at CCAFS. The Final Supplemental EIS for the Evolved Expendable Launch analyzes 210 launches of the Atlas V system and 68 launches of the Delta IV system from CCAFS between 2001 and 2020. From 2008 to 2020, the projected annual launch rate from CCAFS for the Atlas launch family ranges from 11 to 13, and the projected annual launch rate from CCAFS for the Delta launch family ranges from 11 to 13 as well. The Delta II is launched from Space LC-17 (pads A and B) at CCAFS. In 2008, three launches of

Delta II are scheduled from CCAFS, and one launch is scheduled for 2009 (KSC, 2003; NASA, 2008a). No more than four launches of Delta II would occur annually.

See Exhibit 10-1 for a summary of the estimated total number of launches at Cape Canaveral from 2008-2013.

Exhibit 10-1. Launch Rate Forecast for Cape Canaveral

Launch Vehicle	Year					
	2008	**2009**	**2010**	**2011**	**2012**	**2013**
Atlas IIB/V	3[1]	6[1]	3[1]	12[2]	11[2]	12[2]
Delta II/IV	7[1]	7[1]	9[1]	12[2]	12[2]	13[2]
Titan IV	0[1]	0[1]	0[1]	0[1]	0[3]	0[3]
SLBM	1[1]	2[1]	1[1]	1[3]	1[3]	1[3]
Falcon 1[1]	6	6	6	6	6	6
Falcon 9[4]	6	6	6	6	6	6
OSP PK- Derived Launches (max)[1]	2	2	2	NP	NP	NP
OSP MM-Derived Launches (max)[1]	3	3	3	NP	NP	NP
Pegasus (license until 2011)	NP	NP	NP	NP	NP	NP
Total	**28**	**32**	**30**	**37**	**36**	**38**

NP = No predicted launches based on sources listed below

Source:

1 Economic Development Commission of Florida's Space Coast and Patrick Air Force Base (EDCFSC/PAFB). 2005. *Final Draft Programmatic Environmental Assessment for Reactivation/Reuse of 12 Space Launch Complexes, Cape Canaveral Air Force Station, Florida*. March

2 Table 2.1-2 Launch rates from EELV with the Proposed Action from the Evolved Expendable Launch Vehicle EIS and Final Supplemental EIS for the Evolved Expendable Launch Vehicle

3 Final Environmental Assessment for the Orbital/Suborbital Program (2006)

4 Final Environmental Assessments for the Operation and Launch of the Falcon 1 and Falcon 9 Space Vehicles at the Cape Canaveral Air Force Station Florida (2007)

10.2.2 Actions at Kennedy Space Center

In February 2007, NASA released a final EA for the Construction, Modification, and Operation of Three Facilities in Support of the Constellation Program at *KSC,* Florida. This EA analyzed the modification of the existing LC-39B tower, construction of a lightning protection system around LC-39B, and fabrication of a new mobile launcher to support the Constellation Program. A FONSI was signed in May 2007, allowing this action to proceed. NASA released the Constellation Program Programmatic EIS in January 2008, and a subsequent record of decision in February 2008. This document analyzes proposed modifications to KSC to support launch operations for the Constellation Program. Two Ares I Ascent Development Flight Tests are estimated for 2009, and one Flight Test is estimated for 2012 at KSC. Two Ares I Orbital Flight Tests are estimated in both 2013 and 2014 at KSC. At KSC, up to five Ares I Mission Flights are estimated annually from 2015 to 2020, and two Ares V Flight tests are estimated for 2018. Two Ares V Mission Flights are estimated in 2019 and one in 2020 at KSC.

In February 2008, NASA released the Draft Space Shuttle Program (SSP) Programmatic EA; Transition and Program Property Disposition addressing the retirement of the Space Shuttle in

2010. KSC currently serves as a location for space shuttle assembly, launch, and landing. In 2008, two launches of the Space Shuttle Discovery, one launch of the Space Shuttle Endeavor, and one launch of the Space Shuttle Atlantis are scheduled from LC-39A at the KSC (NASA, 2008a). In conjunction with the shuttle program, NASA is expanding the existing shuttle landing facility to allow for commercial and military uses. Modifications and construction activities will be focused on the mid-field and south-field sites, including modifications of the Control Tower and construction of taxiways, hanger facilities, and a specialized propellant and/or ordnance staging and support facilities. These facilities will be used for commercial launches conducted at KSC.

Additionally, NASA has proposed the development and operation of a Commercial Vertical Launch Complex at Kennedy Space Center. This complex would include two launch pads and associated support facilitates. Two potential sites are currently being evaluated for this Launch Complex. One site is located along the Atlantic Coast south of Shuttle LC-39A and north of the Atlas LC-41. The second potential site is located more inland, east of State Route 3, north of State Route 406, and south of the Scrub Ridge Trail Road. The draft EA for the Commercial Vertical Launch Complex is expected to be released in July 2008, and the final is planned for release in September 2008 (NASA, 2008d).

See Exhibit 10-2 for a summary of the estimated total number of launches at Cape Canaveral from 2008-2013.

Exhibit 10-2. Launch Rate Forecast for the Kennedy Space Center

Launch Vehicle	Year					
	2008	**2009**	**2010**	**2011**	**2012**	**2013**
Ares I Ascent Development Flight Test/ Orbital Flight Test[1]	NP	2	NP	NP	1	2
Space Shuttle Discovery[2]	2	NP	NP	NP	NP	NP
Space Shuttle Endeavor[2]	1	NP	NP	NP	NP	NP
Space Shuttle Atlantis[2]	1	NP	NP	NP	NP	NP
Total	**4**	**2**	**0**	**0**	**1**	**2**

NP= No predicted launch based on sources listed below

Source:

1 NASA, 2008b

2 NASA's Shuttle and Rocket Missions. http://www.nasa.gov/missions/highlights/schedule.html

10.2.3 Actions at Merritt Island National Wildlife Refuge

Merritt Island NWR is a 140,000-acre refuge that overlays KSC, Florida. Approximately one-half of the refuge consists of brackish estuaries and marshes, and the remaining lands consist of coastal dunes, scrub oaks, pine forests and flatwoods, and palm and oak hammocks. Within a year of the finalization of the Draft Comprehensive Conservation Plan, Merritt Island NWR plans to site and develop an administrative office facility. Within five years of plan approval, Merritt Island NWR plans to upgrade refuge water, sewer, and telecommunication utilities. The Refuge also plans to construct a dormitory and recreational vehicle pad facilities within three years of plan approval. Additionally, the Refuge plans to repave State Route 406 from State Route 402 to State Route 3 within two years of plan approval (DOI, 2006).

10.3 Cumulative Impact Analysis

10.3.1 Air Quality

The area surrounding LC-46 includes CCAFS and KSC and has a history of launching commercial space rockets and NASA space shuttles. As a result, the area has experienced similar types of air emissions as under the Proposed Action from previous launches and launch programs.

The SpaceX Falcon 1 and Falcon 9 Program at CCAFS would have increased H_2O and PM emissions, which may affect ozone reactions, but launch emissions would not affect local attainment levels. There would also be some local emissions from construction vehicles, construction energy sources, and cleanup materials and solvents, but these impacts would be temporary and small. Evolved expendable launches at CCAFS could also have minimal air impacts related to construction. However, launch emissions would be smaller than emissions from the previous program. The PM and NO_X launch emissions would not affect attainment.

Demolition and disposal activities related to transitioning out of the current Space Shuttle Program would temporarily increase local emissions, but would have minimal and short-term impacts. The KSC Constellation Program construction activities would create temporary short-term air impacts from land clearing, and Constellation activities would create minor air impacts from fugitive emissions, the transfer and storage of hypergolic propellants, and possible combustion emissions from backup generators. The Constellation Programmatic Environmental Impact Statement (PEIS) also indicates that the area would experience increased vehicle traffic from workers and launch day visitors.

The Merritt NWR Conservation Plan actions would positively impact air quality due to its habitat conservation goals. Any impacts from facilities construction would be minimal and temporary.

The Proposed Action, in addition to the past, present, and reasonably foreseeable actions in the project area, would result in a minor, temporary increase in air emissions in an area that is currently in attainment for all criteria pollutants. The emissions of GHGs and ODSs would be extremely small in the context of national and global emissions. Because these impacts would be minor and temporary, the incremental contribution to cumulative air quality impacts from the Proposed Action would be negligible.

10.3.2 Biology Resources (Fish, Wildlife, Plants, and Special Status Species)

The area surrounding LC-46 includes CCAFS and KSC, which have a history of launching commercial space rockets and NASA space shuttles. As a result, the vegetation and wildlife that occur at CCAFS have been previously exposed to the impacts from rocket and shuttle launches.

Similar to the Proposed Action, SpaceX Falcon launches at CCAFS would have temporary impacts on vegetation from scorch and acid deposition near the pad. In the unlikely event of early termination of a Falcon 9 launch carrying a Dragon capsule, hypergolic fuels, which are toxic for marine species, would be released and could impact marine species. If construction for evolved expendable launch vehicle (EELV) launches causes jurisdictional wetlands loss at

CCAFS LC-41 and LC-37, it would be mitigated with replacement, protection, restoration, and avoidance. These launches would also cause temporary HCl and Al_2O_3 deposition from ground clouds, but with short-term impacts.

Demolition and disposal of the Space Shuttle Program at KSC would potentially impact wildlife due to noise, but would also potentially increase natural vegetation on abandoned land at the site. Ares launches under the Constellation Program would temporarily startle wildlife, but no long-term behavioral impacts are expected.

Implementing the Conservation Plan at Merritt NWR would have positive impacts on local wildlife, with increased management to support populations and to enhance and restore habitat. The actions at the Refuge would decrease disturbance in many habitats and increase removal of many invasive species from the Refuge. The refuge manages habitat for more than 500 species of wildlife, including 21 federally- and State-listed threatened and endangered species, and has one of the most important sea turtle nesting beaches in the United States (USFWS, 2000). Because the habitat at Merritt Island NWR is similar to that at CCAFS, any startled species may find temporary shelter at the Refuge.

However, the impacts from the Proposed Action would likely be less than at other launch pads since the vehicles are relatively small, resulting in less noise, air emissions, and scorching, and would only be launched approximately twice per month. Because the impacts on biological resources would be temporary and relatively infrequent, the incremental contribution to cumulative biological impacts from the Proposed Action would be negligible.

Sea Turtles

Many of the projects in the Proposed Action area would potentially impact sea turtle hatchlings. An on-site tower for the Constellation Program at KSC LC-39 would require artificial lighting under FAA regulations, which could have significant impacts on sea turtle hatchlings and on the number of bird strikes with towers or guide wires. KSC would implement mitigation measures to minimize impacts and wildlife populations would be monitored. Any changes in artificial light during the night at the EELV launch sites or SpaceX Falcon launches sites would also impact sea turtle hatchlings. Additionally, CCAFS requires compliance with light management plans, which require the use of low-pressure sodium light fixtures and shielding to minimize impacts. Because the Proposed Action would create minimal artificial light at night, it would not impact the sea turtle hatchlings. Therefore, the incremental contribution to cumulative impacts on the sea turtle from the Proposed Action would be negligible.

10.3.3 Water Resources (Surface Water, Ground Water, Floodplains, and Wetlands)

The area surrounding LC-46 has historically seen many commercial space rocket and NASA space shuttle launches, and local water resources have been exposed to launch impacts by many past actions. Impacts on water resources from other launches at CCAFS and KSC may result from incidental spills and release of propellants from on-pad accidents or emergencies, launch anomalies, and rocket stages impacting the ocean. Such spills or releases may impact surface water, ground water, floodplains, and wetlands. Emergency response and clean-up procedures similar to those discussed under the Proposed Action would be employed to address on-pad

accidents and emergency releases, and solid waste recovery and treatment would reduce the severity of launch anomalies. In total, 30 to 40 launches per year would occur at CCAFS and KSC, which would have similar impacts as the Proposed Action. The probability of spills or accidents from these launches would be extremely low.

Construction to support the SpaceX Falcon 1 and Falcon 9 launches at CCAFS would potentially alter drainage patterns at LC-40, but would be mitigated with a Stormwater Discharge Pollution Prevention Plan. Payload processing for the Falcon 1 and Falcon 9 launches would only require 110 gallons of water per day, which would be supplied to and removed from the site through existing CCAFS infrastructure. Falcon launches would have no significant launch emissions. Five gallons per launch of RP-1 fuel would be emitted and rapidly dispersed in the ocean. Experimental launches at CCAFS would also temporarily decrease pH levels in local waterbodies.

Space Shuttle Program demolition and disposal at KSC as it transitions to the new Constellation Program would temporarily disturb soils and possibly cause erosion, but this would be mitigated with soil stabilization measures. Launch of Ares rockets would impact surface water and wetlands due to heat, vibration, and exhaust in nearby Mosquito Lagoon, Banana Creek and River, and the Indian River based on wind direction during launch, causing a short-term depression of surface water pH.

The Merritt NWR Conservation Program would have positive cumulative impacts on local water quality, floodplains, and wetlands by protecting ground water recharge, preventing runoff, retaining sediment, decreasing non-point-source pollution and boating in the area, and protecting wetlands within the refuge.

The Proposed Action would not introduce any additional arsenic into the ground water supply at LC-46. Although exact water requirements are not known, the Proposed Action would not use a deluge suppression system, which is a major water requirement. Therefore, it can be assumed that the Proposed Action's water requirements would not affect operating requirements of other programs in the project's vicinity, and would have a minimal effect on cumulative water supply. Because these projects have minor and temporary impacts on the water resources of the affected region, the incremental contribution to cumulative water resource impacts from the Proposed Action would be negligible.

10.3.4 Noise

The area surrounding the project has a long history of commercial space rocket and NASA space shuttle launches and the resulting launch noise. Noise impacts resulting from launch activities in the area would be brief and temporary. Ares rocket launches under the Constellation Program at KSC would create 20 to 30 seconds of launch noise audible for several miles, with associated vibrations and ground waves. Ares I rocket noise would produce less noise than the current Space Shuttle Program, while Ares V noise would be slightly louder, with sonic booms for both rockets similar to Space Shuttle launches. The EELV launches at CCAFS would have brief impacts with sonic boom footprints over the Atlantic Ocean, as would Falcon 1 and Falcon 9 launches. Launches under the Proposed Action would have noise impacts similar to other launches at CCAFS.

Noise impacts on wildlife are discussed in Section 10.3.2. Because these projects have minor and temporary noise impacts, the incremental contribution to cumulative noise impacts from the Proposed Action would be negligible.

10.3.5 Land Use (Section 4(f), Visual Resources, and Coastal Resources)

The area surrounding the project has historically been used for launching rockets and NASA space shuttles and contains launch infrastructure and associated facilities for those past and present actions. The updated SpaceX launch project at CCAFS LC-40 would have less of a visual impact than previous launches at the site, because it would use smaller rockets. This site is not visible by the public, and the public would only see the rockets from marine craft in the ocean.

Future launches from KSC would create greater visual disturbance from pre-launch patrol over flight activities than from the actual rocket launches. However, the launch site would not obstruct any scenic views. The Space Shuttle Program would require temporary construction activity to modify launch facilities for their new required capacity as NASA decommissions the current Space Shuttle Program and transitions to the Constellation Program, but it would not significantly change the visual aspect of the launch site. Construction activities to modify facilities for the Constellation Program would require constructing a lightning protection facility and mobile launcher. The action would have short-term temporary visual impacts due to construction, but would not materially change the skyline. Spacecraft that would be launched under the Constellation Program would have similar visual impacts on the current Space Shuttle Program.

The conservation plan for Merritt NWR would have minor and temporary visual impacts on the landscape due to habitat management, restoration, and facility development. However, these would be offset by management toward improving native refuge habitat. Because these projects have minor and temporary impacts on the visual resources of the affected region, no material cumulative visual impacts due to these projects or the Space Florida launches would be expected.

Neither EELV launches nor the SpaceX Falcon 1 and Falcon 9 launches at CCAFS would include activities that would affect coastal resources, Section 4(f) Resources, or compatible land use. Actions related to transitioning from the Space Shuttle Program to the Constellation Program at KSC would all be managed consistently with the Florida Coastal Zone Management Plan and would be a compatible land use. The Merritt NWR Conservation Plan actions would protect coastal resources through management of coastal erosion, protection of 100 acres of coastal dune habitat, and protection of native vegetation. The Proposed Action would have no effect on coastal resources, Section 4(f) Resources, or compatible land use; therefore, the incremental contribution to cumulative land use impacts from the Proposed Action would be negligible.

10.3.6 Socioeconomics Resources

The project area has a long been used for commercial space industry, military and NASA launches, including space shuttle launches. These past and present actions provided both construction jobs and jobs for implementing the programs within the project area. Launches

occurring at CCAFS or KSC require personnel to be onsite during all launch activities. Most launch personnel would travel to CCAFS or KSC for launch preparation and leave following the event. Due to the temporary nature of the stay, the small increase in personnel during launch activities at either base would not increase the demand for housing in the region.

All projects in the Proposed Action area would have small, positive socioeconomic impacts. The EELV launch program at CCAFS would have negligible impacts on local employment, and the SpaceX Falcon launches would only require an additional 25 employees. The Space Shuttle Program would not require additional staff during the decommissioning, but construction for the Constellation Program would require 500-750 construction jobs (NASA, 2008c). Many of those jobs would come from existing KSC construction staff. Jobs related to running the Constellation Program fall outside of this document's analysis timeframe. Improvements at Merritt NWR would have positive impacts on the local community due to increased property values for adjacent properties and improved aesthetics.

The Proposed Action may increase tourism within the region. Future launches of the Space Shuttle and other vehicles or rockets may increase the demand for tourist-related amenities. However, the region is accustomed to accommodating tourists and appropriate infrastructure exists to handle such demand. The addition of 24 annual launches to those already occurring at CCAFS and KSC would economically benefit the region.

Because these projects have minor and temporary impacts on the socioeconomic resources of the affected region, the incremental contribution to cumulative socioeconomic impacts from the Proposed Action would be negligible.

10.3.7 Hazardous Materials, Solid Waste, and Pollution Prevention

The area surrounding the project has a long history of commercial space rocket and NASA space shuttle launches, and past and present actions have required the use and handling of hazardous materials. EELV launch activities at CCAFS would use increased amounts of hazardous materials and solid waste, but would require storage of less solid propellant and would use less hazardous materials per launch than past launch vehicle programs. SpaceX Falcon launch hazardous materials impacts would occur related to the use of hypergolic propellants. However, hazardous materials would be handled in accordance with applicable regulations for both launch programs at CCAFS. The Proposed Action would not introduce any new hazardous materials or hazardous wastes to CCAFS. Because individual contractors maintain their own hazardous waste satellite accumulation points and 90-day hazardous waste accumulations areas, the hazardous waste generated by Space Florida would not impact the hazardous waste management of other contractors at CCAFS. Offsite treatment, storage, and disposal facilities would be able to handle the non-significant increase in hazardous wastes and solid waste. Cumulative impacts from hazardous materials and hazardous waste management could occur on the portions of CCAFS with historic soil and ground water contamination, including LC-46. However, significant cumulative impacts are not expected due to the remediation activities that have been completed at the site. The cumulative amount of hazardous materials, hazardous wastes, and solid wastes handled at CCAFS would increase slightly.

Actions associated with dismantling the Space Shuttle Program, constructing new facilities for the Constellation Program, and launching Ares rockets from KSC would not require additional hazardous materials at the site. Existing hazardous materials would be handled, processed, and stored according to existing rules and regulations. The Merritt NWR would not have hazardous materials needs or impacts. Because these projects have minor and temporary impacts on the hazardous materials resources of the affected region, the incremental contribution to cumulative hazardous materials impacts from the Proposed Action would be negligible.

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11.0 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

CEQ regulations (Section 1502.16) specify that environmental analysis must address "…the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity." Special attention should be given to impacts that narrow the range of beneficial uses of the environment in the long-term or pose a long-term risk to human health or safety. This section evaluates the short-term benefits of the proposed alternatives compared to the long-term productivity derived from not pursuing the proposed alternatives. A short-term use of the environment is generally defined as a direct consequence of a project in its immediate vicinity.

This EA evaluates how impacts from short-term uses of the environment would affect long-term productivity for each environmental resource area. Under the Proposed Action, there would be short-term non-significant impacts on the environment; however, none of these impacts would be long term (see Exhibit 11-1). As a result, the Proposed Action is not expected to narrow the range of beneficial uses of the environment in the long-term or pose a long-term risk to human health or safety.

Exhibit 11-1. Effects of short-term uses on long-term productivity

Resource Area	Impacts from short-term uses	Effects on long-term productivity
Air Quality	Minimal emissions of haze-related pollutants	No effect
Biological Resources (Fish, Wildlife, Plants, and Special Status Species)	Localized scorching of grasses and potential disruption to wildlife from increased noise levels	No effect
Water Resources (Surface Water, Ground Water, Floodplains, and Wetlands)	Non-significant decrease in water quality could occur from launch anomalies or on-pad emergency propellant releases, although there is an extremely low probability of these events to occur	No effect
Noise	Non-significant, temporary increased noise levels	No effect
Land-Use (Section 4(f), Visual Resources, and Coastal Resources	No significant effects	No effect
Socioeconomic Resources	Slight economic benefit from increased launches and associated influx of visitors and launch personnel accommodated by existing infrastructure	No effect
Hazardous Materials, Solid Waste, and Pollution Prevention	Low probability of a spill of hazardous materials or hazardous waste, which would result in a short-term effect	No effect

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12.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

NEPA CEQ regulations require environmental analyses to identify "...any irreversible and irretrievable commitments of resources which would be involved in the Proposed Action should it be implemented" (40 CFR Section 1502.16). Primary irreversible effects result from permanent use of a nonrenewable resource (e.g., minerals or energy). Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action (e.g., disturbance of a cultural site) or consumption of renewable resources that are not permanently lost (e.g., old growth forests). Secondary impacts could result from environmental accidents, such as explosive fires. Natural resources include minerals, energy, land, water, forestry and biota. Nonrenewable resources are those resources that cannot be replenished by natural means, including oil, natural gas and iron ore. Renewable natural resources are those resources that can be replenished by natural means, including water, lumber and soil.

Under the Proposed Action, no irreversible or irretrievable commitment of resources is expected to occur in any of the environmental resource areas analyzed in this EA. The Proposed Action would expend solid and liquid propellants; however, the amounts of propellants and other materials that would be expended as part of the Proposed Action are negligible compared to the quantities routinely produced. No construction activities would occur and launches at the site would be of a small-scale and would occur relatively infrequently. As a result, no substantial irreversible or irretrievable commitments of resources are expected.

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