



Federal Aviation  
Administration

# **Environmental Assessment for Pegasus Launches at Cape Canaveral Air Force Station**

February 2011



**Environmental Assessment and Finding of No Significant Impact for Pegasus Launches at Cape Canaveral Air Force Station, Florida**

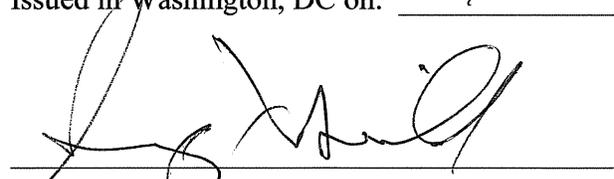
**AGENCY:** Federal Aviation Administration (FAA)

**ABSTRACT:** This Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) for Pegasus Launches at Cape Canaveral Air Force Station (CCAFS), Florida addresses the potential environmental impacts of the FAA's Proposed Action for issuing or renewing Launch Operator Licenses to operate Pegasus launch vehicles at CCAFS. This EA evaluates the impacts of the L-1011 carrier aircraft taking off and landing from a CCAFS runway and the launch of the Pegasus vehicle. Potential environmental impacts of the Proposed Action and the No Action Alternative analyzed in detail in this EA include impacts to air quality; biological resources (including fish, wildlife, and plants); compatible land use; Department of Transportation Section 4(f) resources; hazardous materials, pollution prevention, and solid waste; historical, architectural, archaeological, and cultural resources; noise; socioeconomic impacts; and water quality (including floodplains and wetlands). Potential cumulative impacts of the Proposed Action are also addressed in this EA.

**CONTACT INFORMATION:** Questions regarding the Proposed Action and the Environmental Assessment and Finding of No Significant Impact for Pegasus Launches at Cape Canaveral Air Force Station, Florida can be addressed to Jaclyn M. Johnson, Environmental Protection Specialist, Federal Aviation Administration, 800 Independence Avenue, SW, Suite 325, Washington, DC 20591; e-mail at [Jaclyn.Johnson@faa.gov](mailto:Jaclyn.Johnson@faa.gov) or by phone at (202) 267-5352.

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

Issued in Washington, DC on: 2/25/2011



Dr. George C. Nield  
Associate Administrator for  
Commercial Space Transportation



## DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Office of Commercial Space Transportation; Finding of No Significant Impact

**AGENCY:** Federal Aviation Administration (FAA)

**ACTIONS:** Finding of No Significant Impact

**SUMMARY:** The FAA prepared the Environmental Assessment (EA) for Pegasus Launches at Cape Canaveral Air Force Station (CCAFS), Florida in accordance with the National Environmental Policy Act (NEPA) of 1969, 42 United States Code 4321-4347 (as amended), Council on Environmental Quality (CEQ) NEPA implementing regulations (40 Code of Federal Regulations [CFR Parts 1500 to 1508]), and FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures, Change 1*, to evaluate the potential environmental impacts of issuing or renewing Launch Operator Licenses to operate Pegasus vehicles at CCAFS, Florida. The EA evaluated the environmental impacts associated with the Proposed Action and the No Action Alternative.

After reviewing and analyzing available data and information on existing conditions and potential impacts, the FAA has determined that issuing or renewing Launch Operator Licenses for the operation of Pegasus vehicles at CCAFS would not significantly impact the quality of the human environment within the meaning of NEPA. Therefore, the preparation of an Environmental Impact Statement is not required, and the FAA is issuing a Finding of No Significant Impact. The FAA made this determination in accordance with all applicable environmental laws. The EA is incorporated by reference in this Finding of No Significant Impact.

**FOR A COPY OF THE ENVIRONMENTAL ASSESSMENT:** Visit the following internet address: [http://www.faa.gov/about/office\\_org/headquarters\\_offices/ast/environmental/review/launch/](http://www.faa.gov/about/office_org/headquarters_offices/ast/environmental/review/launch/) or contact Jaclyn M. Johnson, Environmental Protection Specialist, Federal Aviation Administration, 800 Independence Avenue, SW, Suite 325, Washington, DC 20591; e-mail at [Jaclyn.Johnson@faa.gov](mailto:Jaclyn.Johnson@faa.gov) or by phone at (202) 267-5352.

**PURPOSE AND NEED:** The purpose of the FAA's Proposed Action of issuing or renewing Launch Operator Licenses for operation of Pegasus vehicles from CCAFS is to ensure compliance with the international obligations of the United States and to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States during commercial launch or reentry activities. The action would also encourage, facilitate, and promote commercial space launches and reentries by the private sector; and would facilitate the strengthening and expansion of the U.S. space transportation infrastructure, in accordance with 51 U.S.C. Subtitle V, ch. 509, §§ 50901-50923 (Chapter 509) and Executive Order (EO) 12465, *Coordination and Encouragement of Commercial Expendable Launch Vehicle Activities*, for oversight of commercial space launch activities, including licensing of launch and reentry activities.

The Proposed Action is needed to allow the commercial operation of Pegasus vehicles at CCAFS to meet the demand for lower-cost access to space.

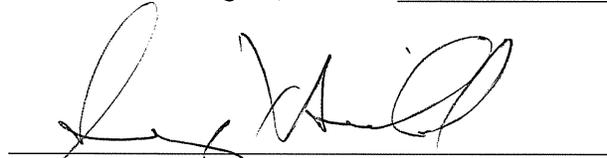
**PROPOSED ACTION:** Under the Proposed Action, the FAA would issue or renew Launch Operator Licenses to operate Pegasus vehicles at CCAFS. Under the Proposed Action, the applicant would conduct takeoffs and landings of the L-1011 carrier aircraft from the CCAFS skid strip and conduct launches of Pegasus vehicles from the aircraft at an altitude of 40,000 feet and approximately 90 nautical miles offshore over the Atlantic Ocean.

**ALTERNATIVES CONSIDERED:** Alternatives analyzed in the EA include the Proposed Action and the No Action Alternative. Under the No Action Alternative, the FAA would not issue or renew Launch Operator Licenses to operate Pegasus vehicles at CCAFS and there would be no commercial launches of Pegasus vehicles from CCAFS. Existing operating procedures, military operations, and other launch activities, including non-commercial launches of Pegasus vehicles would continue at CCAFS.

**ENVIRONMENTAL IMPACTS:** Based on the EA, no significant environmental impacts, as defined in FAA Order 1050.1E, would be expected to result from the Proposed Action. Please refer to Chapter 4, Environmental Consequences, of the EA for a full discussion of potential impacts.

**DETERMINATION:** An analysis of the Proposed Action has concluded that there would be no significant short-term, long-term, or cumulative impacts to the environment or surrounding populations. Therefore, an Environmental Impact Statement for the Proposed Action is not required. After careful and thorough consideration of the facts contained herein, the undersigned finds that the proposed Federal action is consistent with existing national environmental policies and objectives as set forth in Section 101 of NEPA and other applicable environmental requirements and will not significantly affect the quality of the human environment or otherwise include any condition requiring consultation pursuant to Section 102(2)(c) of NEPA.

Issued in Washington, DC on: 2/25/2011



Dr. George C. Nield  
Associate Administrator for  
Commercial Space Transportation

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## **ACRONYMS AND ABBREVIATIONS**

Al	Aluminum
AST	Office of Commercial Space Transportation
CCAFS	Cape Canaveral Air Force Station
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
dBA	A-weighted sound level (in decibels)
DPS	Distinct Population Segment
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FDEP	Florida Department of Environmental Protection
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
GLV	Generic Launch Vehicle
HAPS	Hydrazine Auxiliary Propulsion System
HTPB	Hydroxyl Terminated Polybutadine
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NH <sub>4</sub> ClO <sub>4</sub>	Ammonium Perchlorate
NMFS	National Marine Fisheries Service
PEIS	Programmatic Environmental Impact Statement
USAF	United States Air Force
USCB	United States Census Bureau
USC	United States Code
USFWS	United States Fish and Wildlife Service



## 1. INTRODUCTION

Under the Proposed Action addressed in this EA, the Federal Aviation Administration (FAA) Office of Commercial Space Transportation (AST) would issue or renew Launch Operator Licenses for the operation of Pegasus vehicles at Cape Canaveral Air Force Station (CCAFS), Florida. All pre-launch processing operations for Pegasus vehicles would continue to occur at Building 1555 at Vandenberg Air Force Base, California, and were analyzed in the United States Air Force's (USAF) 1994 STEP Mission 1 EA (USAF 1994a). That analysis is incorporated by reference in this EA. Pre-launch processing operations for Pegasus vehicles include payload integration and mating the carrier aircraft and Pegasus launch vehicle. Activities addressed in this EA include carrier aircraft takeoff and landing from a CCAFS runway and launch of the Pegasus vehicle.

As the agency responsible for licensing launches of the Pegasus vehicle, the FAA is the lead agency for preparation of this EA. The FAA determined that no additional agency consultation was required for the preparation of this EA.

### 1.1 Background

In 2001, the FAA/AST published the Final Programmatic Environmental Impact Statement (PEIS) for Licensing Launches (2001 PEIS) that evaluated the potential environmental consequences of licensed commercial launches (FAA 2001). The purpose of the 2001 PEIS is to allow tiering<sup>1</sup> of environmental reviews for FAA issuances of new licenses, or renewals, or modifications of existing licenses. This Environmental Assessment (EA) tiers from the 2001 PEIS and focuses on localized and site-specific effects of FAA issuing or renewing Launch Operator Licenses to operate the Pegasus expendable launch vehicle at CCAFS.

Issuing or renewing a license is considered a major Federal action subject to environmental review under the National Environmental Policy Act (NEPA) of 1969, 42 United States Code 4321-4347 (as amended). The FAA prepared this EA, in accordance with NEPA, Council on Environmental Quality (CEQ) NEPA implementing regulations (40 Code of Federal Regulations [CFR] Parts 1500 to 1508), and FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures, Change 1*, to evaluate the potential environmental impacts of activities associated with issuing or renewing Launch Operator Licenses for Pegasus vehicle operations.

### 1.2 Purpose and Need for Proposed Action

#### 1.2.1 Purpose

The purpose of the FAA's Proposed Action of issuing or renewing Launch Operator Licenses to operate Pegasus vehicles from CCAFS is to ensure compliance with the international obligations of the United States and to protect the public health and safety, safety of property, and national security and foreign policy interests of the United States during commercial launch or reentry activities. The action would also encourage, facilitate, and promote commercial space launches

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<sup>1</sup> Agencies are encouraged to tier their environmental impact statements to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental review. Whenever a broad environmental impact statement has been prepared (such as a program or policy statement) and a subsequent statement or environmental assessment is then prepared on an action included within the entire program or policy (such as a site specific action) the subsequent statement or environmental assessment need only summarize the issues discussed in the broader statement and incorporate discussions from the broader statement by reference and shall concentrate on the issues specific to the subsequent action. The subsequent document shall state where the earlier document is available. Tiering may also be appropriate for different stages of actions. (40 Code of Federal Regulations [CFR Parts 1500 to 1508, Section 1508.28])

and reentries by the private sector; and would facilitate the strengthening and expansion of the U.S. space transportation infrastructure, in accordance with the requirements of 51 U.S.C. Subtitle V, ch. 509, §§ 50901-50923 (Chapter 509); Commercial Space Transportation Competitiveness Act of 2000 (Public Law 106-405); Executive Order 12465, *Coordination and Encouragement of the Commercial Expendable Launch Vehicle Activities* (February 24, 1984); CFR Title 14, *Aeronautics and Space*, Parts 400-450, *Commercial Space Transportation*, *Federal Aviation Administration, Department of Transportation*; the Commercial Space Act of 1998 (Public Law 105-303); the U.S. Space Transportation Policy of 2004; and the National Space Policy of 2010. The Secretary of Transportation has assigned the FAA/AST responsibility, under Chapter 509 and Executive Order 12465, for oversight of commercial space launch activities, including licensing launches.

### **1.2.2 Need**

The Proposed Action is needed to allow the commercial operation of Pegasus vehicles at CCAFS to meet the demand for lower-cost access to space. Less expensive space launch capability is necessary to support rising industries through more cost-effective commercial, government, and scientific satellite launches. Given the infrastructure and development costs associated with constructing launch facilities and conducting launches, 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.

## 2. PROPOSED ACTION AND ALTERNATIVES

### 2.1 Proposed Action

Under the Proposed Action (the preferred alternative), the FAA would issue or renew Launch Operator Licenses to launch the Pegasus expendable launch vehicle family from CCAFS, Florida. See Exhibit 2-1 for a map of CCAFS. The Pegasus expendable launch vehicle family includes the Standard Pegasus, Standard Pegasus with a Hydrazine Auxiliary Propulsion System (HAPS), Pegasus XL, and Pegasus XL with HAPS, with all configurations operating in combination with an L-1011 aircraft. CCAFS occupies a total of 15,804 acres of land on the Cape Canaveral Barrier Island along the eastern edge of Florida. CCAFS is adjacent to the City of Cape Canaveral and the National Aeronautics and Space Administration (NASA) Kennedy Space Center. CCAFS is bounded to the east by the Atlantic Ocean and on the west by the Banana River. CCAFS is an installation of the USAF Space Command's 45<sup>th</sup> Space Wing headquartered at Patrick Air Force Base, which is located 20 miles from CCAFS (USAF 1991a). CCAFS supports a wide range of government and commercial space launches. CCAFS facilities are dispersed throughout the acreage with scrub vegetation separating the developed areas. Elevation within CCAFS ranges from sea level to 20 feet above mean sea level. The CCAFS skid strip is also known as Facility 50305, was constructed in 1952 and includes a 10,000-foot runway (USAF 1995). The L-1011 aircraft, which transports the Pegasus vehicle, would take off from and land at the skid strip.

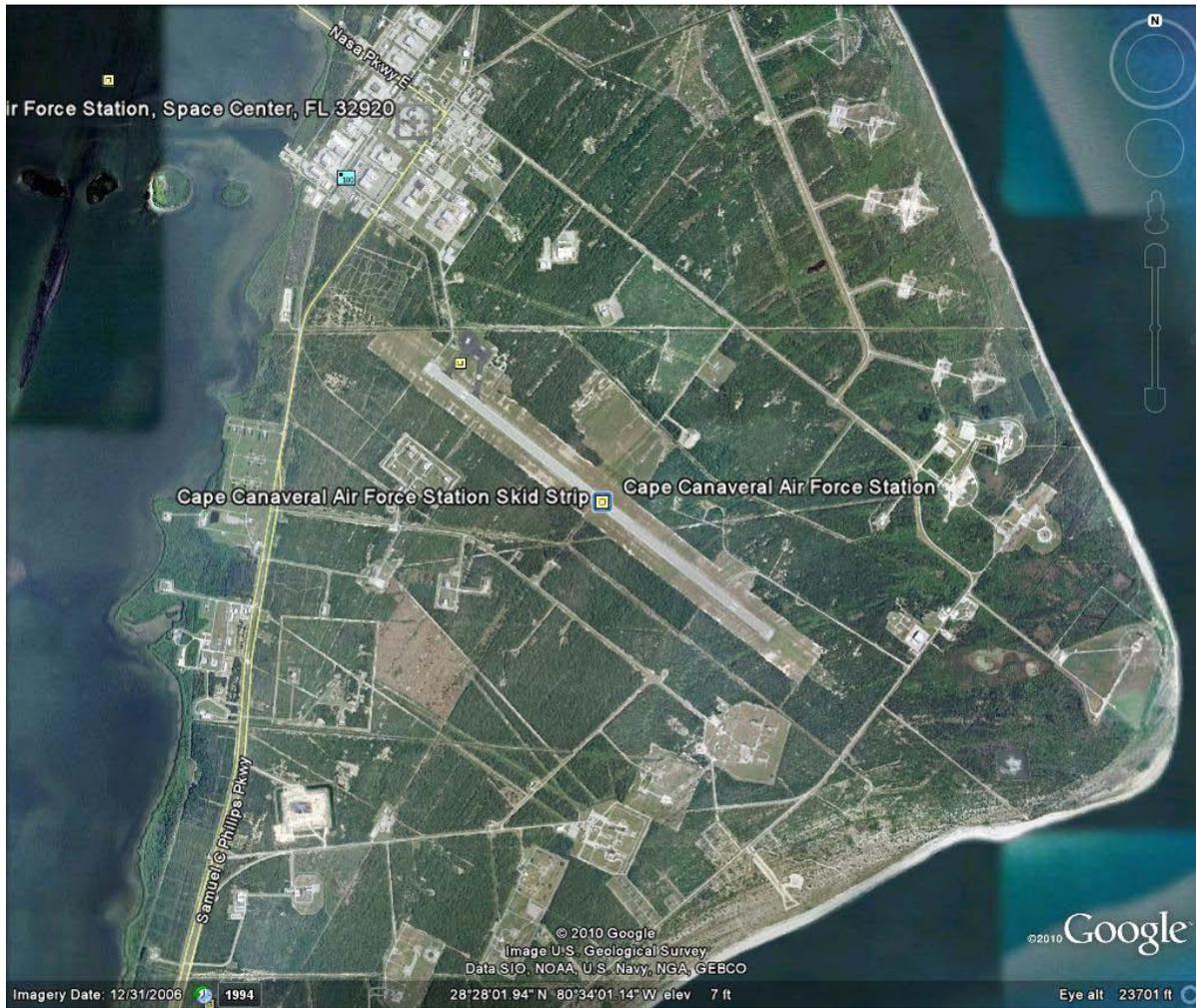
The Pegasus vehicle is an air-launched expendable launch vehicle, which is designed to be carried and released from an L-1011 aircraft (see Exhibit 2-2). The L-1011 aircraft has standard FAA-approved engines and uses FAA-certified fuels (i.e., Commercial Jet A or Military JP4 or JP10). The Pegasus expendable launch vehicle consists of three graphite epoxy case solid rocket propellant motor stages with an optional liquid propellant-based HAPS fourth stage. The HAPS is added to a launch vehicle to obtain higher altitudes, achieve finer altitude accuracy, or conduct more complex maneuvers. The HAPS is powered by three restartable, monopropellant hydrazine thrusters and contains approximately 130 pounds of liquid hydrazine, and pressurized helium gas (USAF 2006). Exhibit 2-3 presents the characteristics of the Pegasus vehicle for all three stages and the optional HAPS.

Pre-launch vehicle processing for all Pegasus vehicles, regardless of where they are launched, occurs at Building 1555 at Vandenberg Air Force Base in southern California, where the vehicle is mated with the L-1011 aircraft and transported to a launch facility, such as CCAFS, for launch. Under the Proposed Action, all pre-launch processing for Pegasus vehicles would continue to occur at Vandenberg Air Force Base and the L-1011 aircraft would be used for vehicle launches. The FAA does not license pre-launch processing activities. However, the environmental impacts of these activities have been examined as related activities in a separate NEPA document<sup>2</sup> and, therefore, will not be examined further in this document (USAF 1994). The relevant portions of this prior NEPA analyses are incorporated by reference in this EA.

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<sup>2</sup> 1994 USAF STEP Mission 1 EA (USAF 1994a.)

### Exhibit 2-1. Map of CCAFS



Source: Google Earth 2010.

**Exhibit 2-2. L-1011 Aircraft Coupled with Pegasus XL Vehicle**



Source: Orbital Sciences Corporation, 2010b.

**Exhibit 2-3. Pegasus Launch Vehicle Stage Characteristics**

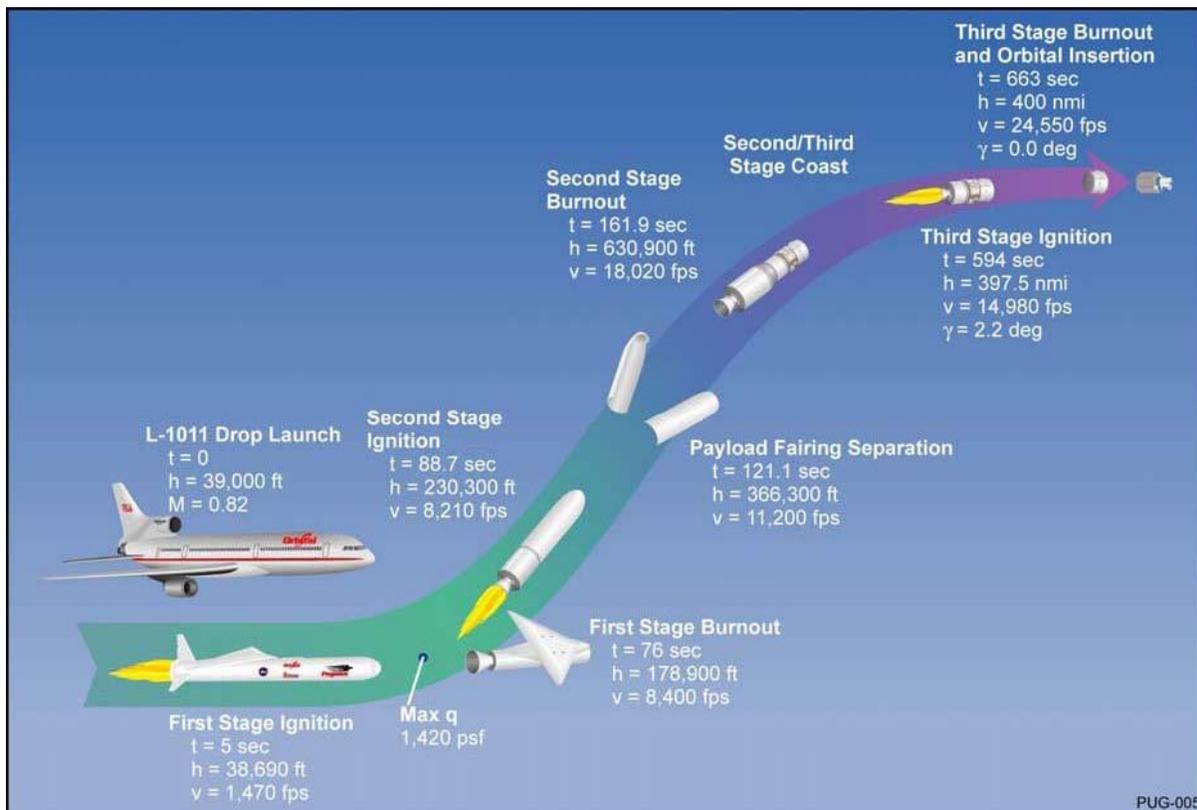
	<b>Length</b>	<b>Diameter</b>	<b>Propellant Mass</b>	<b>Gross Mass</b>
Stage 1	29.13 feet (8.88 meters)	4.17 feet (1.27 meters)	33,175 pounds 15,048 kilograms	36,182 pounds 16,412 kilograms
Stage 2	11.75 feet (3.58 meters)	4.17 feet (1.27 meters)	8,631 pounds 3,915 kilograms	9,548 pounds 4,331 kilograms
Stage 3	4.40 feet (1.34 meters)	3.18 feet (0.97 meters)	1,700 pounds 771 kilograms	1,978 pounds 897 kilograms
Hydrazine Auxiliary Propulsion System	-	-	130	-

Source: FAA 2004.

Once the Pegasus vehicle arrives at CCAFS for launch, the L-1011 aircraft, coupled with the launch vehicle takes off from CCAFS and flies approximately 90 nautical miles off the coast of Florida. Once the aircraft reaches an altitude of about 40,000 feet, it releases the Pegasus vehicle. Approximately five seconds after the vehicle is released from the L-1011 aircraft, the first stage of the rocket is ignited (USAF 1989). The first stage burns for approximately 77 seconds, propels the vehicle to an altitude of 223,000 feet, and pitches the rocket and orients it for orbit. The flight azimuth would be from 43 to 119 degrees. The spent first stage detaches and falls to the ocean. Then, the rocket coasts for approximately 12 seconds before the second stage ignites. The second stage burns for about 83 seconds, carrying the vehicle and its payload to an altitude of 689,000 feet. During ignition of the second stage, the payload fairing would jettison and fall into the ocean. Following burnout, the spent second stage would also fall to the

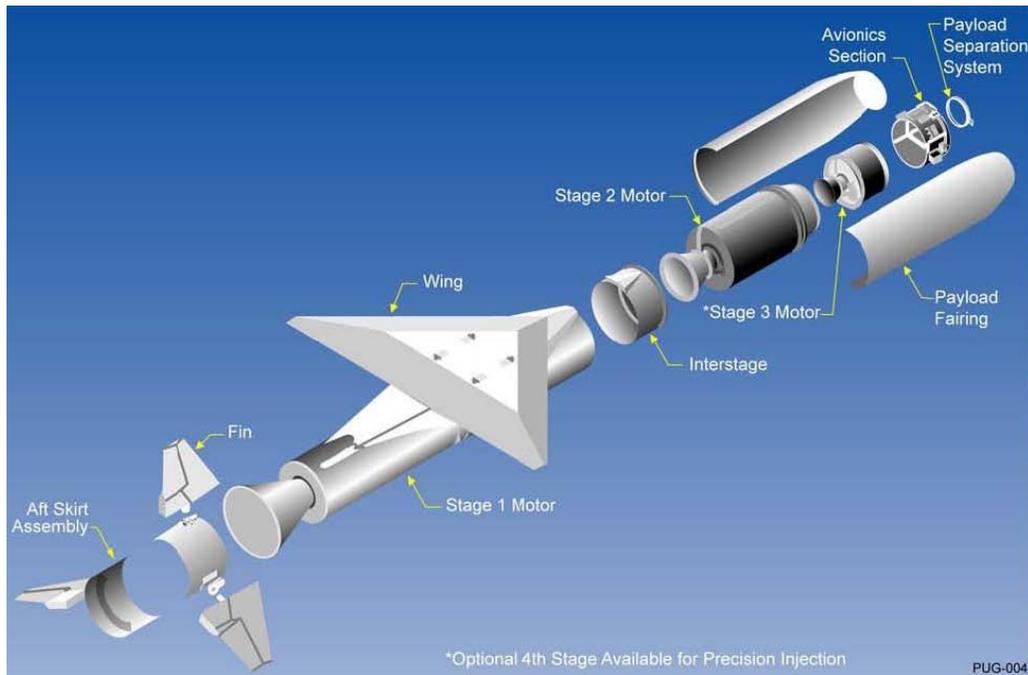
ocean. The rocket continues to coast for approximately five minutes to orbital altitude before the third stage ignites and provides the lift the rocket needs to be launched into orbit. The third stage would continue to burn for 65 seconds carrying the payload into orbital insertion, detach from the payload and optional HAPS (if appropriate), and fall into the ocean. The HAPS stage would provide additional altitude and orbital precision before detaching and falling back into the ocean. None of the three jettisoned stages or the optional HAPS would be recovered. Exhibit 2-4 depicts the Pegasus XL mission profile and shows the three stages.

### Exhibit 2-4. Pegasus XL Mission Profile



Source: Orbital Sciences Corporation 2010a.

The first stage uses three hydraulic aero fins for directional control; the second and third stages have a flex seal nozzle controlled by electromechanical actuators. The second and third stages use cold nitrogen gas for their reaction control systems. Each stage is designed to burn to completion. Pegasus vehicles also contain a flight termination system, which is mounted on the aft dome of each rocket motor; if ignited, the flight termination system cuts through the structure of the graphite case and the propellant, causing the stage to become non-propulsive and to tumble through the atmosphere and into the ocean. Exhibit 2-5 shows the Pegasus XL motor configurations.

**Exhibit 2-5. Pegasus XL Motor Configurations**

Source: Orbital Sciences Corporation 2010a.

The solid rocket propellant used in Pegasus vehicles consists of class 1.3 propellant. This contains aluminum (Al) fuel (19 percent by weight), ammonium perchlorate ( $\text{NH}_4\text{ClO}_4$ ) oxidizer (69 percent by weight), hydroxyl terminated polybutadiene (HTPB) binder (approximately 7 percent by weight), and other additives (approximately 5 percent by weight). A more detailed description of the composition of Pegasus solid rocket propellant is provided in Exhibit 2-6.

**Exhibit 2-6. Pegasus Solid Rocket Propellant Composition**

Constituent	Percent Composition (by weight)
Al	19.0
$\text{NH}_4\text{ClO}_4$	69.0
HTPB	7.14
Aziridine	0.3
Tri (mixed mono- and dinonylphenyl) phosphate with triisopropanolamine	0.12
2-methoxy sebacate	3.56
Dimethyl diisocyanate	0.82
Maleic anhydride	0.03

Source: Orbital Sciences Corporation 2010a

The Pegasus launch vehicle would carry a total of approximately 43,500 pounds of solid rocket propellant in its three motor stages (Orbital Sciences Corporation 2010a). Ignition of the rocket motors on the Pegasus vehicle would not take place until the rocket was released over the Atlantic Ocean at an altitude of approximately 40,000 feet.

The 2001 PEIS, from which this EA is tiered, evaluated the launch impacts associated with four vehicle categories (small, medium, intermediate, and heavy-payload capacities); three propellant types (solid, liquid, and hybrid propellant); and three launch scenarios (land, air, and sea). The Pegasus launch vehicle falls within the parameters of the small-payload capacity vehicle using

solid propellant to launch from the air. The 2001 PEIS evaluated the impacts of launching 72 small capacity rockets, including the Pegasus launch vehicle family, over a 10-year period. The estimated annual number of launches ranged from four to nine launches, with an average of seven annual launches. The rate of Pegasus launches at CCAFS under the FAA's Proposed Action would not be expected to exceed the rate of launches analysis in the 2001 PEIS.

## 2.2 No Action Alternative

Under the No Action Alternative, the FAA would not issue or renew Launch Operator Licenses to operate Pegasus vehicles at CCAFS and there would be no commercial launches of Pegasus vehicles from CCAFS after March 17, 2011 when the existing Launch Operator License expires. Existing operating procedures, military operations, and other launch activities, including non-commercial launches of the Pegasus vehicle would continue at CCAFS.

## 2.3 Impacts and Resources Analyzed in Detail

FAA reviewed all environmental resources covered under FAA Order 1050.1E, Change 1 and determined which would be impacted by the Proposed Action. Those that would be impacted are described in further depth in Sections 3 and 4, which provide an analysis of the environmental resources that could be impacted by the Proposed Action, including: air quality; biological resources (including fish, wildlife, and plants); compatible land use; Department of Transportation Section 4(f) resources; hazardous materials, pollution prevention, and solid waste; historical, architectural, archaeological, and cultural resources; noise; socioeconomic impacts; and water quality (including floodplains and wetlands). Potential cumulative impacts of the Proposed Action were also considered.

The affected environment section (Section 3) describes 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 resource area is commensurate with the potential for impact on that resource area.

The environmental consequences section (Section 4) describes 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 Regulations (FAA Order 1050.1E, Change 1) for implementing NEPA, which specify significance thresholds by resource.

## 2.4 Impacts and Resources Not Analyzed in Detail

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, for the reasons explained below.

**Coastal Resources** – The entire State of Florida is defined as being part of a coastal zone (NOAA 2004). However, because no construction activities are planned as part of the Proposed Action, there would be no impacts to coastal resources protected under the requirements of the Federal Coastal Zone Management Act.

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

**Environmental Justice and Children's Environmental Health and Safety Risks** – The Proposed Action would not disproportionately adversely affect children or minority and low-income populations because the Proposed Action would have negligible impacts on all residents

surrounding CCAFS. The Proposed Action would be implemented at existing facilities at CCAFS or over the open ocean. While noise from the jet engines may be audible, it would not be expected to exceed current noise levels at CCAFS. Additionally, any noise associated with the Proposed Action would be temporary.

**Farmlands** – The Proposed Action would not convert farmland to nonagricultural use, as there is no farmland present on CCAFS.

**Light Emissions and Energy Supply** – The Proposed Action would not result in any light emission impacts or cause a measurable effect on local supplies of energy or natural resources.

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

**Wild and Scenic Rivers** – There are no wild and scenic rivers as designated by the Wild and Scenic Rivers Act of 1968 (16 U.S.C. 1271 et seq.) located on or near CCAFS.



### 3. AFFECTED ENVIRONMENT

FAA reviewed all resources covered under FAA Order 1050.1E, Change 1 and determined which would be impacted by the Proposed Action. Those that would be impacted are described in further depth in Sections 3 and 4, which provide an analysis of the environmental resources that could be impacted by the Proposed Action, including: air quality; biological resources (including fish, wildlife, and plants); compatible land use; Department of Transportation Section 4(f) resources; hazardous materials, pollution prevention, and solid waste; historical, architectural, archaeological, and cultural resources; noise; socioeconomic impacts; and water quality (including floodplains and wetlands) and cumulative impacts.

The affected environment section (Section 3) describes 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 resource area is commensurate with the potential for impact on that resource area.

#### 3.1 Air Quality

Under the authority of the Clean Air Act, 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” including ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter less than 10 microns in diameter, particulate matter less than 2.5 microns in diameter, and lead. 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 Clean Air Act, State and local agencies may establish their own Ambient Air Quality Standards, provided these standards are at least as stringent as the Federal requirements. The standards set by the State of Florida are similar to the NAAQS (see Exhibit 3-1). EPA designates areas of the U.S. having air quality equal to or better than the NAAQS as being in “attainment.” Areas with air quality worse than the NAAQS are referred to as being in “non-attainment.”

**Exhibit 3-1. Florida and National Ambient Air Quality Standards (NAAQS)**  
(page 1 of 2)

<b>Pollutant</b>	<b>Averaging Time<sup>c</sup></b>	<b>Florida Standards<sup>a,b</sup></b>	<b>National Primary Standards<sup>a,b</sup></b>	<b>National Secondary Standards<sup>a,b</sup></b>
Ozone (O <sub>3</sub> )	8 Hours	–	0.075 ppm (147 µg/m <sup>3</sup> ) <sup>d</sup>	0.075 ppm (147 µg/m <sup>3</sup> )
	1 Hour	0.12 ppm (235 µg/m <sup>3</sup> )	–	–
Carbon Monoxide (CO)	8 Hours	9.0 ppm (10,000 µg/m <sup>3</sup> )	9.0 ppm (10,000 µg/m <sup>3</sup> )	–
	1 Hour	35 ppm (40,000 µg/m <sup>3</sup> )	35 ppm (40,000 µg/m <sup>3</sup> )	–

**Exhibit 3-1. Florida and National Ambient Air Quality Standards (NAAQS)**  
(page 2 of 2)

<b>Pollutant</b>	<b>Averaging Time<sup>c</sup></b>	<b>Florida Standards<sup>a,b</sup></b>	<b>National Primary Standards<sup>a,b</sup></b>	<b>National Secondary Standards<sup>a,b</sup></b>
Nitrogen Dioxide (NO <sub>2</sub> )	Annual Arithmetic Mean	0.05 ppm (100 µg/m <sup>3</sup> )	0.053 ppm (100 µg/m <sup>3</sup> )	0.053 ppm (100 µg/m <sup>3</sup> )
	1 Hour	–	0.100 ppm (200 µg/m <sup>3</sup> )	–
Sulfur Dioxide (SO <sub>2</sub> )	Annual Arithmetic Mean	0.02 ppm (60 µg/m <sup>3</sup> )	–	–
	24 Hours	0.1 ppm (260 µg/m <sup>3</sup> )	–	–
	3 Hours	0.5 ppm (1,300 µg/m <sup>3</sup> )	–	0.5 ppm (1300 µg/m <sup>3</sup> )
	1 Hour	–	0.075 ppm (200 µg/m <sup>3</sup> )	–
Particulate Matter <10 microns in diameter (PM <sub>10</sub> )	Annual	50 µg/m <sup>3</sup>	–	–
	24 Hours	150 µg/m <sup>3</sup>	150 µg/m <sup>3</sup>	150 µg/m <sup>3</sup>
Particulate Matter <2.5 microns in diameter (PM <sub>2.5</sub> )	Annual	–	15 µg/m <sup>3</sup>	15 µg/m <sup>3</sup>
	24 Hours	–	35 µg/m <sup>3</sup>	35 µg/m <sup>3</sup>
Lead	Rolling 3-Month Average	–	0.15 µg/m <sup>3</sup>	0.15 µg/m <sup>3</sup>
	Quarterly Average	1.5 µg/m <sup>3</sup>	Revoked <sup>e</sup>	Revoked <sup>e</sup>

Source: National – 40 CFR 50 (EPA 2010a). Florida – Florida Administrative Code, Rule 62-204.240 (FDEP 2010a).

a. ppm = parts per million; µg/m<sup>3</sup> = micrograms per cubic meter.

b. Florida ambient air quality standards for ozone, carbon monoxide, sulfur dioxide, nitrogen dioxide and PM<sub>10</sub> are values that are not to be exceeded. The lead value is not to be equaled or exceeded. Florida does not have an ambient air quality standard for PM<sub>2.5</sub>.

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 1-hour NO<sub>2</sub> standard is attained when the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area does not exceed 0.100 ppm. The 24-hour PM<sub>10</sub> standard is attained when the 24-hour concentrations does not exceed 150 µg/m<sup>3</sup> more than once per year on average over 3 years. The annual PM<sub>2.5</sub> standard is attained when the 3-year average of the weighted annual mean PM<sub>2.5</sub> concentrations from single or multiple community-oriented monitors does not exceed 15.0 µg/m<sup>3</sup>. The 24-hour PM<sub>2.5</sub> standard is attained when the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area does not exceed 35 µg/m<sup>3</sup>. The quarterly lead standard is not to be exceeded in a calendar year. The rolling 3-month lead standard is not to be exceeded over a 3-year period. The 1-hour sulfur dioxide standard is attained when the 3-year average of the 99th percentile of the daily maximum 1-hour average concentrations does not exceed 0.075 ppm.

d. EPA has proposed to reduce the 8-hour ozone standard to a value between 0.060 and 0.070 ppm. EPA intended to issue the final ozone standard by August 2010, but this rule has not yet been finalized.

e. On October 15, 2008 EPA revoked the quarterly average lead standard, although some areas have continuing obligations under that standard.

CCAFS is located off the eastern coast of Florida in Brevard County. Brevard County has been designated by the EPA and the Florida Department of Environmental Protection (FDEP) to be in attainment for both the NAAQS and the Florida Ambient Air Quality Standards (FAA 2009a). Therefore, FAA is not required to conduct a General Conformity analysis. The 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 CCAFS. For some pollutants, the nearest station with three full years of data is located many miles away from CCAFS (e.g., the Winter Park station is located about 50 miles away). Data from those stations are illustrative of general attainment conditions in Central Florida rather than of local air quality in the area around CCAFS. Exhibit 3-2 shows that ground-level concentrations of criteria pollutants in the region around CCAFS are also within the NAAQS and Florida standards.

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

Pollutant <sup>a</sup>	Averaging Time	Nearest Monitoring Station	Maximum Measured Concentration (ppm, except PM in $\mu\text{g}/\text{m}^3$ )		
			2007	2008	2009
O <sub>3</sub>	1 Hour	Freedom 7 Elementary School	0.086	0.088	0.080
	8 Hours <sup>b</sup>	Freedom 7 Elementary School	0.081 (1st max.)	0.077 (1st max.)	0.068 (1st max.)
CO	8 Hours	Winter Park	1	1	1.6
	1 Hour	Winter Park	1.6	1.1	2
NO <sub>2</sub>	Annual	Winter Park	0.007	0.006	No Data
	1 Hour	Winter Park	0.058	0.044	0.048
SO <sub>2</sub>	Annual	Winter Park	0.001	0.001	No Data
	24 Hours	Winter Park	0.003	0.0014	0.0025
	3 Hours	Winter Park	0.009	0.009	0.0096
	1 Hour	Winter Park	0.011	0.012	0.011
PM <sub>10</sub>	Annual	Winter Park	19	18	No data
	24 Hours	Winter Park	50	32	27
PM <sub>2.5</sub>	Annual	Melbourne	7.29	8.03	No Data
	24 Hours	Fay Park	66 <sup>c</sup>	23.7	20.5
Lead	Quarterly	No lead monitors are located within 100 miles of CCAFS	No Data	No Data	No Data

Source: FDEP 2010b; EPA 2010b, 2010c

- a. O<sub>3</sub> = ozone; CO = carbon monoxide; NO<sub>2</sub> = nitrogen dioxide; SO<sub>2</sub> = sulfur dioxide; PM<sub>10</sub> = particulate matter with an aerodynamic diameter less than 10 micrometers; PM<sub>2.5</sub> = particulate matter with an aerodynamic diameter less than 2.5 micrometers; ppm = parts per million;  $\mu\text{g}/\text{m}^3$  = micrograms per cubic meter air.
- b. Nonattainment status is met if the 3 year running average of the highest 8-hour ozone measurements is greater than 0.075 ppm. A review of all 8-hour ozone data between 2007 and 2009 indicate that Freedom 7 Elementary School monitoring station is in attainment for 8-hour ozone.
- c. A review of the next highest nine readings for this year were all below 28.1  $\mu\text{g}/\text{m}^3$ , and at no time in the stations history has a reading ever been higher than 28.1  $\mu\text{g}/\text{m}^3$

Stationary point sources of air emissions at CCAFS typically include launch vehicle processing, fueling, and other point sources such as heating/power plants, generators, incinerators, and storage tanks. Mobile sources include support equipment, commercial transport vehicles, rocket launch vehicles, and personal motor vehicles. CCAFS operates under an EPA-issued Title V air emissions permit (USAF 1998, 2006).

## **3.2 Biological Resources (Including Fish, Wildlife, and Plants)**

### **3.2.1 Fish and Wildlife**

Marine species that inhabit areas around CCAFS include fish, squids, sea turtles, and marine mammals such as bottlenose dolphins, spotted dolphins, and manatees. The waters in the vicinity of CCAFS are home to several marine species including the loggerhead, green and leatherback sea turtles, dolphins, whales, and manatees. According to the 2010 Supplemental EA, benthic communities made up of marine organisms that live on or near the sea floor, such as bottom dwelling fish, shrimp, worms, snails, and starfish are also present. Essential Fish Habitat includes the waters and substrates necessary for marine species to reach all stages of their life cycle. The waters surrounding CCAFS are classified as Habitat Areas of Particular Concern within the Essential Fish Habitat designation (NOAA, 2010). Coral reefs are not located off of CCAFS (USAF 2009).

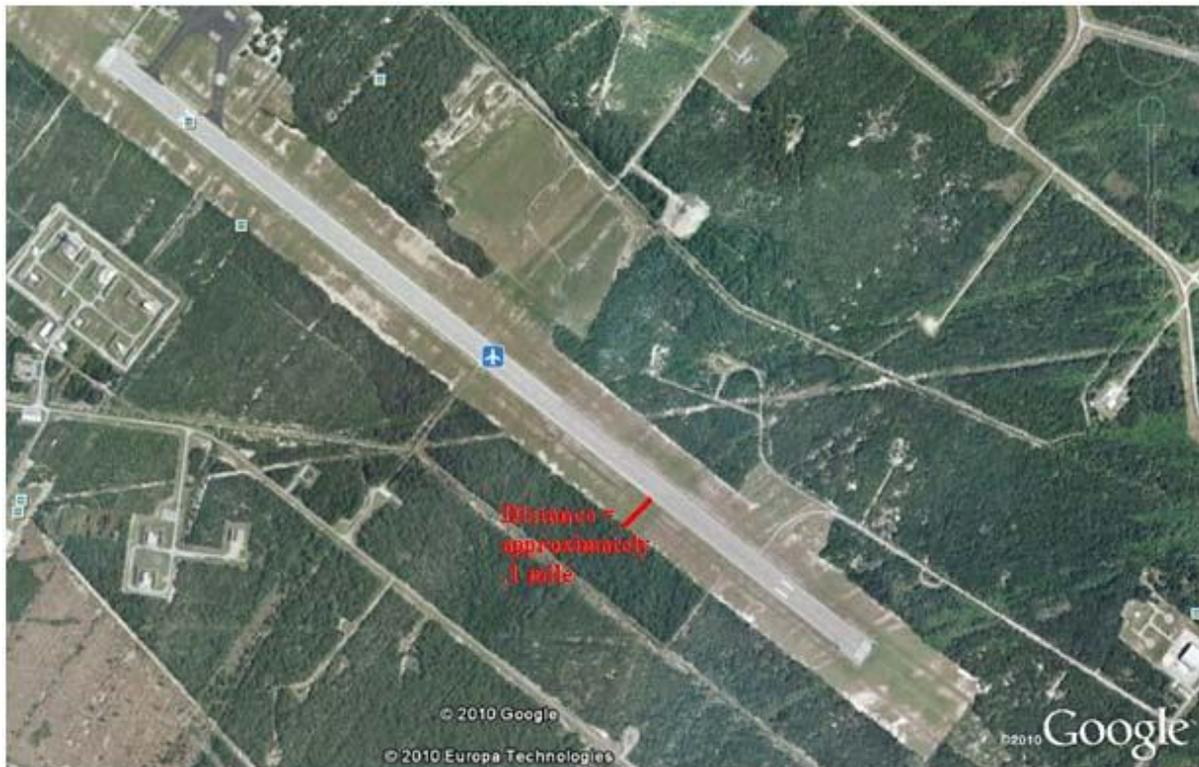
Almost 30 species of mammals inhabit, utilize, or frequent CCAFS, including white-tailed deer, armadillos, bobcats, feral hogs, raccoons, long-tail weasels, the cotton rat, and round-tail muskrats. CCAFS is also home to numerous bird species, both resident and migratory, including those protected at the Federal level by the Migratory Bird Treaty Act (USAF 2009). As stated in the 2010 Supplemental EA, migratory seabird species have been observed nesting on beaches and in the Canaveral National Seashore and Merritt Island National Wildlife Refuge. The Merritt Island Wildlife Refuge overlaps the northwestern portion of the Kennedy Space Center. The Cape Canaveral National Seashore is adjacent to the Merritt Island Wildlife Refuge. Both the Cape Canaveral National Seashore and Merritt Island Wildlife Refuge are located north of CCAFS (FAA, 2010). Other birds commonly occurring in the vicinity of CCAFS include gulls, red-winged blackbirds, mockingbirds, and southeast American kestrel. More than 35 amphibian and reptile species also occur in the area, including the Florida pine snake and several protected species (see discussion below).

### **3.2.2 Plants**

CCAFS is situated on the eastern central coast of Florida on 15,800 acres of a barrier island that separates the Banana River from the Atlantic Ocean. According to the FAA Supplemental Environmental Assessment to the September 2008 Environmental Assessment for Space Florida Launch Site Operator License (2010 Supplemental EA), CCAFS contains wetlands, estuaries, and lagoons and associated vegetation communities, such as the indigenous Florida coastal scrub, coastal and sea grasses, and xeric and maritime hammocks (FAA 2010). The position of these communities on CCAFS reflects the erosional and depositional processes of coastal lands (USAF 2009). The landscape at CCAFS contains a series of ridges and swales already fragmented by construction for previous launch activities.

The majority of the property surrounding the skid strip consists of disturbed, mowed, and maintained vegetation, transitioning into dense native vegetation communities (see Exhibit 3-3 below). There is a maintained vegetation buffer that surrounds the skid strip; it is approximately one-tenth of one mile at its thinnest point (Google Earth 2010).

**Exhibit 3-3. Vegetation Transition in the Vicinity of the Skid Strip**



Source: Google Earth 2010.

**3.2.3 Threatened and Endangered Species**

According to the 2010 Supplemental EA, there is a variety of State and federally protected species known to be found on and in the vicinity of CCAFS (see Exhibit 3-4 below).

**Exhibit 3-4. Threatened and Endangered Species Found in the Vicinity of CCAFS  
(page 1 of 2)**

Common Name	Scientific Name	Status	
		Federal	State
<b>Plants</b>			
Curtiss' milkweed	<i>Asclepias curtissii</i>	-	E
Sand dune spurge	<i>Chamaesyce cumulicola</i>	-	E
Satinleaf	<i>Chrysophyllum oliviforme</i>	-	T
Florida lantana	<i>Lantana depressa var. floridana</i>	-	E
Nodding pinweed	<i>Lechea cernua</i>	-	T
Hand fern	<i>Ophioglossum palmatum</i>	-	E
Nakedwood, Simpson's stopper	<i>Myrcianthes fragrans</i>	-	T
Shell mound prickly-pear cactus	<i>Opuntia stricta</i>	-	T
Beach star	<i>Remirea maritime</i>	-	E
Scaevola, inkberry	<i>Scaevola plumier</i>	-	T
Sea lavender	<i>Tournefortia gnaphalodes</i>	-	E
Coastal vervain	<i>Verbena maritime</i>	-	E

**Exhibit 3-4. Threatened and Endangered Species Found in the Vicinity of CCAFS  
(page 2 of 2)**

Common Name	Scientific Name	Status	
		Federal	State
<b>Reptiles and Amphibians</b>			
American Alligator	<i>Alligator mississippiensis</i>	T (S/A)	SSC
Atlantic Loggerhead Turtle	<i>Caretta caretta</i>	T	T
Atlantic Green Turtle	<i>Chelonia mydas</i>	E	E
Leatherback Turtle	<i>Dermochelys coriacea</i>	E	E
Atlantic Ridley Sea Turtle	<i>Lepidochelys kemp</i>	E	E
Hawksbill Turtle*	<i>Eretmochelys imbricate</i>	E	E
Gopher Tortoise	<i>Gopherus polyphemus</i>	-	T
Eastern Indigo Snake	<i>Drymarchon corais couperi</i>	T	T
Florida Pine Snake	<i>Pituophis melanoleucus mugitus</i>	-	SSC
Florida gopher frog	<i>Rana capito aesopus</i>	-	SSC
<b>Birds</b>			
Roseate Spoonbill	<i>Ajaia ajaja</i>	-	SSC
Florida Scrub-Jay	<i>Aphelocoma coerulescens</i>	T	T
Piping Plover	<i>Charadrius melodus</i>	T	T
Little Blue Heron	<i>Egretta caerulea</i>	-	SSC
Reddish Egret	<i>Egretta rufescens</i>	-	SSC
Snowy Egret	<i>Egretta thula</i>	-	SSC
Tricolored Heron	<i>Egretta tricolor</i>	-	SSC
White Ibis	<i>Eudocimus albus</i>	-	SSC
Arctic Peregrine Falcon	<i>Falco peregrines tundrius</i>	-	E
Southeastern American Kestrel	<i>Falco sparverius paulus</i>	-	T
American Oystercatcher	<i>Haematopus palliatus</i>	-	SSC
Wood Stork	<i>Mycteria Americana</i>	E	E
Brown Pelican	<i>Pelecanus occidentalis</i>	-	SSC
Black Skimmer	<i>Rynchops niger</i>	-	SSC
Least Tern	<i>Sterna antillarum</i>	-	T
<b>Mammals</b>			
Right Whale*	<i>Balaena glacialis</i>	E	E
Sei Whale*	<i>Balaenoptera borealis</i>	E	E
Finback Whale*	<i>Balaenoptera physalus</i>	E	E
Humpback Whale*	<i>Megaptera novaeangliae</i>	E	E
Gray Bat*	<i>Myotis grisescens</i>	E	E
Southeastern Beach Mouse	<i>Peromyscus poliontus niveiventris</i>	T	T
Florida Mouse	<i>Podomys floridanus</i>	-	SSC
Florida Manatee	<i>Trichechus manatus</i>	E	T

Source: USAF 2009.

SSC – Species of Special Concern

T – Threatened

E – Endangered

S/A – Similar in Appearance (to the federally listed endangered species, the American crocodile)

\* – Not observed on CCAFS, but known to occur in the vicinity

For instance, loggerhead sea turtles are currently listed as federally threatened throughout their range. A Proposed Rule notice published in the Federal Register on March 16, 2010, announced the joint determination of the National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) that the Loggerhead sea turtle globally comprises nine distinct population segments (DPSs) that qualify as “species” for listing as endangered or threatened under the Endangered Species Act (ESA), and that two DPSs should be proposed for listing as threatened and seven DPSs including the Northwest Atlantic Ocean should be proposed for listing as endangered (50 CFR Parts 223 and 224 Endangered and Threatened Species; Proposed Listing of Nine Distinct Population Segments of Loggerhead Sea Turtles as Endangered or Threatened). The NMFS and USFWS solicited public comments on this proposal; the comment period closed on September 13, 2010.

According to the 2010 Supplemental EA, the federally threatened Florida scrub-jay occupies coastal strand vegetation in the vicinity of CCAFS. The State-threatened least terns have been known to nest on gravel beaches near CCAFS, and federally threatened piping plovers may occur on CCAFS beaches during the non-breeding season. The federally endangered wood stork has also been observed feeding in the CCAFS drainage canal system.

Federally and State listed as a threatened species, the Eastern indigo snake has been identified throughout CCAFS (FAA 2010). These snakes are strongly associated with high, dry, well-drained sandy soils, closely paralleling the dune habitat preferred by gopher tortoises. The gopher tortoise, State-listed as threatened, is found in high densities on CCAFS. 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. The American alligator is federally listed as threatened because of its similarity in appearance to another endangered species, the American crocodile, which is not found in Brevard County. Several alligators have been observed in the drainage canals on CCAFS.

Five species of federally protected sea turtles (Hawksbill, Loggerhead, Leatherback, Kemp’s Ridley and Green) have been observed in the waters offshore at CCAFS and all but the Hawksbill and Kemp’s Ridley are known to nest on beaches around CCAFS.

The federally threatened southeastern beach mouse is found along the entire reach of coastline on CCAFS, mostly within areas of coastal dune and coastal strand vegetation.

The federally endangered West Indian manatee can also be found in the Banana River along the western boundary of CCAFS. Sections of the Upper Banana River are designated as State Manatee Protection Areas. Manatees inhabit salt-water lagoon systems, and the USFWS has designated the Indian and Banana Rivers as Critical Habitat for the manatee. The USFWS has not formally designated Critical Habitat for any federally listed species at CCAFS.

### **3.3 Compatible Land Use**

The area surrounding the skid strip has been extensively disturbed by development, including active and inactive launch complexes, roads, and launch support facilities. Port operations south of the skid strip include commercial and industrial facilities. There are also industrial support facilities for CCAFS located west of the skid strip along the Banana River. There are no receptor areas with sensitivity to light or noise near the skid strip at CCAFS. The closest residential areas to CCAFS are approximately 5 miles from the skid strip.

### **3.4 Department of Transportation Act Section 4(f) Resources**

According to FAA Order 1050.1E, Change 1, Department of Transportation 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, State, or local significance as determined by the officials having jurisdiction over the 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. As defined in 49 U.S.C. § 303 (c), impairment of a resource occurs when impacts are sufficiently serious such that the value of the site in terms of its prior significance and enjoyment are substantially reduced or lost.

Numerous public parks, recreation areas, and wildlife refuges are located outside of CCAFS (FAA 2008). The Merritt Island Wildlife Refuge overlaps the northwestern portion of the Kennedy Space Center. The Cape Canaveral National Seashore is adjacent to the Merritt Island Wildlife Refuge and is operated by the National Park Service. However, there are no Department of Transportation Act Section 4(f) designated properties, including public parks, recreation areas, or wildlife refuges within the boundaries of CCAFS.

### **3.5 Hazardous Materials, Pollution Prevention, and Solid Waste**

Numerous types of hazardous materials are currently used at CCAFS to support the various missions and general maintenance operations (USAF 2000). These include, but are not limited to, petroleum products, oils, lubricants, volatile organic compounds, corrosives, refrigerants, adhesives, sealants, epoxies, and propellants (USAF 2000). There are no sites at CCAFS currently listed or under consideration for listing on the National Priorities List (EPA 2010d).

Hazardous materials are managed using a HazMat Pharmacy, also known as HAZMART, at CCAFS (USAF 2007, 2006). Orbital Sciences Corporation would be responsible for developing its own Hazardous Waste Management Plan in accordance with the 45th Space Wing Hazardous Management Plan to document how they would control hazardous wastes for the Pegasus vehicle (USAF 2007, 2006).

Individual contractors and organizations maintain their own hazardous waste satellite accumulation points and 90-day hazardous waste accumulation areas in accordance with the Resource Conservation and Recovery Act (USAF 2007, 2006). 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. The licensee 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, 2006).

Solid waste consists of everyday items of refuse in solid, liquid, semi-solid, and contained gaseous form. These items are routinely disposed of through transport to local landfills in accordance with CCAFS solid waste disposal practices.

### **3.6 Historical, Architectural, Archaeological, and Cultural Resources**

Cultural resources include prehistoric and historic archaeological sites, buildings, districts, structures, landscapes, or objects having historical, architectural, archaeological, cultural, or scientific importance. CCAFS has been extensively evaluated for its historical, archaeological

and cultural resources, some of which date to prehistoric times. The CCAFS National Historic Landmark District is comprised of six discontinuous properties including the Old Mission Control Center (Facility 1385) and Launch Complexes 5/6, 14, 19, 26 and 34 (USAF 2009). While there are cultural resources on CCAFS, there are no cultural resources in the vicinity of the skid strip.

### **3.7 Noise**

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.

CCAFS is a relatively isolated facility. The closest residential communities to CCAFS are the City of Merritt Island, located approximately 7 miles to the east-southeast, and the City of Cape Canaveral, located approximately 7 miles to the south. Ambient noise levels in these communities are normally low, with higher noise levels occurring in the communities' industrial areas (60 to 80 dBA), and lower noise levels (normally about 45 to 55 dBA occurring in residential areas and along beaches.

Infrequent aircraft fly-overs and rocket launches from CCAFS and Kennedy Space Center currently increase noise levels for short periods of time (FAA 2010). Launch noise includes both noise resulting from ignition of launch vehicle engines as well as sonic booms produced as launch vehicles reach supersonic speeds (FAA 2010). A sonic boom is a shock wave generated by an object moving at or faster than the speed of sound. Once the wave reaches the ground, a boom is perceived. Sonic boom magnitudes are typically presented in terms of pounds per square foot. Typical launch trajectories from CCAFS result in sonic booms occurring to the east of CCAFS produced at high altitudes over the Atlantic Ocean. Other noise sources resulting from industrial operations are present in the vicinity of CCAFS, but these sources are considered minor in comparison to launch noise.

### **3.8 Socioeconomic Impacts**

CCAFS is located in eastern Brevard County, Florida. Brevard County had an estimated population of 536,357 people in 2009 (USCB 2010).

In the area surrounding CCAFS, over 250,000 people are in the workforce, with over 45 percent of the population between the ages of 20 and 54. The median household income is just over \$49,000, and roughly 28 percent of households earn an income of \$75,000 or more. In Brevard County, Florida, the most common type of work is in professional and business services (16.9 percent), followed by education and health services (14.7 percent), government (14.0 percent), and retail trade (12.9 percent). The racial composition of the county is predominately White (85.6 percent) with 10.1 percent Black, 7.2 percent Hispanic, and 2 percent Asian. Unemployment rates have steadily risen since 2006 from 3.3 percent to 6.5 percent in 2008 (Economic Development Commission 2009).

### **3.9 Water Quality (Including Floodplains and Wetlands)**

CCAFS is located within the Florida Middle East Coast Basin and situated on a barrier island that separates the Banana River from the Atlantic Ocean.

In addition to the Banana River, there are several other surficial water resources at CCAFS. These resources include impoundments, drainage canals, borrow pits, freshwater wetlands, mangrove wetlands, and salt marsh wetlands (USAF 2009). The surficial and Floridian aquifer systems underlie CCAFS (USAF 1998). CCAFS contains portions of land that are located within in the 100-year floodplain; however, the area in which the skid strip is located is outside of the 500-year floodplain (FEMA 2010; USAF 2009).

## 4. ENVIRONMENTAL CONSEQUENCES

### 4.1 Proposed Action

The 2001 PEIS evaluated the impacts of launching small capacity rockets, including the Pegasus launch vehicle family, 72 times over a 10-year period. The FAA's Proposed Action would not exceed the scope of the analysis from the 2001 PEIS. The data and analyses in the 2001 PEIS remain current and substantially valid. As detailed in the sections below, the FAA used the 2001 PEIS data and analyses, as well as other recent FAA impact analyses (such as the FAA 2010 Supplemental EA for the Space Florida Launch Site Operator License), to perform the analyses to determine whether any significant potential environmental impacts would result from the Proposed Action.

#### 4.1.1 Air Quality

In the lower atmosphere, emissions associated with combustion of fuel during takeoff and landing of the L-1011 carrier aircraft (see Exhibit 4-1) could result in short-term impacts to local air quality by contributing to the production of smog and acid rain.

#### **Exhibit 4-1. L-1011 Carrier Aircraft Emissions from Takeoff and Landing Cycle**

Activity	Emissions, lbs/launch				
	CO	HC	NO <sub>x</sub>	SO <sub>x</sub>	PM
L-1011 Landing/Takeoff Cycle	708	498	126	13	NA

Source: USAF 1994a.

However, L-1011 emissions do not differ substantially from other aircraft currently flying in the vicinity of CCAFS, and the impact of a single aircraft on local air quality would be indistinguishable from the impact of ongoing flight operations at CCAFS. Brevard County is currently in attainment for all criteria pollutants, and emissions from the L-1011 would be indistinguishable from ongoing flight operations in the area; therefore, emissions resulting from the L-1011 aircraft would be expected to have negligible impacts on local air quality.

Because the Pegasus vehicle is launched from the L-1011 aircraft operating in the stratosphere (approximately 40,000 feet altitude and approximately 90 miles off the Florida coast over the Atlantic Ocean) all propellant emissions would occur in the upper atmosphere as opposed to beginning at ground level as with the GLV. Emissions from the Pegasus vehicle would have no air quality impacts at ground level because emissions released above the atmospheric mixing height (nominally 3,000 feet altitude) do not disperse down to ground level. In addition, solid propellant vehicle emissions produced during ignition of the Pegasus vehicle's rocket motors could result in exhaust emissions of aluminum oxide particles, carbon monoxide, hydrogen chloride, nitrogen gas, water, and carbon dioxide. Even if the Pegasus launch vehicle were ground launched from CCAFS, there would be no significant impacts. Previous analyses have considered impacts to air quality resulting from operation of larger ground-launched vehicles at CCAFS (FAA 2010). One such example is the Generic Launch Vehicle (GLV), a conceptual vehicle used to encompass the attributes of a variety of launch vehicles which operate at CCAFS. The GLV is a ground-launched liquid propellant medium class launch vehicle with a solid propellant second stage and four strap-on Graphite-Epoxy Motor 40 solid rocket motors. In total, this vehicle carries 131,504 pounds of solid rocket propellant between the four strap-on motors and the second stage of the vehicle. The Pegasus vehicle would carry a total of

approximately 43,451 pounds of solid rocket propellant in its three engine stages. In comparison, the GLV would carry almost three times as much solid propellant as the Pegasus vehicle. As a result, any impacts from launch vehicle emissions would be expected to be greater for the GLV than for the Pegasus vehicle.

The 2001 PEIS estimated the total amount of CO<sub>2</sub> emissions from all launches into the troposphere for the period 2000-2010 to be approximately 25,000 tons. This estimate included vehicles of all weight classes (small, medium, intermediate, and high) and over 261 launches. In comparison, the total CO<sub>2</sub> emissions from all sources in the U.S. were 5,687 million tons in 1994. Even if all 261 launches analyzed in the 2001 PEIS occurred in one year, based on 1994 CO<sub>2</sub> emission levels, these launches would only be a very small fraction (less than 0.00005%) of the total CO<sub>2</sub> emissions. Consequently, the CO<sub>2</sub> emission effects from launch vehicles on global warming would be insignificant (FAA 2001).

Analyses of impacts to air quality associated with 12 launches per year of the GLV at CCAFS concluded that, because launches would be infrequent and because emissions within the lower atmosphere would be of very short duration and would disperse rapidly, total potential emissions of any criteria pollutants would not be expected to cause exceedances of the NAAQS or the Florida Ambient Air Quality Standards (FAA 2010). These analyses concluded that pollutant concentrations resulting from launch of the GLV would not exceed the NAAQS. Similarly, the launch of the Pegasus vehicle would also not be expected to exceed these standards.

In the upper atmosphere, emissions of greenhouse gases and ozone depleting substances such as CO<sub>2</sub> and water vapor can contribute to global climate change. Previous analyses have also considered impacts to the upper atmosphere resulting from operation of the GLV. These analyses concluded that the incremental contribution of emissions from the GLV would be extremely small and would result in a negligible impact on global climate change. The impacts from the launch of the Pegasus vehicle would be less than those of the GLV because the quantity of propellant burned by the Pegasus vehicle is much smaller. As a result, the Pegasus vehicle would also be expected to result in a negligible impact on global climate change.

Launch failures such as vehicle destruction on the runway, in-flight failure, and commanded vehicle destruction could also result in impacts to air quality. Air pollutants generated by a launch failure would be similar to those generated by a normal launch, except that quantities and concentrations would be undetermined. With the exception of a runway accident, emissions would be generated at high altitude over the open ocean and thus dilution of pollutants would occur before detection at ground level. As a result, launch accidents would be expected to result in only short-term impacts to ambient air quality (USAF 1991b).

Overall, the issuance or renewal of Launch Operator Licenses for Pegasus operations at CCAFS would not result in potential impacts related to air quality.

#### **4.1.2 Biological Resources (Including Fish, Wildlife, and Plants)**

##### **4.1.2.1 Fish and Wildlife**

The spent stages from the Pegasus vehicle would be jettisoned in the open waters of the Atlantic Ocean. There is a remote possibility that jettisoned stages of the Pegasus launch vehicle could strike a marine animal. The probability of such a strike was approximated in the 2001 PEIS and results indicate an extremely small chance of a launch vehicle or jettisoned stage contacting a marine mammal. Jettisoned stages from the Pegasus launch vehicle would fall into the ocean and sink to the ocean floor. Corrosion of stage hardware would contribute various metal ions to

the water column (USAF 1988). Because of the slow rate of corrosion in the deep ocean environment and the large volume of water available for dilution, toxic concentrations of metals would not be likely. Residual amounts of propellant could be released in the water column. However, because the vehicle stages are designed for full burn, any residual amount of propellant would be expected to be negligible. In the event of an accidental release of unburned solid rocket propellant, due to the natural buffering ability of the ocean, any unburned propellant would be diluted and dispersed and would not be expected to harm marine life (FAA 2009b).

A launch failure of a Pegasus vehicle with the additional HAPS stage could cause a release of hydrazine into the water column. However, the released hydrazine would quickly oxidize forming amines and amino acids. Hydrazine is acutely toxic to aquatic life, but the amino acids are soluble substances, and only local impacts would be expected due to the small volume of the propellant in comparison to the surrounding ocean waters. The oxidized hydrazine would be dispersed and have negligible impacts on marine species (FAA 2001).

The Pegasus vehicle would generate sonic booms at altitudes in excess of 40,000 feet and it is possible that the sonic booms would reach the ocean surface and possibly reach underwater depths. These types of booms represent a threat of physical and physiological impairment to marine animals in the vicinity of the water surface (FAA 2001). However, at this depth they would be well attenuated and would not be expected to negatively impact any marine species because of their low frequency, the low density of marine species in the ocean's surface water, and the distance of the sonic boom footprint from CCAFS.<sup>3</sup> Pegasus launches would be infrequent, sonic boom impacts would be less than significant, and a direct strike would be unlikely. The Proposed Action would be expected to result in negligible impacts to marine wildlife.

There would be little or no impacts to terrestrial animals under the Proposed Action because the Pegasus vehicle would be launched over the open ocean at a distance of approximately 90 nautical miles from shore (FAA 2009b). CCAFS is an active air station with existing launch activities and aircraft operations, therefore jet engine noise from takeoff and landing of the L-1011 launch vehicle would not adversely impact birds and mammals. Propane air cannons were recently installed at the CCAFS skid strip to minimize bird collisions with aircraft. Air cannons are active wildlife control devices. The air cannon system is used to scare birds away from the skid strip prior to aircraft takeoff and landing to minimize impacts to birds and damage to the aircraft (USAF 2009a). Additionally, because there would be no construction activities or modification to the surrounding area and a limited number of launches, the Proposed Action would result in negligible impacts to terrestrial wildlife.

The Proposed Action would not be expected to impact species that are federally protected or protected under Florida state law. Although noise would be produced as a result of the Proposed Action, the only noise that would reach protected terrestrial species would be from the takeoff and landing of the L-1011 aircraft. The noise produced by the takeoff and landing of the L-1011 is not different from that of other aircraft routinely using the CCAFS skid strip. The sonic booms from the launch of the Pegasus vehicle would take place at altitudes in excess of 40,000 feet, over 90 nautical miles off the coast of CCAFS. No other aspects of the launch would have the potential to impact protected species on the ground.

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<sup>3</sup> The sonic boom footprint is the region at surface level that is affected by the sonic boom. The actual shape and size of the sonic boom footprint is influenced by weather and atmospheric conditions as well as the size and altitude of the aircraft and any changes in its speed or direction.

The issuance or renewal of Launch Operator Licenses for Pegasus operations at CCAFS would not result in potential impacts related to terrestrial vegetation and wildlife, marine species, or protected species.

#### **4.1.2.2 Plants**

No construction would be required to support the Proposed Action, and therefore no direct impacts would be expected to vegetation. In addition, launch of the Pegasus vehicle would occur approximately 90 nautical miles offshore and would not result in damage to vegetation.

#### **4.1.3 Compatible Land Use**

Takeoff of the L-1011 aircraft would use existing infrastructure at the skid strip, and release of the Pegasus vehicle would occur over the Atlantic Ocean, approximately 90 nautical miles offshore, at an altitude of approximately 40,000 feet. Implementation of the Proposed Action would conform to the designated land uses at CCAFS, and would not change any planned or existing land use designations.

The issuance or renewal of Launch Operator Licenses for Pegasus operations at CCAFS would not result in potential impacts related to compatible land use.

#### **4.1.4 Department of Transportation Act Section 4(f) Resources**

Pegasus launch operations would not result in impacts to Section 4(f) resources in the vicinity of CCAFS because launch activities would not result in substantial impairment of Section 4(f) properties. The Pegasus vehicle is air-launched; therefore, ignition of the engines on the Pegasus vehicle would not take place until the launch vehicle is released over the open ocean at an altitude of approximately 40,000 feet. This would take place approximately 90 nautical miles off the Florida coastline and away from Department of Transportation Act Section 4(f) resources; therefore, the Proposed Action would not be considered a constructive or physical use of Section 4(f) properties.

The issuance or renewal of Launch Operator Licenses for Pegasus operations at CCAFS would not result in potential impacts related to Department of Transportation Act Section 4(f) Resources located in the vicinity of CCAFS.

#### **4.1.5 Hazardous Materials, Pollution Prevention, and Solid Waste**

The only hazardous materials used under the Proposed Action would be propellants for the Pegasus vehicle. As described in Section 2.1, FAA-certified fuels (i.e., hazardous materials) would be used by the L-1011 aircraft. 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.

All hazardous materials and hazardous waste would be handled and disposed of in accordance with the CCAFS Environmental Standards and Safety Standards. Individual contractors operating out of CCAFS are required to have a Spill Prevention Control and Countermeasure (SPCC) Plan and Stormwater Pollution Prevention (SWPP) Plan in place, as applicable under the Federal regulations. If an individual contractor is not required under Federal regulations to have a site-specific SPCC or SWPP Plan, then the 45th Space Wing Comprehensive Emergency Management Plan (10-2, Volume II, Hazardous Materials Emergency Planning and Response) would be enacted. The licensee would be responsible for compliance with all applicable State and EPA reporting requirements.

The Proposed Action would not be expected to generate more hazardous waste than can be safely managed by CCAFS, and existing hazardous waste management plans would not be expected to change (FAA 2008). Orbital Sciences Corporation would adhere to all applicable Federal, State, local, and USAF rules and regulations concerning the storage, handling, usage, transportation, and disposal of hazardous materials and hazardous wastes; therefore, no impacts on hazardous waste management would be expected.

The amount of solid waste generated at CCAFS could increase slightly under the Proposed Action. The amount of solid waste generated would be handled under existing collection and disposal operations. Given the relative infrequency of anticipated launches under the Proposed Action no impacts to solid waste disposal is expected.

The issuance or renewal of Launch Operator Licenses for Pegasus operations at CCAFS would not result in potential impacts related to the prevalence of hazardous materials or wastes, spills, or solid waste.

#### **4.1.6 Historical, Architectural, Archeological, and Cultural Resources**

The Proposed Action would not require any construction or modification at CCAFS for the skid strip or related facilities. The Proposed Action would not result in any ground-disturbing activities, and there are no historic or tribal sites of significance at the skid strip. As the launch of the Pegasus vehicle would take place over the open ocean, an accident would not likely affect nearby historic resources.

Because the Proposed Action would not result in any ground-disturbing activities, removal, alteration, or physical impingement of any archaeological or historical resources at CCAFS, the issuance or renewal of Launch Operator Licenses for Pegasus operations at CCAFS would not result in potential impacts on historical, architectural, archeological, and cultural resources.

#### **4.1.7 Noise**

The most noticeable noise produced during Pegasus vehicle launches would be noise generated by the L-1011 carrier aircraft during takeoff and landing. L-1011 noise levels do not differ substantially from other aircraft currently flying in the vicinity of CCAFS. In addition, the number of proposed launches is small compared with existing aircraft operations at CCAFS, and there would be little to no noise impact of the L-1011 (related to Pegasus launches) on nearby communities. Personnel in the vicinity of the skid strip could be exposed to high noise levels during takeoff and landing. However, all personnel would be required to wear adequate hearing protection to comply with the U.S. Occupational Safety and Health Administration's standards for noise exposure, and therefore these impacts would be negligible (FAA 2010).

The Pegasus vehicle is air-launched from the L-1011 at an altitude of 40,000 feet and approximately 90 nautical miles offshore. At this altitude, noise generated from ignition of the rocket motors on the Pegasus vehicle and sonic booms produced during vehicle flight would be minor due to distance attenuation and atmospheric absorption. The potential impact of sonic booms on wildlife is discussed in Section 4.1.2.

The issuance or renewal of Launch Operator Licenses for Pegasus operations at CCAFS would not result in potential impacts related to noise levels.

#### **4.1.8 Socioeconomic Impacts**

Each launch of the Pegasus vehicle could require up to 15 non-local professional support staff. The staff would be required onsite for a period of time not to exceed one or two months. The personnel would contribute to, but would not noticeably increase the demand for existing services, including hotels, restaurants, and transportation. The 15 staff would not be noticeable to the community, as Brevard County is a popular vacation destination, which hosts tourists and visitors throughout the year. Hotels near the launch site have successfully managed short-term increases in demand due to launches of the Space Shuttle at the adjacent Kennedy Space Center and other high profile launch events at CCAFS; however, no such increase in demand is anticipated under the Proposed Action.

The Proposed Action would not necessitate the relocation of local residents or businesses. Because the Pegasus vehicle is launched at a distance of over 90 nautical miles from shore, tourism to witness the launch is not anticipated. Therefore, no impacts on local traffic patterns or demand for lodging, restaurants, emergency services, and transportation-based services are expected surrounding launch activities. Traffic in the county would not be materially affected during pre- and post-launch activities due to the temporary staff required to support launch activities.

The issuance or renewal of Launch Operator Licenses for Pegasus operations at CCAFS would not result in socioeconomic impacts.

#### **4.1.9 Water Quality (Including Floodplains and Wetlands)**

No potential impacts to any water resources in the area surrounding the skid strip at CCAFS are expected. The L-1011 aircraft takeoff and landing activities are not expected to be different from the impacts of other aircraft that routinely takeoff and land at CCAFS. In addition, the Pegasus vehicle arrives at CCAFS fully mated, encapsulated and fueled.

The Proposed Action would not result in any impact to groundwater quality or characteristics because the Pegasus vehicle is launched at a distance of over 90 nautical miles offshore, away from any groundwater resources. There would be no ground disturbance associated with the Proposed Action, and existing surface drainage patterns would not be impacted. The Proposed Action would take place within an area of land that is outside of the 500-year floodplain and does not include any wetlands. No resulting impacts to floodplains or wetlands are anticipated under the Proposed Action.

The potential release of pollutants or jettisoned stages during the launch would occur over the open ocean. Therefore, such a release would have a negligible impact on the water quality of the Atlantic Ocean. A launch failure for a Pegasus vehicle with the additional HAPS phase poses the potential for hydrazine to be introduced to surface water. However, the accidental release of hydrazine would be expected to be quickly dispersed and have a negligible impact on the water quality of the Atlantic Ocean.

Pre-launch anomalies and other accidental spillage of hazardous materials contained in the Pegasus vehicle could result in impacts on floodplains and wetlands, due to contamination from the rocket propellant. In the unlikely occurrence of a pre-launch anomaly or other accidental spill, propellant could enter nearby water bodies. Emergency response and clean-up procedures would reduce the magnitude and duration of any impacts (FAA 2008).

Because the issuance or renewal of Launch Operator Licenses for Pegasus operations at CCAFS would not result in potential impacts to surface water, groundwater, wetlands, or floodplains surrounding the skid strip, the Proposed Action would not result in impacts to water quality.

## **4.2 Cumulative Impacts**

Past, present and reasonably foreseeable actions at CCAFS and the surrounding area include ongoing and future aircraft and rocket launch operations at CCAFS and facilities in the vicinity of CCAFS such as Kennedy Space Center and Patrick Air Force Base. These actions, considered in conjunction with the Proposed Action, formed the basis for the cumulative impacts analysis.

The Proposed Action could result in a minor, temporary increase in air emissions in the vicinity of CCAFS as a result of the L-1011 landing/take off cycles. These emissions would be infrequent and temporary, and when combined with emissions from existing and potential future aircraft and rocket launch operations in the area, would not affect local attainment levels for any NAAQS. In addition, while Pegasus launch operations would produce emissions of greenhouse gases and ozone depleting substances, these emissions would be extremely small in the context of national and global emissions and occur 90 nautical miles from shore, over the Atlantic Ocean. As a result, the incremental contribution to cumulative air quality impacts from Pegasus launch operations would be negligible (FAA 2008).

The noise generated from Pegasus launch operations would be infrequent and would be similar to the types of noise routinely generated at CCAFS and surrounding areas. When combined with other noise producing activities in the vicinity of CCAFS, little to no impact would be expected. Because of the altitude at which launch noise and sonic booms would be generated, the infrequency of the Pegasus vehicle launches under the Proposed Action, and because they would be produced at a distance of 90 nautical miles from shore, this noise would not be expected to contribute to impacts to biological resources on or in the vicinity of CCAFS and surrounding waters. As a result, the incremental contribution to cumulative noise impacts from Pegasus launch operations would be negligible.

Because the Proposed Action will not impact compatible land use; Department of Transportation Act Section 4(f) resources; plants; hazardous materials, pollution prevention, and solid waste; historical, architectural, archaeological, and cultural resources; socioeconomic; and water quality at CCAFS, the Proposed Action will not contribute to cumulative impacts for these resources.

## **4.3 No Action Alternative**

Under the No Action Alternative, the FAA would not issue or renew Launch Operator Licenses for Orbital Sciences Corporation to operate Pegasus vehicles at CCAFS. Under this Alternative, there would be no commercial launches of the Pegasus launch vehicle from CCAFS. Impacts from commercial Pegasus operations would not occur to: air quality; biological resources (including fish, wildlife, and plants); compatible land use; Department of Transportation Section 4(f) resources; hazardous materials, pollution prevention, and solid waste; historical, architectural, archaeological, and cultural resources; noise; socioeconomic impacts; and water quality (including floodplains and wetlands) and cumulative impacts; however, impacts resulting from existing activities at CCAFS would continue.



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