Federal Aviation Administration

Environmental Assessment for Pegasus Launches at the U.S. Army Kwajalein Atoll Ronald Reagan Ballistic Missile Defense Test Site

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Environmental Assessment for Pegasus Launches at the U.S. Army Kwajalein Atoll Ronald Reagan Ballistic Missile Defense Test Site

AGENCY: Federal Aviation Administration (FAA), lead agency; U.S. Army, cooperating agency

ABSTRACT: The Environmental Assessment (EA) for Pegasus Launches at the U.S. Army Kwajalein Atoll Ronald Reagan Ballistic Missile Defense Test Site (USAKA/RTS) addresses the potential environmental impacts of the FAA's Proposed Action of renewing Orbital Sciences Corporation's Launch Operator License for launch operations of the Pegasus expendable launch vehicle family at the USAKA/RTS in the Republic of the Marshall Islands. Potential environmental impacts of the Proposed Action and No Action Alternative analyzed in detail in the EA include impacts to air quality; biological resources; hazardous materials, pollution prevention, and solid waste; noise; and water resources (surface water, groundwater, floodplains, and wetlands). Potential cumulative impacts of the Proposed Action are also addressed in the EA. The EA found that there would be no significant impacts to any of the resource areas analyzed as a result of renewing Orbital Sciences Corporation's Launch Operator License for launch operations of the Pegasus expendable launch vehicle family at the USAKA/RTS. A Finding of No Significant Impact (FONSI) has been included in the EA.

CONTACT INFORMATION: Questions regarding the EA or FONSI for Pegasus Launches at the USAKA/RTS can be addressed to Mr. Daniel Czelusniak, Environmental Protection Specialist, Federal Aviation Administration, 800 Independence Avenue, SW, Suite 331, Washington, DC 20591; e-mail Daniel.Czelusniak@faa.com; or telephone (202) 267-5924.

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

Responsible FAA Official:

6/25/09

Dr. George Nield
Associate Administrator for Commercial Space Transportation

Date

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration
Office of Commercial Space Transportation; Finding of No Significant Impact

AGENCY: Federal Aviation Administration (FAA), Department of Transportation (DOT)

ACTION: Finding of No Significant Impact

SUMMARY: Orbital Sciences Corporation has applied to the FAA for renewal of a Launch Operator License (license number LLO 04-069) for operation of the Pegasus expendable launch vehicle at the U.S. Army Space and Missile Defense Command Kwajalein Atoll Ronald Reagan Ballistic Missile Defense Test Site (USAKA/RTS) in the Republic of the Marshall Islands. The proposed license would expire 5 years from issuance unless surrendered, suspended, or revoked. Following the license period, a license renewal would require additional environmental review. Renewing a license is considered a major Federal action subject to environmental review under the National Environmental Policy Act of 1969, as amended (NEPA; 42 U.S.C. 4231, *et seq.*). The FAA prepared the *Environmental Assessment for Pegasus Launches at the U.S. Army Kwajalein Atoll Ronald Reagan Ballistic Missile Defense Test Site* (the 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 renewing LLO 04-069. The U.S. Army was a cooperating agency in the development of the EA.

After reviewing and analyzing available data and information on existing conditions and potential impacts, the FAA has determined that renewing Orbital Sciences Corporation's Launch Operator License for launch operations of the Pegasus expendable launch vehicle family 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 this Finding of No Significant Impact. The FAA made this determination in accordance with all applicable environmental laws.

FOR A COPY OF THE EA OR FONSI: Visit the following internet address: http://www.faa.gov/about/office_org/headquarters_offices/ast/licenses_permits/launch_site/environmental/ or contact Mr. Daniel Czelusniak, Environmental Protection Specialist, Federal Aviation Administration, 800 Independence Avenue, SW, Room 331, Washington, D.C. 20591. You may also send e-mail requests to Daniel.Czelusniak@faa.gov or via telephone to (202) 267-5924.

PURPOSE AND NEED: The purpose of the FAA's Proposed Action of renewing Orbital Sciences' Launch Operator License for launch operations of the Pegasus launch vehicle family is to ensure compliance with the international obligations of the U.S. and protect the public health and safety, safety of property, and national security and foreign policy interest of the U.S. during commercial launch or reentry activities. This action would also encourage, facilitate, and promote commercial space launches and re-entries by the private sector; and to facilitate the strengthening and expansion of the U.S. space transportation infrastructure, in accordance with

the requirements of the Commercial Space Launch Amendments Act of 2004 (Public Law 108-492); the Commercial Space Transportation Competitiveness Act of 2000 (Public Law 106-405); Executive Order 12465, *Commercial Expendable Launch Vehicle Activities* (February 24, 1984); Code of Federal Regulations (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 1996 and 2006.

The need for the action is to allow the continued operation of the Pegasus launch vehicles 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.

PROPOSED ACTION: Orbital Sciences Corporation has applied to the FAA for renewal of LLO 04-069. Under the Proposed Action (the preferred alternative), the FAA would renew Orbital Sciences Corporation's Launch Operator License for launch operations of the Pegasus expendable launch vehicle family from USAKA/RTS in the Republic of the Marshall Islands.

The Pegasus expendable launch vehicle consists of three graphite epoxy case solid rocket propellant motor stages with an optional liquid propellant-based Hydrazine Auxiliary Propulsion System (HAPS) fourth stage and is designed to be carried to its launch point by an L-1011 Launch Carrier Aircraft (LCA). The L-1011 LCA, which consists of FAA-approved standard engines, uses Commercial Jet-A or Military JP4 or JP10 fuel. Pre-launch and mating activities would occur at Vandenberg Air Force Base (VAFB) under LLO 00-053. A separate environmental review was conducted in conjunction with the approval of LLO 00-053. Therefore, pre-launch Pegasus processing operations are not included under this Proposed Action.

The L-1011 LCA and mated Pegasus launch vehicle would travel to USAKA/RTS and land on an existing runway. Once on the ground at USAKA/RTS, the L-1011 LCA would be refueled and systems would be checked. Concurrently, an advisory to nearby ships and aircraft would be issued. The L-1011 LCA and mated Pegasus launch vehicle would takeoff and travel under jet power to the launch area over the Pacific Ocean. At an altitude of 35,000 feet, the L-1011 LCA would release the Pegasus launch vehicle and return to a designated runway at USAKA/RTS. The Pegasus vehicle would free fall for 5 seconds before the first stage motor ignites. As described in the Environmental Assessment of Pegasus Air-launched Space Booster from Edwards AFB/Western Test Range, CA (the 1989 EA), the first stage of the Pegasus vehicle would burn for approximately 77 seconds following ignition while propelling the vehicle to an altitude of approximately 223,000 feet. The spent first stage would detach and fall to the ocean. The second stage motor would ignite and burn for approximately 83 seconds carrying the vehicle and its payload to an altitude of 689,000 feet. During the ignition of the second stage, the payload fairing would jettison and fall into the ocean. The spent second stage would detach and fall to the ocean. Ignition of the third stage would occur approximately 578 seconds after launch. 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 optional HAPS fourth stage could be used in or near orbit to obtain higher altitudes, achieve finer

altitude accuracy, or conduct more complex maneuvers. None of the jettisoned stages would be recovered.

ALTERNATIVES CONSIDERED: The only alternative analyzed in the EA is the No Action Alternative. Under this alternative, the FAA would not renew Orbital Sciences Corporation's Launch Operator License and there would be no commercial launches of the Pegasus launch vehicle from USAKA/RTS. Existing operating procedures, military operations, and other launch activities would continue at USAKA/RTS.

ENVIRONMENTAL IMPACTS: In accordance with NEPA-related FAA requirements and the Compact of Free Association between the Republic of the Marshall Islands and the United States, the FAA analyzed the potential environmental impacts of Pegasus launch operations at USAKA/RTS. The EA describes in detail potential impacts to air quality; biological resources (fish, wildlife, plants); hazardous materials, pollution prevention, and solid waste; noise; and water resources from the Proposed Action. A summary of the impacts of the Proposed Action provided below incorporates by reference environmental documentation from the 2001 *Final Programmatic Environmental Impact Statement for Licensing Launches* (the 2001 PEIS) and the 1993 *Final Supplemental Environmental Impact Statement – Proposed Action at U.S. Army Kwajalein* (the 1993 SEIS). The 2001 PEIS assessed the environmental impacts of approximately 7 annual launches of small-capacity vehicles, of which the Pegasus vehicle family is included. The 1993 SEIS analyzed launch impacts of up to 172 annual launches of meteorological rockets, sounding rockets, and strategic-launch vehicles. The Pegasus vehicle falls within the strategic-launch vehicle category. As appropriate, the EA incorporates by reference and summarizes relevant information from those analyses. The Proposed Action would not be expected to exceed the analyzed number of launches under the 1993 SEIS or the 2001 PEIS.

Air Quality

The Proposed Action would not be expected to significantly impact air quality around USAKA/RTS. The activities associated with the Proposed Action would fall within the parameters analyzed in the 1993 SEIS, which found that impacts from jet-fuel emissions would be negligible. Therefore, the potential impacts to air quality from jet-fuel emissions under the Proposed Action addressed in the EA would not be significant.

Pegasus launches would result in minor contributions of greenhouse gases and stratospheric ozone depletion due to releases of carbon dioxide, hydrochloric acid, nitrogen oxides, and aluminum oxide, as described in the 1989 EA. The 2001 PEIS found that launch-related emissions of carbon dioxide would have a negligible impact on global climate change. The emissions expected under the Proposed Action would fall within the parameters analyzed in the 2001 PEIS. Therefore, launches under the Proposed Action would not be expected to significantly affect global climate change. The 2001 PEIS analysis also found that effects on the ozone layer would be localized and temporary and no permanent damage would be expected from the analyzed launch activity. Because the Proposed Action would be expected to fall within the parameters of the activity analyzed in the 2001 PEIS, contributions of greenhouse gasses and ozone depletion under the Proposed Action would be negligible.

Biological Resources

Due to the high level of existing disturbance and extensive clearing, the 1993 SEIS found that activities similar to those associated with the Proposed Action would not result in impacts or would result in negligible impacts to terrestrial plants and wildlife at USAKA/RTS. No construction would be required as part of the Proposed Action. Therefore, the impacts to vegetation would be negligible. The 2001 PEIS analysis of activities similar to those associated with the Proposed Action found that that noise associated with launches could startle birds and mammals. Startle responses are usually temporary and birds and mammals would be expected to return to their normal behavior patterns within minutes. In addition, impacts to terrestrial animals under the Proposed Action would be expected to be minimal because the Pegasus vehicle would be launched over the open ocean. While jet engine noise from takeoff and landing could startle birds and mammals, USAKA/RTS is an active military base with existing launch activities and aircraft operations. The Proposed Action would not significantly increase the overall existing noise level. Furthermore, because there would be no construction activities or modification to the surrounding area and a limited number of proposed launches, the Proposed Action would result in negligible impacts to terrestrial wildlife.

The 1993 SEIS found that there would be no impacts or negligible impacts to reef habitat, fishery resources, and other marine biological resources from rocket launch emissions and debris at USAKA/RTS and surrounding ocean water. According to the 2001 PEIS, the probability of a jettisoned portion of the launch vehicle striking a marine animal would be extremely small. Jettisoned stages of the Pegasus launch vehicle that fall into the ocean would not likely contribute toxic concentrations of metals to the water column because of the slow rate of corrosion in the deep ocean environment and the large volume of water available for dilution. 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 extremely small. 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. 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. The oxidized hydrazine would be dispersed and have negligible long-term impacts on marine species. Sonic booms from Pegasus launches might represent a physical, habitat, or migratory threat to marine species, especially those on the surface of the ocean. However, because Pegasus launches would be infrequent, the Proposed Action would be expected to result in negligible impacts to marine wildlife.

The Proposed Action would not result in a significant impact on threatened and endangered species. The turtle, pigeon, dolphin, and whale species identified in Exhibit 3-1 of the EA could be startled by launches and sonic booms. Startle responses would be temporary and animals would be expected to return to their normal behavior patterns within minutes. There is also the remote possibility that the Pegasus launch vehicle or other debris could strike one of these threatened and endangered species, but the probability of such a strike would be extremely low.

Hazardous Material, Pollution Prevention, and Solid Waste

The Proposed Action would not be expected to cause significant impacts related to hazardous material, pollution prevention, and solid waste. Orbital Sciences Corporation would continue to complete all hazardous pre-launch processing operations at Vandenberg Air Force Base in accordance with a separate FAA-license agreement. Furthermore, the Pegasus vehicle, which would be mated to the L-1011 LCA at Vandenberg, would have its solid rocket propellant loaded before leaving Vandenberg; therefore, there would be no need for fueling at USAKA/RTS. However, the L-1011 LCA might need to be refueled upon landing at USAKA/RTS. Because launch activities would be infrequent and there are standard operating procedures for fueling jet aircraft that substantially minimize the risk of fuel spillage, the potential impacts of using hazardous materials would be expected to be negligible.

There would be no significant impacts from solid waste associated with the Proposed Action because there would be no construction or population-base increase. Existing operations and facilities would be able to handle the limited potential increase in solid waste. In addition, the Proposed Action would not affect pollution prevention measures if Orbital Sciences Corporation continues to comply with all applicable waste disposal regulations, including Resource Conservation and Recovery Act requirements and standard operating procedures.

Noise

The Proposed Action would not be expected to significantly impact noise-sensitive receptors around USAKA/RTS. Noise associated with L-1011 LCA takeoff and landing is common to other similar activities conducted at USAKA/RTS. The potential impacts of noise from the L-1011 LCA would be temporary and infrequent. Therefore, potential noise impacts from L-1011 LCA takeoffs and landings under the Proposed Action would be negligible. The noise that would be audible at the altitude over the ocean where the Pegasus vehicle is launched would be of no consequence to humans. In addition, potential sonic booms would occur over the Pacific Ocean and would not be expected to impact populated areas. Noise from launches could startle birds, but this effect would be of short duration. Sonic booms from Pegasus launches might represent a physical, habitat, or migratory threat to marine species, especially those on the surface of the ocean. However, because Pegasus launches would be infrequent, the Proposed Action would be expected to result in negligible impacts to marine wildlife.

Water Resources (Surface Water, Groundwater, Floodplains, and Wetlands)

The Proposed Action would not be expected to significantly impact water resources around USAKA/RTS. Launches of the Pegasus launch vehicle at USAKA/RTS would not place an increased demand on the groundwater supply and the impacts on wastewater would be negligible since additional staff would not be needed due to the occurrence of pre-launch activities at Vanderburg Air Force Base. In the event of an accidental release of solid rocket propellant that has not burned completely, ammonium perchlorate can occasionally form a binder matrix and be released into water bodies as unburned segments. Ammonium perchlorate can be highly toxic, depending on its reactivity; however, the binder matrix configuration would dissolve slowly in the water column, with only very local impacts to marine life. The 1993 SEIS concluded that negligible impacts from these spill events would be expected because of the buffering capacity of

the ocean. A launch failure of a Pegasus vehicle with the additional HAPS stage could release hydrazine into the water column. However, the released hydrazine would be quickly oxidized and dispersed. There are no designated wetlands at USAKA/RTS, thus no impacts to wetland resources would occur. In addition, no flood hazards have been designated at Kwajalein Atoll.

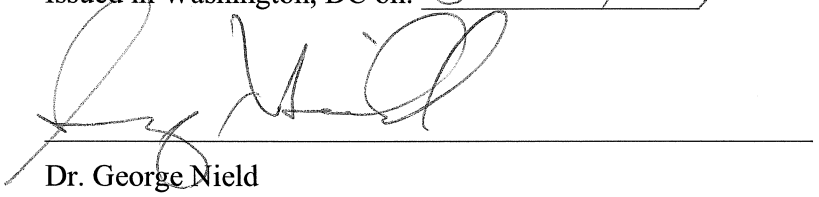
Cumulative Impacts

No significant cumulative impacts would be expected under the Proposed Action. USAKA/RTS is an active military base which supports missile defense and U.S. security operations. Multiple facilities are spread across several islands of the Atoll and consist of several launch pads and airfields. Bucholz Army Airfield on Kwajalein Island has reported a maximum air traffic volume of 1,674 operations per month, averaging over 55 operations per day. Flight operations consist of inter-atoll commercial aircraft traffic and helicopter activities as well as military operations. Space Exploration Technologies Corporation (SpaceX), a privately owned enterprise aimed at developing launch vehicles for commercial space transport, has also established a launch location for its Falcon Launch Vehicle Program on Omelek Island, part of USAKA/RTS. In December 2004, the U.S. Army Space and Missile Defense Command released the Final EA for the SpaceX Falcon Program and Finding of No Significant Impact (the SpaceX EA) for the construction/refurbishment and operation of the Falcon Launch Vehicle launch site and supporting facilities. Other ongoing launch activities at USAKA/RTS include the Missile Defense Agency's Theater High Altitude Area Defense (THAAD) system. The THAAD system involves multiple test launches of target and interceptor missiles from USAKA/RTS, specifically Meck Island. The environmental impacts of the THAAD test flights at USAKA/RTS were analyzed in the *THAAD Pacific Test Flights Environmental Assessment* (THAAD EA). Recent operational changes at USAKA/RTS have resulted in planned facility closures. Facilities proposed for closure include a hospital annex, water-treatment facility, a photography laboratory, warehouses, Xerox repair shop, weather-balloon storage, and a theater. The potential impacts of facility closures and associated demolition and decommissioning activities have been addressed in the U.S. Army Space and Missile Defense Command's 2009 *Final Environmental Assessment – U.S. Army Kwajalein Atoll Ronald Reagan Ballistic Missile Defense Test Site Facility Closures and Demolitions* (the 2009 EA). Based on the SpaceX EA, THAAD EA, and 2009 EA analyses, along with the analysis of potentially impacted resources under the Proposed Action, the Pegasus launches added to the proposed demolition and closure activities, Falcon and other launches, and existing operations would not be expected to result in significant cumulative impacts.

DETERMINATION: An analysis of the Proposed Action has concluded that there would be no significant short-term, long-term, or cumulative effects to the environment or surrounding populations. After careful and thorough consideration of the facts herein, the undersigned finds that the proposed Federal action is consistent with existing national environmental policies and objectives set forth in Section 101(a) of NEPA and other applicable environmental requirements

and that it will not significantly affect the quality of the human environment or otherwise include any condition requiring additional consultation pursuant to Section 102(2)(c) of NEPA. Therefore, an Environmental Impact Statement for the Proposed Action is not required.

Issued in Washington, DC on: June 29, 2009



Dr. George Nield
Associate Administrator for Commercial Space Transportation

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Exhibit

ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
DEP	Document of Environmental Protection
DOT	Department of Transportation
EA	Environmental Assessment
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
HAPS	Hydrazine Auxiliary Propulsion System
LCA	Launch Carrier Aircraft
LLO	Launch Operator License
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
PCBs	Polychlorinated biphenyls
PEIS	Programmatic Environmental Impact Statement
PM_{10}	Particulate matter with a diameter equal to or less than 10 microns
$PM_{2.5}$	Particulate matter with a diameter equal to or less than 2.5 microns
RMI	Republic of the Marshall Islands
SEIS	Supplemental Environmental Impact Statement
SpaceX	Space Exploration Technologies Corporation
THAAD	Theater High Altitude Area Defense
UES	Environmental Standards and Procedures for United States Army Kwajalein Atoll (USAKA) Activities in the Republic of the Marshall Islands
U.S.C.	United States Code
USAKA/RTS	U.S. Army Kwajalein Atoll Ronald Reagan Ballistic Missile Defense Test Site

1. INTRODUCTION

Orbital Sciences Corporation (Orbital Sciences) has applied to the Federal Aviation Administration (FAA) for renewal of a Launch Operator License for operation of the Pegasus expendable launch vehicle at the U.S. Army Space and Missile Defense Command Kwajalein Atoll Ronald Reagan Ballistic Missile Defense Test Site (USAKA/RTS) in the Republic of the Marshall Islands. The proposed license would expire 5 years from issuance unless suspended, surrendered, or revoked. Following the license period, a license renewal would require additional environmental review. Renewing a license is considered a major Federal action subject to environmental review under the National Environmental Policy Act of 1969, as amended (NEPA; 42 U.S.C. 4231, *et seq.*). The FAA prepared this Environmental Assessment (EA), in accordance with NEPA, Council on Environmental Quality (CEQ) NEPA implementing regulations (40 Code of Federal Regulations [CFR Parts 1500 to 1508), and FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures, Change 1,* to evaluate the potential environmental impacts of activities associated with renewing Orbital Sciences' Launch Operator License.

1.1 BACKGROUND

In 1999, the U.S. Department of Transportation (DOT) issued a Finding of No Significant Impact (DOT 1999) for the issuance of a Launch Operator License to Orbital Sciences based on the *Final Environmental Impact Statement - Proposed Actions at U.S. Army Kwajalein Atoll* (USASDC 1989) (the 1989 EIS) and the *Final Supplemental Environmental Impact Statement - Proposed Actions at U.S. Army Kwajalein Atoll* (USASSDC 1993) (the 1993 SEIS). The license authorized Orbital Sciences to conduct:

- Pre-launch processing operations at Vandenberg Air Force Base in California associated with the conduct of commercial space flights,
- Commercial space flights of Pegasus launch vehicles from USAKA/RTS, as specified in the license orders, and
- Additional pre-launch processing operations (launch system monitoring, flight termination system testing, and removing safety pins prior to flight).

In 2000, the FAA reorganized the licensing structure for the Pegasus Launch Operator License into two parts to differentiate between common Pegasus operations at Orbital Sciences' integration and pre-launch site at Vandenberg Air Force Base [Launch Operator License (LLO) 00-053] and site-specific launch operations at each launch site (Vandenberg, Cape Canaveral Air Force Station, Wallops Flight Facility, and USAKA/RTS). Site-specific launch operations at USAKA/RTS were licensed under LLO 99-046 and renewed under LLO 04-069 in 2004. Under LLO 04-069, the Pegasus launch vehicle was launched once (FAA 2009).

Under the Proposed Action addressed in this EA, the FAA would renew Orbital Sciences' LLO 04-069 for Pegasus launch operations at USAKA/RTS. Orbital Sciences would continue to complete all hazardous pre-launch processing operations at Vandenberg in accordance with LLO 00-053, including mating of the carrier vehicle and Pegasus launch vehicle. This EA evaluates

the potential environmental impacts associated with renewing Orbital Sciences' Launch Operator License for Pegasus operations at USAKA/RTS. Operations addressed in this EA include carrier vehicle landing and takeoff from an USAKA/RTS runway. System tests and corrective actions would be conducted upon arrival at USAKA/RTS. The carrier vehicle might be refueled at USAKA/RTS for the flight to the Pegasus launch point.

The FAA, as the agency responsible for licensing the launches of the Pegasus vehicle, is the lead agency for preparation of this EA; the U.S. Army, as the agency with jurisdiction at USAKA/RTS, is a cooperating agency.

1.2 PURPOSE AND NEED FOR AGENCY ACTION

1.2.1 Purpose

The purpose of the FAA's Proposed Action of renewing Orbital Sciences' Launch Operator License for launch operations of the Pegasus launch vehicle is to ensure compliance with the international obligations of the United States and 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 the requirements of the Commercial Space Launch Amendments Act of 2004 (Public Law 108-492), the Commercial Space Transportation Competitiveness Act of 2000 (Public Law 106-405); Executive Order 12465, *Commercial Expendable Launch Vehicle Activities* (February 24, 1984); Code of Federal Regulations (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 1996 and 2006.

The Secretary of Transportation has assigned the FAA Office of Commercial Space Transportation responsibility, under the Commercial Space Launch Amendments Act and Executive Order 12465, for oversight of commercial space launch activities, including licensing of launches.

1.2.2 Need

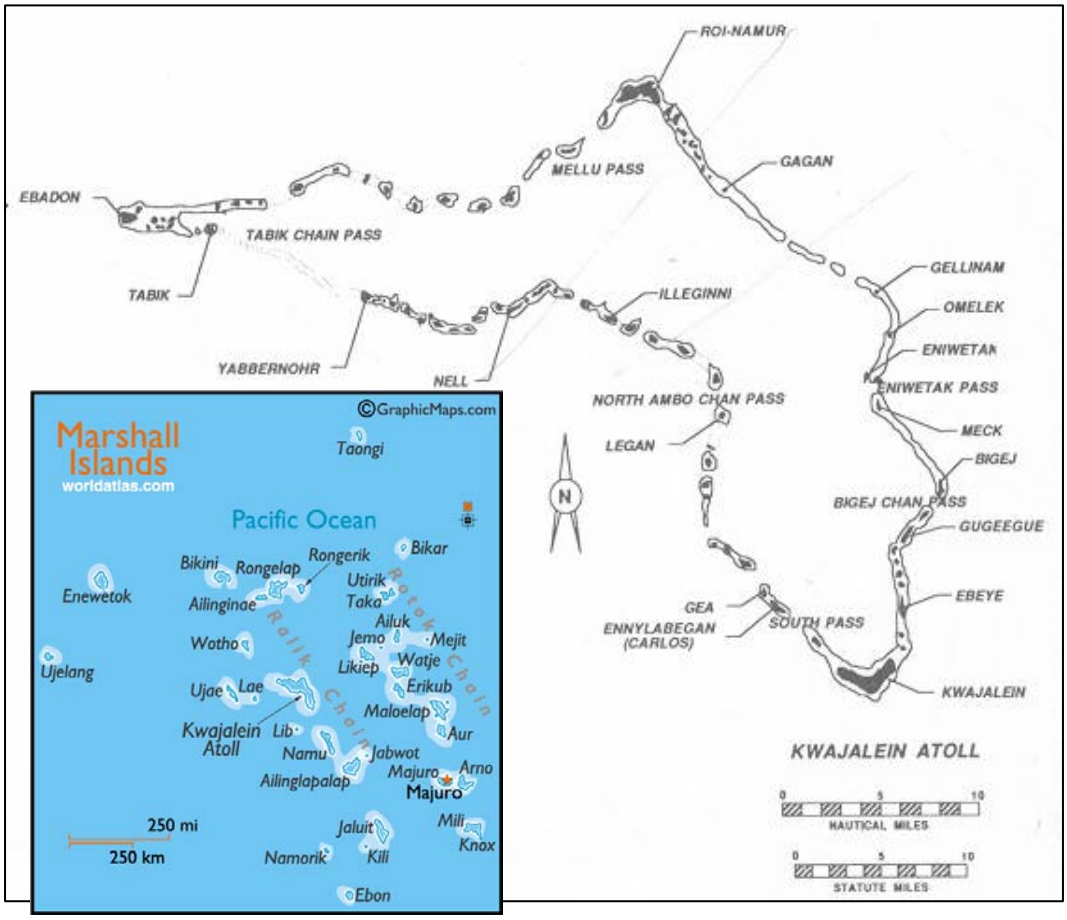
The Proposed Action is needed to allow the continued operation of the Pegasus launch vehicles to meet the demand for lower-cost access to space. Less expensive space launch capability is necessary to support rising industries through more cost-effective commercial, government, and scientific satellite launches.

2. PROPOSED ACTION AND NO ACTION ALTERNATIVE

2.1 PROPOSED ACTION

Orbital Sciences has applied to the FAA for renewal of LLO 04-069. Under the Proposed Action (the preferred alternative), the FAA would renew Orbital Sciences' Launch Operator License for launch operations of the Pegasus expendable launch vehicle family from USAKA/RTS in the Republic of the Marshall Islands. USAKA/RTS, a subordinate command of the U.S. Army Space and Missile Defense Command, consists of all or portions of 11 of the 100 islands that make up the Kwajalein Atoll (DOT 1999). Exhibit 2-1 is a map of Kwajalein Atoll.

Exhibit 2-1. Map of Kwajalein Atoll



Source: WorldAtlas 2009; Kwajalein Archives 2009.

The Pegasus expendable launch vehicle consists of three graphite epoxy case solid rocket propellant motor stages with an optional liquid propellant-based Hydrazine Auxiliary Propulsion System (HAPS) and is designed to be carried to its launch point by an L-1011 Launch Carrier Aircraft (LCA). Exhibit 2-2 shows the characteristics of the Pegasus vehicle. Detailed information regarding the characteristics of the HAPS is not provided. Section 3.1.2.6 of the 1989 EA includes a detailed description of the typical Pegasus launch vehicle without the optional HAPS. The L-1011 LCA, which consists of FAA-approved standard engines, uses Commercial Jet-A or Military JP4 or JP10 fuel.

Exhibit 2-2. Pegasus Launch Vehicle Stage Characteristics

	Length (feet)	Diameter (feet)	Propellant Mass (pounds)	Gross Mass (pounds)
Stage 1	29.13	4.17	33,175	36,182
Stage 2	11.75	4.17	8,631	9,548
Stage 3	4.40	3.18	1,700	1,978
Hydrazine Auxiliary Propulsion System	-	-	130	-

Source: FAA 2004.

The HAPS can be added as an optional liquid propellant-based fourth stage to the Pegasus launch vehicle. 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 (U.S. Air Force 2006).

Pre-launch and mating activities would be performed at Vandenberg Air Force Base under LLO 00-053. A separate environmental review was conducted in conjunction with the approval of LLO 00-053 (FAA 2005). Therefore, the Proposed Action addressed in this EA does not include Pegasus pre-launch processing operations.

The L-1011 LCA and mated Pegasus launch vehicle would travel to USAKA/RTS and land on an existing runway. Once on the ground at USAKA/RTS, the carrier aircraft would be refueled and systems would be checked. Before L-1011 LCA takeoff, aircraft would survey ship traffic along the flight corridor and launch site and issue a Notice to Airmen and Notice to Mariners to clear the airspace and ocean area. Once clear, the L-1011 LCA and mated Pegasus launch vehicle would takeoff and travel under jet power to the launch site over the Pacific Ocean. At an altitude of 35,000 feet, the L-1011 LCA would release the Pegasus launch vehicle and return to a designated runway at USAKA/RTS. The Pegasus vehicle would free fall for 5 seconds before the first stage motor ignites (Orbital Sciences 2009). As described in the *Environmental Assessment of Pegasus Air-launched Space Booster from Edwards AFB/Western Test Range, CA* (U.S. Air Force 1989) (the 1989 EA), the first stage of the Pegasus vehicle would burn for approximately 77 seconds following ignition while propelling the vehicle to an altitude of approximately 223,000 feet. The spent first stage would detach and fall to the ocean. The second stage motor would ignite and burn for approximately 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 also would fall to the open ocean. Ignition of the third stage would occur approximately 578 seconds after launch. This 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 jettisoned stages would be recovered.

The FAA's *Final Programmatic Environmental Impact Statement for Licensing Launches* (FAA 2001) (the 2001 PEIS) 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 the 10-year period of 2000 through 2010. Annual launches ranged from 4 to 9 launches, with an average of 7 annual launches.

The 1993 SEIS analyzed launch impacts based on four different levels of activity (alternatives) – No Action Alternative (84 annual launches), Low Level of Activity (104 annual launches), Intermediate Level of Activity (140 annual launches), and High Level of Activity (172 annual launches). Launch vehicles analyzed under each alternative included meteorological rockets, sounding rockets, and strategic-launch vehicles. For the High Level of Activity Alternative, 4 to 84 annual launches of the strategic launch vehicles, which are similar to the Pegasus vehicle, were evaluated. The Proposed Action would not be expected to exceed the analyzed number of launches under the 1993 SEIS or the 2001 PEIS.

2.2 NO ACTION ALTERNATIVE

The only alternative to the Proposed Action is the No Action Alternative. Under this alternative, the FAA would not renew Orbital Sciences' Launch Operator License and there would be no commercial launches of the Pegasus launch vehicle from USAKA/RTS. Existing operating procedures, military operations, and other launch activities would continue at USAKA/RTS.

2.3 IMPACTS AND RESOURCES NOT ANALYZED IN DETAIL

This EA does not analyze all potential impacts and environmental resource areas in detail, as listed and explained below.

- Construction impacts – The Proposed Action does not include any construction or modification of existing facilities.

- Wild and scenic rivers – There are no wild and scenic rivers in the Kwajalein Atoll (National Wildlife and Scenic Rivers System 2009).

- Natural resources and energy supply – The Proposed Action would not result in any measurable effect on local supplies of energy or natural resources.

- Farmland resources – The Proposed Action would not convert farmlands to nonagricultural use.

- Compatible land use – The compatibility of existing and planned land uses in the vicinity of an airport is usually associated with the extent of the airport's noise impacts. Section 4.4 of this EA concludes that there would be no significant impacts from noise related to the Proposed Action.

- U.S. Department of Transportation Action Section 4(f) resources – The Proposed Action would not involve the use of publicly owned parks, recreation areas, wildlife and waterfowl refuges, or public and private historical sites.

- Light emissions and visual resources – The Proposed Action would not require the creation of additional lighting and would not result in any visually intrusive impacts.

- Historic, archaeological, architectural, and cultural resources – Several World War II era structures at USAKA/RTS are considered part of the Kwajalein National Historic Landmark. Additionally, a 1996 survey of Cold War era infrastructure at USAKA/RTS identified several structures eligible for listing on the National Registry of Historic Places; however, it was determined by the RMI Historic Preservation Office that the eligibility requirements would not be applied to Cold War era buildings at USAKA/RTS (USASMDC 2009b). The Proposed Action would not impact these buildings because no construction or modification of existing facilities would be required. Existing infrastructure would not be affected by operational activities, including jet engine noise, since noise created as part of the Proposed Action would fall within the levels of current activities.

- Environmental justice and socioeconomics – The Proposed Action would not disproportionately affect minority communities because the Proposed Action would have negligible impacts on all residents of Kwajalein Atoll. The Proposed Action would use existing facilities at USAKA/RTS and not involve the relocation of residents or businesses nor require a large immigration of new residents. Therefore, socioeconomics are not analyzed in detail.

- Children's environmental health and safety risks – The Proposed Action would be implemented at existing facilities within a designated U.S. Army base 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 USAKA/RTS. Additionally, any noise associated with the Proposed Action would be temporary.

- Coastal resources – The Proposed Action would not affect coastal resources land identified under the Coastal Zone Management Act. Under Republic of the Marshall Islands statute, Title 35, Chapter 4, Part II, Section 2(c) of the Coast Conservation Act, the coastal zone is defined as "the area laying within a limit of 25 feet landward of the mean high water line and a limit of 200 feet seawards of the mean low water line" (RMI 1988). The Proposed Action would not directly involve activities in this zone. The L-1011 LCA would fly over the coastal zone during takeoff and landing. Furthermore, no construction in the coastal zone would be required under the Proposed Action. Therefore, the Proposed Action would not be expected to affect coastal resources.

- Secondary impacts – The Proposed Action would not involve the potential for induced or secondary impacts to surrounding communities. The resources analyzed would have a negligible impact; therefore, the potential for secondary (induced) impacts would also be expected to be negligible.

3. AFFECTED ENVIRONMENT

Exhibit 3-1 summarizes the affected environment for the resource areas analyzed in detail in this EA (air quality; biological resources; hazardous materials, pollution prevention, and solid waste; noise; and water resources (surface water, groundwater, floodplains, and wetlands). To minimize redundancy, Exhibit 3-1 incorporates by reference environmental documentation from the 1993 EIS, the *U.S. Army Kwajalein Atoll Temporary Extended Test Range – Environmental Assessment* (USASSDC 1995) (the 1995 EA), and the *Final Environmental Assessment – U.S. Army Kwajalein Atoll Ronald Reagan Ballistic Missile Defense Test Site Facility Closures and Demolitions* (USASMDC 2009b) (the 2009 EA).

Exhibit 3-1. Affected Environment Summary of Information Incorporated by Reference (page 1 of 4)

Resource Area	Summary
Air quality	The climate of the Kwajalein Atoll is categorized as tropical marine, with high temperatures, high humidity, and variable rainfall (USASSDC 1993). Power plants, fuel storage tanks, solid-waste incinerators, aircraft, rocket launches, and transportation are the primary man-made sources of air emissions. *Environmental Standards and Procedures for United States Army Kwajalein Atoll (USAKA) Activities in the Republic of the Marshall Islands* (UES) outlines ambient air quality standards for activities at USAKA/RTS. The following lists the USAKA/RTS ambient air quality standards and incremental degradation standards:

Pollutant	Averaging Period	Ambient Standard (microgram per cubic meter)	Incremental Degradation Standard (micrograms per cubic meter)
Sulfur oxides	Annual	80	20
	24 hours	365	91
	3 hours	1,300	325
Carbon monoxide	8 hours	10	2,500
	1 hour	40	10,000
Particulate matter with a diameter equal to or less than 2.5 microns ($PM_{2.5}$)	Annual	15	3.8
	24 hours	65	16.3
Particulate matter with a diameter equal to or less than 10 microns (PM_{10})	Annual	50	12.5
	24 hours	150	37.5
Ozone	8 hours	160	40
Nitrogen dioxide	Annual	80	25
Lead	3 months	1.2	0.375

Source: UES 2006.

Stationary sources of criteria and hazardous air pollutants are subject to a Document of Environmental Protection (DEP) as described in the UES. The 2009 EA found that all stationary sources were in compliance with the DEP 05-0001.1, and all ambient air quality standards were met.

Exhibit 3-1. Affected Environment Summary of Information Incorporated by Reference (page 2 of 4)

Resource Area	Summary
Air quality (continued)	Past air quality data is only available for Kwajalein Island. The 1993 SEIS estimated the concentration of criteria pollutants and found that none exceeded National Ambient Air Quality Standards (NAAQS) (USASSDC 1993). The 1995 EA concluded that due to strong wind dispersion, the ambient air quality at Illeginni, Meck, Omelek, Gellinam, and Legan Islands would comply with NAAQS. In addition, Roi-Namur Island was assumed to have air quality similar to Kwajalein (U.S. Army Space and Strategic Defense Command 1995). An air quality study at Kwajalein Island measured ambient concentrations of sulfur dioxide, nitrogen oxides, PM_{10}, total suspended particulates, lead, and carbon monoxide from two different stations – one upwind and one downwind (USASSDC 1993). The study found no exceedances of NAAQS for sulfur dioxide, PM_{10}, carbon monoxide (1-hour standard), or lead at either station. Monitoring showed several exceedances of the 8-hour standard for carbon monoxide. These exceedances were not considered representative because of performance problems with the analyzing tools. Exceedances of total suspended particulates were assumed to be caused by aerosol salt particles related to passing storms. There is no known data regarding $PM_{2.5}$ concentrations.
Biological resources	The Biological Resource Maps contained within the UES illustrate the location of biological resources on detailed maps (See 2006 UES, Figures 3.4H.1 – 3.4H.11). The UES also provides lists of protected species. The following paragraphs summarize the various biological resources found or known to exist at USAKA/RTS. Biological resources are protected under U.S. and Republic of the Marshall Islands regulations and statues, including the U.S. Endangered Species Act of 1973, and the Republic of the Marshall Islands (RMI) Endangered Species Act of 1975, RMI Marine Mammal Protection Act of 1990, and RMI Marine Resources Act of 1997. Terrestrial Wildlife The Republic of the Marshall Islands has listed the Ratak Micronesian pigeon as endangered (RMI 2008). There are no other rare, threatened, or endangered terrestrial species on the islands of the Kwajalein Atoll. The islands are home to several species of migratory and resident birds and coconut crabs, several species of lizards, and rodents. Surveys in 1996, 1998, and 2000 identified 32 species of seabirds, shorebirds, and land birds and 2 species of domesticated birds. The UES designates potentially significant habitat, including seabird colonies, shorebird sites, reef heron breeding sites, mixed broadleaf forest, pemphis forest, and central salt pond (USASMDC 2009b). Vegetation Much of the flora surrounding U.S. installations at Kwajalein Atoll has been disturbed by human occupation. There are no rare, threatened, or endangered species of vegetation on the islands (UES 2006). Marine Wildlife A 1988 study determined that the overall quality of the marine environment at the Kwajalein Atoll is good (USASSDC 1995). The Republic of the Marshall Islands, under Section 3 of the Marine Mammal Protection Act of 1990, has established protective status for offshore spotted dolphins, coastal spotted dolphins, whitebelly spinner dolphins, Costa Rica spinner dolphins, common dolphins, striped dolphins, and eastern spinner dolphins. The Act also provides protective status for any other species of small-toothed cetaceans (RMI 1990). The provisions of the Act are intended to minimize the impacts of tuna fishing on these species. The Republic of the Marshall Islands Marine Resources Act establishes protection for all sponges, black-lip mother-of-pearl oyster, hawksbill turtle,

Exhibit 3-1. Affected Environment Summary of Information Incorporated by Reference (page 3 of 4)

Resource Area	Summary
Biological resources (continued)	leatherback turtle, loggerhead sea turtle, and the olive ridley sea turtle (UES 2006). The Republic of the Marshall Islands and the United States list the hawksbill turtle, leatherback turtle, blue whale, and sperm whale as endangered (RMI 2008). In addition, the United States has listed as threatened or endangered the dugong, loggerhead sea turtle, olive ridley sea turtle, green sea turtle, finback whale, and humpback whale, which are known to occupy the waters in and around Kwajalein Atoll. Beaches on Kwajalein, Legan, Gagan, Roi-Namur, and Ennylabegan Islands might provide a suitable nesting ground for threatened and endangered turtles. Other marine animals, including whales and dolphins, could be present along the flight path to the open ocean launch site.
Hazardous materials, pollution prevention, and solid waste	Hazardous materials stored at USAKA/RTS include jet fuel, rocket propellant, solvent, paint, cleaning fluids, pesticides, and refrigerants. Materials are transported to USAKA/RTS via aircraft or ship and are distributed by the Base Operating Contractor under the auspices of the USAKA/RTS Environmental Office. USAKA/RTS is a permitted generator of hazardous waste as defined by the Resource Conservation and Recovery Act (Public Law 94-580) (USASSDC 1995). Hazardous wastes generated at USAKA/RTS include solvent and oil wastes, polychlorinated biphenyl (PCBs), medical waste, and unexploded ordinance. No hazardous waste is treated or disposed of at USAKA/RTS. Instead, hazardous waste is collected and contained in 55-gallon drums at the point of generation. Once full, the drums are shipped to a central collection facility, the USAKA/RTS Hazardous Waste 90-Day Storage Facility, on Kwajalein Island. Drummed waste is then shipped off the island for treatment and disposal (USASMDC 2009b). While most unexploded ordnance disposal is done on Illeginni, other areas throughout the 11 islets are set aside for unexploded ordnance disposal that cannot be transported to Illeginni (USASMDC 2009a). A recycling program has been instituted to divert solid waste from the landfill at USAKA/RTS. Solid waste is collected and incinerated at facilities on Kwajalein and Roi-Namur Islands.
Noise	Noise sources at USAKA/RTS include rocket launches, power plants, airport and helicopter operations, construction, diesel generators, air conditioning units, marine sandblasting, and services and transportation. Meteorological rockets have been launched from the Islands of Omelek, Meck, and Illeginni. These islands are not inhabited and do not have sensitive noise receptors (USASSDC 1995). There are houses and schools at various locations on Kwajalein Island, which is also home to an active military airport. The noise analysis conducted as part of the 1989 EA found that all sensitive noise receptors would fall outside the 65 day-night average sound level noise contour. Noise from the power plant on the island does not impact sensitive noise receptors (USASMDC 2009a). Roi-Namur Island has been used for HAVE JEEP launches. To minimize impacts from noise, workers are supplied with appropriate hearing protection during launch activities. In addition, noise from the airport on Roi-Namur Island, which supports military operations, is contained within the boundaries of airport property (USASSDC 1993).

Exhibit 3-1. Affected Environment Summary of Information Incorporated by Reference (page 4 of 4)

Resource Area	Summary
Water resources (surface water, groundwater, floodplains, and wetlands)	Except for two small tidal ponds on Legan Island, in general, USAKA/RTS does not have natural bodies of surface water because of high soil porosity and permeability. USAKA/RTS has several man-made catchment basins designed to capture rainwater for potable use for Kwajalein, Roi-Namur, Meck, Ennylabegan, and Illeginni Islands. Potable water for the other islands is transported from Kwajalein Island. The UES designates coastal waters as Class AA, A, and B. Class AA waters are preserved for scientific research and potable water. Class A waters are designated for recreational uses and to support aquatic life. Class B waters are preserved for boating and fishing activities (UES 2006). In general, marine water resources (a lagoon and the Pacific Ocean) around USAKA/RTS are considered to be in excellent condition. However, localized contamination has been identified in the nearshore waters around Kwajalein, Roi-Namur, and Meck Islands. This contamination is attributed to landfill runoff and improper disposal of waste. The UES classify three levels of groundwater – Class I, II, and III. Groundwater contamination has been identified downgradient of the fuel farm on Kwajalein Island, along with traces of chlorinated solvents near solvent storage sites. However, this low level of contamination has not affected groundwater quality (USAEHA 1991).

4. ENVIRONMENTAL CONSEQUENCES

In accordance with NEPA-related FAA requirements and the Compact of Free Association between the Republic of the Marshall Islands and the United States, the FAA is analyzing the potential environmental impacts of Pegasus launch operations at USAKA/RTS. This chapter describes potential impacts to air quality; biological resources (fish, wildlife, plants); hazardous materials, pollution prevention, and solid waste; noise; and water resources from the Proposed Action. As described in Section 2.1, the 2001 PEIS and the 1993 SEIS analyzed the impacts of launches similar to those under the Proposed Action. The 2001 PEIS assessed the environmental impacts of approximately 7 annual launches of small-capacity vehicles, of which the Pegasus vehicle family is included. The 1993 SEIS analyzed launch impacts of up to 172 annual launches of meteorological rockets, sounding rockets, and strategic-launch vehicles. The Pegasus vehicle falls within the strategic-launch vehicle category. As appropriate, this chapter incorporates by reference and summarizes relevant information from those analyses.

Sections 4.1 through 4.5 analyze the impacts of the Proposed Action in accordance with FAA Order 1050.1E, Change 1. Appendix A of the Order describes significance thresholds for each resource area. Section 4.6 addresses cumulative impacts.

4.1 AIR QUALITY

The Proposed Action would not be expected to significantly impact air quality around USAKA/RTS. The air quality data and analyses in the 1993 SEIS and the 2001 PEIS remain substantially valid, and the FAA used those data and analyses to reach the conclusions in Section 4.1.1.

4.1.1 Proposed Action

In the troposphere, which is defined as the area from 0 to 6 miles above Earth's surface, the L-1011 LCA would generate emissions from jet-fuel. The 1993 SEIS evaluated the air impacts from simultaneous launches of multiple rockets. The activities associated with the Proposed Action would be expected to fall within the parameters analyzed in the 1993 SEIS, which found that impacts from jet-fuel emissions would be negligible. Therefore, potential impacts to air quality from jet-fuel emissions under the Proposed Action addressed in this EA would not be significant.

At an altitude of 6.6 miles above Earth's surface, the Pegasus vehicle would be released from the L-1011 LCA and would launch. Pegasus launches would result in minor contributions of greenhouse gases and stratospheric ozone depletion due to releases of carbon dioxide, hydrochloric acid, nitrogen oxides, and aluminum oxide, as described in the 1989 EA. The 2001 PEIS found that launch-related emissions of carbon dioxide would have a negligible impact on global climate change. The emissions expected under the Proposed Action would fall within the parameters analyzed in the 2001 PEIS. Therefore, launches under the Proposed Action would not be expected to significantly affect global climate change. The 2001 PEIS analysis also found that effects on the ozone layer would be localized and temporary and no permanent damage would be expected from the analyzed launch activity. Because the Proposed Action would be

expected to fall within the parameters of the activity analyzed in the 2001 PEIS, contributions of greenhouse gasses and ozone depletion under the Proposed Action would be negligible.

If the optional HAPS stage was added to the Pegasus launch vehicle, it would not be expected to impact the troposphere or the stratosphere. The HAPS would be ignited within the ionosphere. A launch failure may cause a release of hydrazine. However, the U.S. Department of Health and Human Services determined that hydrazine released into the air would be destroyed by reactive molecules with a few minutes to hours (HHS 1997).

4.1.2 No Action Alternative

Under the No Action Alternative, the FAA would not renew Orbital Sciences' Launch Operator License, and commercial launches of the Pegasus vehicle would not be conducted from USAKA/RTS. Therefore, there would be no additional impacts to air quality. Under the No Action Alternative, existing operating procedures, military operations, and other launch activities would continue at USAKA/RTS.

4.2 BIOLOGICAL RESOURCES

The Proposed Action would not be expected to significantly impact biological resources around USAKA/RTS. The biological resources data and analyses in the 1993 SEIS and the 2001 PEIS remain substantially valid, and the FAA used those data and analyses to reach the conclusions in Section 4.2.1.

4.2.1 Proposed Action

4.2.1.1 Impacts to Terrestrial Plants and Animals

Due to the high level of existing disturbance and extensive clearing, the 1993 SEIS found that activities similar to those associated with the Proposed Action would not result in impacts or would result in negligible impacts to terrestrial plants and wildlife at USAKA/RTS. All Pegasus launch-related activities would occur at existing facilities; therefore, no construction would be required as part of the Proposed Action. Therefore, the impacts to vegetation at USAKA/RTS would be negligible. The 2001 PEIS analyzed impacts to wildlife from small-capacity launch vehicles similar to the Pegasus launch vehicle. That analysis found that noise associated with launches could startle birds and mammals. Startle responses are usually temporary and birds and mammals would be expected to return to their normal behavior patterns within minutes. In addition, impacts to terrestrial animals under the Proposed Action would be expected to be minimal because the Pegasus vehicle would be launched over the open ocean. While jet engine noise from takeoff and landing could startle birds and mammals, USAKA/RTS is an active military base with existing launch activities and aircraft operations. The Proposed Action would not significantly increase the overall existing noise level. Furthermore, because there would be no construction activities or modification to the surrounding area and a limited number of proposed launches, the Proposed Action would result in negligible impacts to terrestrial wildlife.

4.2.1.2 Impacts to Marine Resources along the Flight Path and at the Launch Site

The 1993 SEIS found that there would be no impacts or negligible impacts to reef habitat, fishery resources, and other marine biological resources from rocket launch emissions and debris at USAKA/RTS and surrounding ocean water. The Pegasus is an expendable launch vehicle, and its components would be discarded in the open waters of the Pacific Ocean. There is a remote possibility that the jettisoned portions of the Pegasus launch vehicle entering the ocean could strike a marine animal. According to the 2001 PEIS, the probability of such a strike has been approximated and results indicate an extremely small chance of a launch vehicle contacting a marine mammal. Jettisoned stages of 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 extremely small. According to the 2001 PEIS, in the event of an accidental release of unburned solid rocket propellant, ammonium perchlorate can occasionally form a binder matrix and be released into water bodies as unburned segments. Ammonium perchlorate can be highly toxic, depending on its reactivity; however, the binder matrix configuration would dissolve slowly in the water column with only very localized impacts to marine life (FAA 2001). Due to the natural buffering ability of the ocean, the unburned propellant would be diluted and dispersed and would not be expected to harm marine life.

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. The oxidized hydrazine would be dispersed and have negligible long-term impacts on marine species (U.S. Air Force 2006).

According to the 2001 PEIS, sonic booms from launches similar to those of the Pegasus launch vehicle can impact underwater environments. Sonic booms from Pegasus vehicles could reach underwater depths of 820 feet and might represent a physical, habitat, or migratory threat to marine species, especially those on the surface of the ocean. However, because Pegasus launches would be infrequent and a direct strike would be unlikely, the Proposed Action would be expected to result in negligible impacts to marine wildlife.

4.2.1.3 Impacts to Threatened and Endangered Species

The Proposed Action would not result in a significant impact to threatened and endangered species. The turtle, pigeon, dolphin, and whale species identified in Exhibit 3-1 could be startled by launches and sonic booms. Startle responses would be temporary and animals would be expected to return to their normal behavior patterns within minutes. There is also the remote possibility that the Pegasus launch vehicle or other debris could strike one of these threatened and endangered species, but the probability of such a strike would be extremely low.

4.2.2 No Action Alternative

Under the No Action Alternative, the FAA would not renew Orbital Sciences' Launch Operator License, and commercial launches of the Pegasus vehicle would not be conducted from USAKA/RTS. Therefore, there would be no additional impacts to biological resources. Under the No Action Alternative, existing operating procedures, military operations, and other launch activities would continue at USAKA/RTS.

4.3 HAZARDOUS MATERIALS, POLLUTION PREVENTION, AND SOLID WASTE

The Proposed Action would not be expected to cause significant impacts related to hazardous material, pollution prevention, and solid waste. The data and analyses in the 1993 SEIS and the 2001 PEIS remain substantially valid, and the FAA used those data and analyses to reach the conclusions in Section 4.3.1.

4.3.1 Proposed Action

Typical hazardous materials used for rocket launches include propellants and maintenance-related material such as solvents and paints. These materials are used during pre-launch activities. Orbital Sciences would continue to complete all hazardous pre-launch processing operations at Vandenberg Air Force Base in accordance with LLO 00-053. Furthermore, the Pegasus vehicle, which would be mated to the L-1011 LCA at Vandenberg, would have its solid rocket propellant loaded before leaving Vandenberg; therefore, there would be no need for fueling at USAKA/RTS. However, the L-1011 LCA might need to be refueled upon landing at USAKA/RTS. Because launch activities would be infrequent and there are standard operating procedures for fueling jet aircraft that substantially minimize the risk of fuel spillage, the potential impacts of using hazardous materials would be expected to be negligible.

The 1993 SEIS analyzed impacts of launches from strategic launch vehicles, such as the Pegasus, related to hazardous and solid waste for low, medium, and high levels of activity. The SEIS did not identify significant impacts from any of the activity levels due to hazardous waste.

The 1993 SEIS found there could be significant impacts from solid waste for medium and high levels of activity because of the proposed construction and population increases. Under the Proposed Action addressed in this EA, there would be no construction and no solid waste would be generated from construction activities. In addition, no increases in population would be expected as a result of the Proposed Action. Therefore, there would be no population-based increase in solid waste. Launch-related solid waste would be minimal. Existing operations and facilities would be able to handle the limited potential increase in solid waste, and no significant impacts related to solid waste would be expected.

The Proposed Action would not affect pollution prevention measures if Orbital Sciences continued to comply with all applicable waste disposal regulations, including Resource Conservation and Recovery Act requirements and standard operating procedures.

4.3.2 No Action Alternative

Under the No Action Alternative, the FAA would not renew Orbital Sciences' Launch Operator License, and commercial launches of the Pegasus vehicle would not be conducted from USAKA/RTS. Therefore, there would be no additional impacts related to hazardous materials, pollution prevention, and solid waste. Under the No Action Alternative, existing operating procedures, military operations, and other launch activities would continue at USAKA/RTS.

4.4 NOISE

The Proposed Action would not be expected to significantly impact noise-sensitive receptors around USAKA/RTS. The noise data and analyses in the 1993 SEIS and the 2001 PEIS remain substantially valid, and the FAA used those data and analyses to reach the conclusions in Section 4.4.1.

4.4.1 Proposed Action

The activities associated with the Proposed Action would be expected to fall within the parameters analyzed in the 1993 SEIS, which found that noise impacts ranged from negligible to short-term insignificant impacts to workers. The L-1011 LCA and mated Pegasus vehicle would leave USAKA/RTS under jet power. The noise associated with L-1011 LCA takeoff and landing is common to other similar activities at USAKA/RTS. The potential impacts of noise from the L-1011 LCA would be temporary and infrequent. Therefore, potential noise impacts from L-1011 LCA takeoffs and landings under the Proposed Action would be negligible.

At an altitude of 6.6 miles above the surface of the Pacific Ocean, the Pegasus vehicle would be released from the L-1011 LCA and would launch. From such an altitude over the ocean, audible noise would be of no consequence to humans. The 2001 PEIS analyzed the impacts of small-capacity launch vehicles, similar to Pegasus, and found there would be no impacts to humans from noise. Noise from launches could startle birds, but this effect would be of short duration. Launch noise may be audible at the ocean surface; however, the noise would be temporary and infrequent. Therefore, launch noise would not be expected to impact marine life.

According to the 2001 PEIS, sonic booms from launches similar to those of the Pegasus launch vehicle could impact underwater environments. Sonic booms from Pegasus launches could reach underwater depths of about 820 feet and might represent a physical, habitat, or migratory threat to marine species, especially those on the surface of the ocean. See Section 4.2.1.2 for a discussion of noise impacts on marine species. Potential sonic booms would occur over the Pacific Ocean and would not be expected to impact populated areas. .

4.4.2 No Action Alternative

Under the No Action Alternative, the FAA would not renew Orbital Sciences' Launch Operator License, and commercial launches of the Pegasus vehicle would not be conducted from USAKA/RTS. Therefore, there would be no additional impacts from noise. Under the No Action Alternative, existing operating procedures, military operations, and other launch activities would continue at USAKA/RTS.

4.5 WATER RESOURCES (SURFACE WATER, GROUNDWATER, FLOODPLAINS, AND WETLANDS)

The Proposed Action would not be expected to significantly impact water resources around USAKA/RTS. The data and analyses on water resources in the 1993 SEIS and the 2001 PEIS remain substantially valid, and the FAA used those data and analyses to draw the conclusions reported Section 4.5.1.

4.5.1 Proposed Action

The 1993 SEIS found that implementation of the highest level of launches at USAKA/RTS could cause short-term degradation of the groundwater supply from overdraft. However, the proposed number of launches would not exceed the launches analyzed in the 1993 SEIS and 2001 PEIS. Launches of the Pegasus vehicle at USAKA/RTS would not place an increased demand on the groundwater supply. Existing staffing levels would remain relatively similar because pre-launch activities would occur at Vandenberg Air Force Base. Therefore, an increase in demand for groundwater-derived potable water would not be expected. Only system checks and potential fueling of the L-1011 LCA would occur at USAKA/RTS. Therefore, the generation of wastewater would be limited. Kwajalein, Roi-Namur, and Meck Islands have wastewater collection and treatment systems. The Proposed Action would not be expected to increase demand on these systems. Due to the infrequency of launches and limited nature of pre-launch activities, impacts to water resources would not be significant.

The Pegasus launch vehicle uses a solid rocket propulsion system consisting of ammonium perchlorate, which is designed to burn the propellant in its entirety. According to the 2001 PEIS, in the event of an accidental release of solid rocket propellant that has not burned completely, ammonium perchlorate can occasionally form a binder matrix and be released into water bodies as unburned segments. Ammonium perchlorate can be highly toxic, depending on its reactivity; however, the binder matrix configuration would dissolve slowly in the water column, with only very local impacts to marine life. The 1993 SEIS concluded that negligible impacts from these spill events would be expected because of the buffering capacity of the ocean. A launch failure of a Pegasus vehicle with the additional HAPS stage could release hydrazine into the water column. However, the released hydrazine would be quickly oxidized and dispersed (U.S. Air Force 2006).

There are no designated wetlands at USAKA/RTS, thus no impacts to wetland resources would occur. The United States and the Republic of the Marshall Islands have not designated a flood hazard for the Kwajalein Atoll (USASMDC 2009b).

4.5.2 No Action Alternative

Under the No Action Alternative, the FAA would not renew Orbital Sciences' Launch Operator License, and commercial launches of the Pegasus vehicle would not be conducted from USAKA/RTS. Therefore, there would be no additional impacts to water resources. Under the No Action Alternative, existing operating procedures, military operations, and other launch activities would continue at USAKA/RTS.

4.6 CUMULATIVE IMPACTS

Cumulative impacts are the incremental effects of the Proposed Action when added to other past, present, and reasonably foreseeable future actions regardless of which agency or person undertakes the action. Pegasus operations under the Proposed Action would not significantly impact any of the environmental resources addressed in Section 4.1. However, this section examines other projects in the area, which in combination with Pegasus launches could potentially cause impacts at USAKA/RTS to exceed the significance threshold in any one resource area. The cumulative impacts are organized by the following resource areas: air quality, biological resources, hazardous materials, pollution prevention, and solid waste, noise, and water resources (surface water, groundwater, floodplains, and wetlands).

USAKA/RTS is an active military base which continues to support missile defense and U.S. security operations. USAKA/RTS is spread across several islands of the Atoll and consists of several launch pads and airfields. Bucholz Army Airfield on Kwajalein Island has reported a maximum air traffic volume of 1,674 operations per month, averaging over 55 operations per day. In 2004, flight activities averaged around 25 flights per day. Flight operations consist of inter-atoll commercial aircraft traffic and helicopter activities as well as military operations (USASMDC 2004). Recent operational changes at USAKA/RTS have resulted in planned facility and trailer closures. Facilities proposed for closure include a hospital annex, water-treatment facility, a photography laboratory, warehouses, Xerox repair shop, weather-balloon storage, and a theater. This would include demolition of unnecessary facilities and decommissioning the water-treatment facility. The potential impacts of facility closures, demolition, and decommissioning have been addressed in the *Final Environmental Assessment – U.S. Army Kwajalein Atoll Ronald Reagan Ballistic Missile Defense Test Site Facility Closures and Demolitions* (USASMDC 2009b) (the 2009 EA).

Space Exploration Technologies Corporation (SpaceX) is a privately owned enterprise aimed at developing launch vehicles for commercial space transport. SpaceX established a launch location for its Falcon Launch Vehicle Program on Omelek Island, part of USAKA/RTS, and began launching its Falcon I rocket in 2008. In 2007, the U.S. Army Space and Missile Defense Command released the Final EA for the SpaceX Falcon Program and Finding of No Significant Impact (the SpaceX EA) for the construction/refurbishment and operation of the Falcon Launch Vehicle launch site and supporting facilities.

Other ongoing launch activities at USAKA/RTS include the Missile Defense Agency's Theater High Altitude Area Defense (THAAD) system. The THAAD system involves multiple test flights of target and interceptor missiles from USAKA/RTS, specifically Meck Island. The environmental impacts of the THAAD test flights at USAKA/RTS were analyzed in the *THAAD Pacific Test Flights Environmental Assessment* (USASMDC 2002) (THAAD EA). The THAAD EA analyzed up to 50 THAAD interceptor missiles and 50 target missiles launches from Meck Island between fiscal year 2005 and 2010, with approximately 1 to 14 launches per year.

4.6.1 Air Quality

Under the proposed activities analyzed in the 2009 EA and SpaceX EA, construction and demolition of facility structures would require the use of diesel construction vehicles, such as a

crusher, pile drivers, concrete mixers, pumps, saws, hammers, cranes, and forklifts, which would produce emissions. However, it is not likely that the emissions created by construction equipment would cause an exceedance of the UES air quality standards (USASMDC 2007 and 2009b). Vehicle emissions would be localized and quickly disperse, creating no long-term impacts.

Construction activities addressed in the 2009 EA and Space X EA may produce fugitive dust. However, the local soil is coarse and not easily converted to fugitive dust (USASMDC 2002). If fugitive dust was created, it could impact localized air quality. Standard dust-control measures would minimize and contain fugitive dust, and fugitive dust would not be expected to significantly impact air quality. Once construction and demolition activities concluded, air quality would be expected to return to pre-construction levels. Implementation of the proposed Power and Facilities Reduction Plan described in the 2009 EA would reduce demand for electricity and therefore the associated emissions created as a result of electricity generation.

The aggregate impacts of SpaceX, THAAD, and Pegasus launches would not be expected to exceed NAAQS because launches would not be scheduled concurrently or at the same launch location. The emissions from SpaceX and THAAD launches are not expected to cause exceedances of 25 percent of the UES. Emissions from launch activities would have time to disperse, thereby minimizing cumulative impacts to air quality from the launches.

Furthermore, Pegasus launches, current air traffic activities, operations at the SpaceX Falcon Launch vehicle launch site, THAAD test launches, and USAKA/RTS demolition and closure activities would not result in significant cumulative impacts to air quality.

Cumulative impacts to global climate change from Pegasus launches and the existing rocket and missile launch activities at USAKA/RTS and surrounding islands would be insignificant compared to impacts from emissions from other industrial sources and activities. As described in the 2001 PEIS, the amount of carbon monoxide and carbon dioxide emissions from all launches worldwide is only 0.0005 percent of those emissions from U.S. industrial sources in 1 year. Furthermore, the additional cumulative impact on stratospheric ozone depletion from launches worldwide would not be noticeable when added to the effects of other natural and man-made sources. Therefore, the cumulative impacts to global climate change from existing activities at USAKA/RTS and the proposed Pegasus launches would be negligible.

4.6.2 Biological Resources

The demolition of underutilized structures would not impact previously undisturbed areas. Furthermore, cleared areas would be planted with native and introduced species, eventually the newly cleared areas would return to undisturbed open space. As demolition of facilities is conducted, procedures would be in place to minimize water pooling. Noise created from construction equipment and demolition activities may startle birds and terrestrial wildlife; however, these effects would be expected to be localized and temporary. Furthermore, the demolition of underutilized buildings could have a positive impact on biological resources in the long-term.

Launch activities would be expected to have a minimal impact on biological resources. Biological resources could be startled by construction or launch noise; however, foraging and nesting activities would be expected to return to normal. Construction or demolition associated with the activities addressed in the 2009 EA and SpaceX EA on Kwajalein Island could coincide with a Pegasus launch. However, the noise associated with the activities under the 2009 EA and SpaceX EA was determined to be localized and short-term. The addition of takeoff noise of the L-1011 LCA and mated Pegasus vehicle would not be expected to significantly increase noise levels on Kwajalein Island, particularly at an active military installation base.

Since launches associated with the THAAD, Pegasus, SpaceX programs would not be expected to occur simultaneously, the local wildlife would have sufficient time to return to normal behavioral patterns following a launch. Launch activities would occur on different islands throughout the Atoll, which reduces the amount of noise that wildlife in any given area is exposed to and thus the incremental impact of the launches would not significantly impact wildlife. The SpaceX EA concluded that impacts to biological resources would not be significant because launches would be infrequent and construction would not impact habitat of threatened or endangered species. The proposed Pegasus launches analyzed in this EA also would be periodic. Jet noise is common at USAKA/RTS because of the active military installation on the Atoll. The Pegasus launches would be over open ocean at a high altitude, which would limit potential impacts to biological resources from noise and emissions. In addition, launches of the Falcon and Pegasus vehicles would occur at different facilities within USAKA/RTS and would not be scheduled at the same time. By separating launches, potential emissions would have time to disperse. Like current operations at USAKA/RTS, the Proposed Action has the potential to startle animals, but animals would be expected to return to normal activities within a short time. The Proposed Action would fall within the noise parameters of current activities, including takeoff and landing of commercial and military aircraft and helicopters. While a direct strike on marine animals would be possible, it would be highly unlikely due to the infrequency of launches. As described in the SpaceX EA, the possibility of a jettisoned stage hitting a biological resource is less than one in one million (USASMDC 2007). The addition of the Proposed Action to existing and future activities at USAKA/RTS would not be expected to significantly impact biological resources. Therefore, there would be no cumulative impacts to biological resources.

4.6.3 Hazardous Materials, Pollution Prevention, and Solid Waste

According to the 2009 EA, USAKA/RTS closure and demolition activities could increase the use of fuel for demolition and transport vehicles. There are adequate facilities and procedures to effectively manage the temporary increase in fuel usage. Prior to demolition, building contents and hazardous material, such as asbestos and polychlorinated biphenyls (PCBs), would be removed and properly disposed. Such hazardous material would be shipped off site for treatment and disposal in accordance with the requirements of the UES. Construction waste would also be collected and disposed of in accordance with the UES. Recycling and reuse of construction material would be maximized to divert material from the waste stream.

The SpaceX EA concluded that hazardous waste generated by the proposed Falcon launches would not result in a significant impact. The THAAD test program would increase the amount of hazardous materials, including propellants, solvents, and cleaners. This increase is not

expected to overburden the systems currently in place. The THAAD EA determined that generated hazardous waste would not have a significant impact.

As stated in Section 4.3 of this EA, Pegasus launches would not significantly increase hazardous waste. As an active military base, USAKA/RTS has procedures in place to address hazardous waste generation, storage and disposal. Additionally, hazardous waste generated from current operations at USAKA/RTS would be similar to the hazardous waste expected from the Proposed Action. Since the Proposed Action would only generate a small quantity of hazardous waste, it would not overwhelm the current system. Therefore, the cumulative impacts from current operations, Pegasus launches, SpaceX Falcon launches, THAAD test launches, and USAKA/RTS demolition and closure activities would not result in significant cumulative impacts related to hazardous materials, pollution prevention, and solid waste.

4.6.4 Noise

The 2009 EA stated that the noise created from the demolition activities at USAKA/RTS would be localized and temporary. Because the Pegasus launches and the demolition activities would create only localized and temporary noise impacts, the cumulative impacts of the two activities would be expected to be negligible.

Falcon launches would be from Omelek Island, which was developed as a launch facility and does not contain permanent residential housing. The SpaceX EA found that noise from Falcon launches would have a minimal impact on wildlife and vegetation. The THAAD launches would occur at Meck Island, and not affect sensitive noise receptors. Operation of the radar generators would produce noise; however, the noise levels are not expected to exceed workplace standards or affect sensitive noise receptors. Wildlife may exhibit a startle response from construction as well as launch activities, but impacts would be short-term. Therefore, there would be no long-term impacts from noise on either humans or wildlife. Under the Proposed Action addressed in this EA, the L-1011 LCA, to which the Pegasus vehicle would be mated, would result in impacts from noise similar to those from existing aircraft operations out of USAKA/RTS. In addition, Pegasus launches would be over the open ocean, far away from any sensitive receptors. There also would be sonic booms associated with Pegasus launches, but these would be over the ocean at an altitude that would result in a negligible impact to humans. Sonic booms created by Falcon launches would be expected to occur at an altitude of approximately 5 miles. Sonic booms from such launches could reach underwater depths; however, the sounds create would be equivalent to mild thunder. The THAAD test launches could generate a sonic boom over the open ocean upon reentry. Since the intensity and altitude of the sonic boom is dependent on the trajectory of the launch, the exact impacts of the sonic booms could not be determined. However, sonic booms would occur over the open ocean away from sensitive human noise receptors. Aquatic mammals could be impacted by sonic booms associated with the THAAD missile launches; however, due to the infrequent nature of these activities the long-term impact would be expected to be negligible. Furthermore, because the Falcon, THAAD, and Pegasus launches would result in negligible impacts to humans and wildlife from noise, cumulative impacts would not be expected to be significant.

4.6.5 Water Resources

As analyzed in the 2009 EA, decommissioning the water treatment facility would decrease the amount of potable water on Ennylabegan Island; however, catch-basin capacity would be extended. Demolition activities would not be expected to impact water resources because such activities would be contained to a designated demolition area. Demolition would be conducted in accordance with the facility's Storm Water Pollution Prevention Plan, which minimizes soil erosion and contaminated run-off.

Falcon launches are not expected to significantly impact water resources. Launch operations would occur in accordance with stormwater plans to minimize contaminated runoff. In addition, spills would be quickly contained and cleaned up in accordance with established plans and regulations. Unspent fuel from the Falcon vehicles may leak onto the surface of the ocean creating localized impacts. The SpaceX EA found that much of the leaked fuel would evaporate within a few hours while the rest would be diluted into the water column. The impacts to water resources would be expected to be minimal.

Test launches of THAAD missiles were determined to have no impact on local water resources (USASMDC 2002). The depositing of hazardous materials, such as unspent propellants, into the open ocean was determined to have a negligible impact due to the natural buffering ability of the ocean.

The Proposed Action addressed in this EA would result in negligible impacts to water resources because of the limited scope of activities at USAKA/RTS (landing and takeoff of the L-1011 LCA). Because plans are in place to minimize impacts to water resources, the Pegasus launches added to demolition and closure activities, Falcon launches, THAAD missile launches, and existing operations would not be expected to result in significant cumulative impacts to water resources.

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