Federal Aviation Administration

Draft Environmental Assessment for the Kodiak Launch Complex Launch Pad 3

September 2014

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DRAFT ENVIRONMENTAL ASSESSMENT
Kodiak Launch Complex Launch Pad 3

AGENCY: Federal Aviation Administration (FAA), lead agency; National Oceanic and Atmospheric Administration (NOAA), Missile Defense Agency (MDA), National Aeronautics and Space Administration (NASA), U.S. Air Force Space and Missile Systems Center (SMC) cooperating agencies.

ABSTRACT: This Draft Environmental Assessment (EA) addresses the potential environmental impacts of the Proposed Action where the FAA would modify the Alaska Aerospace Corporation's (AAC) Launch Site Operator License for the Kodiak Launch Complex. The Draft EA evaluates the potential environmental impacts of modifying the Launch Site Operator License to include medium-lift launch capability at KLC with the addition of new infrastructure necessary to support these types of launches, including the construction of a launch pad and associated facilities.

This Draft EA analyzes the potential environmental impacts of the Proposed Action and No Action Alternative on air quality; compatible land use; Section 4(f) resources; fish and wildlife; plants; hazardous materials, pollution prevention, and solid waste; historical, architectural, archaeological, and cultural resources; light emissions and visual effects; natural resources and energy supply; noise; socioeconomics, environmental justice, and children's environmental health and safety risk; water quality; wetlands; secondary/induced impacts; and cumulative impacts.

PUBLIC REVIEW PROCESS: In accordance with the National Environmental Policy Act of 1969, as amended (NEPA; 42 United States Code [U.S.C.] 4321, et seq.), Council on Environmental Quality NEPA implementing regulations (40 CFR Parts 1500 to 1508), FAA Order 1050.1E, Environmental Impacts: Policies and Procedures, Change 1, and FAA Order 5050. 4B, the FAA has initiated a public review and comment period for this Draft EA. Interested parties are invited to submit comments on the Draft EA to the contact listed below, on or before October 15, 2014.

In addition, the FAA will hold an open house public meeting on October 7, 2014 from 5:00 to 8:00 pm at the Katurwik Room of the Kodiak Inn Best Western, 236 E Rezanof Dr, Kodiak, AK 99615.

CONTACT INFORMATION: To request copies of the Draft EA or to submit comments, please contact Stacey M. Zee, Federal Aviation Administration, c/o ICF International, 9300 Lee Highway, Fairfax, VA 22031; phone (202) 267-9305. Comments can also be submitted by email to FAAKodiakEA@icfi.com.

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

Issued in Washington, DC on: 9/12/2014

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

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ACRONYMS AND ABBREVIATIONS

AAC	Alaska Aerospace Corporation
ABR	ABR, Inc.
ADCCED	Alaska Department of Commerce, Community, and Economic Development
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
AHRS	Alaska Heritage Resources Survey
ANILCA	Alaska National Interest Lands Conservation Act
APE	Area of Potential Effect
AS	Alaska Statute
BMPs	Best Management Practices
BO	Biological Opinion
CAA	Clean Air Act
CDP	Census Demographic Profile
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESQG	Conditionally Exempt Small Quantity Generator
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CWA	Federal Clean Water Act
dB	Decibel
dBA	A-weighted Decibel
DNL	Day-Night Average Sound Level
DoD	Department of Defense
DODM	Department of Defense Manual
DOT&PF	Alaska Department of Transportation and Public Facilities
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ENRI	Environmental and Natural Resources Institute
EO	Executive Order
EPA	Environmental Protection Agency

ESA	Endangered Species Act
ESP	Explosive Site Plan
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
FWCA	Fish and Wildlife Coordination Act
GSO	Ground Safety Officer
HC	Hazard Class
HCI	Hydrogen Chloride
HD	Hazard Division
HMTA	Hazardous Materials Transportation Act
HTPB	Hydroxl-terminated polybutadiene
ILMA	Interagency Land Management Assignment
IPF	Integration and Processing Facility
KEA	Kodiak Electric Association
Kg	Kilograms
KIB	Kodiak Island Borough
KLC	Kodiak Launch Complex
LCC	Launch Control Center
LFF	Liquid Fuel Facility
LOA	Letter of Authorization
LOX/LO_2	Liquid Oxygen
LP1	Launch Pad 1 (orbital)
LP2	Launch Pad 2 (suborbital)
LP3	Launch Pad 3
LSO	Launch Site Operator License
LSS	Launch Service Structure
MBTA	Migratory Bird Treaty Act
MCC	Mission Control Center
MDA	Missile Defense Agency
MMPA	Marine Mammal Protection Act
MP	Milepost
MSF	Maintenance Support Facility
NAAQS	National Ambient Air Quality Standards
NASA	National Aeronautics and Space Administration
NE	Northeast

NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOx	Nitrogen Oxides
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NPS	Non-Point Source
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
OHA	Office of History and Archeology
OSHA	Occupational Safety and Health Administration
PAEL	Pre-Approved Emission Limits
PBAN	Polybutadiene acrylonitrile
pH	Solvated Hydrogen
PM10	Particulate Matter
PPF	Payload Processing Facility
PWS	Public Water System
QD	Explosive Quantity Distance
R&M	R&M Consultants, Inc.
RCRA	Resource Conservation and Recovery Act
RMSF	Rocket Motor Storage Facility
ROD	Record of Decision
RP1	Rocket Propellant One
RSF	Rocket Staging Facility
RSRM	Reusable Solid Rocket Motor
SE	Southeast
SHPO	State Historic Preservation Office
SIP	State Implementation Plan
SMC	U.S. Air Force Space and Missile Systems Center
SPCC	Spill Prevention, Control, and Countermeasure
SW	Southwest
SWPPP	Stormwater Pollution Prevention Plan
TSCA	Toxic Substances Control Act
U.S.	United States

USACE	U.S. Army Corps of Engineers
USAF	U.S. Air Force
USCB	U.S. Census Bureau
USCG	United States Coast Guard
USDA	U.S. Department of Agriculture
USDHS	U.S. Department of Homeland Security
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
UST	Underground Storage Tank
VAFB	Vandenberg Air Force Base
VPF	Vehicle Processing Facility
WRCC	Western Regional Climate Center
WWII	World War 2

DRAFT ENVIRONMENTAL ASSESSMENT

Kodiak Launch Complex Launch Pad 3

1 INTRODUCTION

Alaska Aerospace Corporation (AAC) is proposing to expand the launch capabilities of the Kodiak Launch Complex (KLC), a commercial launch site currently operated under a Federal Aviation Administration (FAA) Launch Site Operator License (LSO-03-008). The existing license authorizes small-lift operations. The FAA Office of Commercial Space Transportation (AST) would have to modify the current license to include AAC's proposed expanded launch capabilities. The expansion would include medium-lift launch capability at KLC and the addition of new infrastructure to support these launches, including the construction of an additional launch pad and associated facilities (See Section 2.1 for a more detailed description of the Proposed Action).

Modifying a Launch Site Operator License is considered a major Federal action subject to environmental review under the National Environmental Policy Act of 1969, as amended (NEPA; 42 United States Code [U.S.C.] 4321, et seq.). The FAA/AST is the lead agency responsible for preparing this Draft Environmental Assessment (EA) in accordance with NEPA, Council on Environmental Quality (CEQ) NEPA implementing regulations (40 Code of Federal Regulations [CFR] Parts 1500 to 1508), and FAA Order 1050.1E, Environmental Impacts: Policies and Procedures, Change 1.

The National Oceanic and Atmospheric Administration (NOAA), the Missile Defense Agency (MDA), the National Aeronautics and Space Administration (NASA), and the U.S. Air Force Space and Missile System Center (SMC) are cooperating agencies on this Draft EA. NOAA is serving as a cooperating agency on this EA due to special expertise and jurisdiction on marine resources near KLC, while MDA, NASA, and SMC are serving as cooperating agencies owing to special expertise related to launch operations.

NOAA Fisheries has jurisdiction over the marine resources surrounding the KLC and is providing special expertise regarding the potential effects of the Proposed Action on the federally-listed species and marine mammals addressed in the existing Biological Opinion and Letters of Authorization for launch operations at KLC.

The MDA and SMC are participating as cooperating agencies due to related program experience, the similarity of the Proposed Action to actions taken by the MDA and SMC, as well as their possible use of the KLC as a launch site.

NASA is participating as a cooperating agency as a result of its related program experience and special expertise with respect to space launch vehicles, launch operations, and potential environmental impacts from launch operations. Additionally, it is possible that in the future, a NASA-sponsored payload or technology demonstration could be flown from KLC.

1.0 BACKGROUND

The KLC is a commercial launch site serving both government and commercial launch customers and is located on Narrow Cape on Alaska's Kodiak Island (Figure 1). Under the Proposed Action, the FAA/AST would modify the existing license to include medium-lift launch capability at KLC with the addition of new infrastructure necessary to support these types of launches. This EA also may be used in the future to

support the preparation of environmental documentation to facilitate launch operator license applications from vehicle operators as well as renewals for the Launch Site Operator License and Launch Operator Licenses.

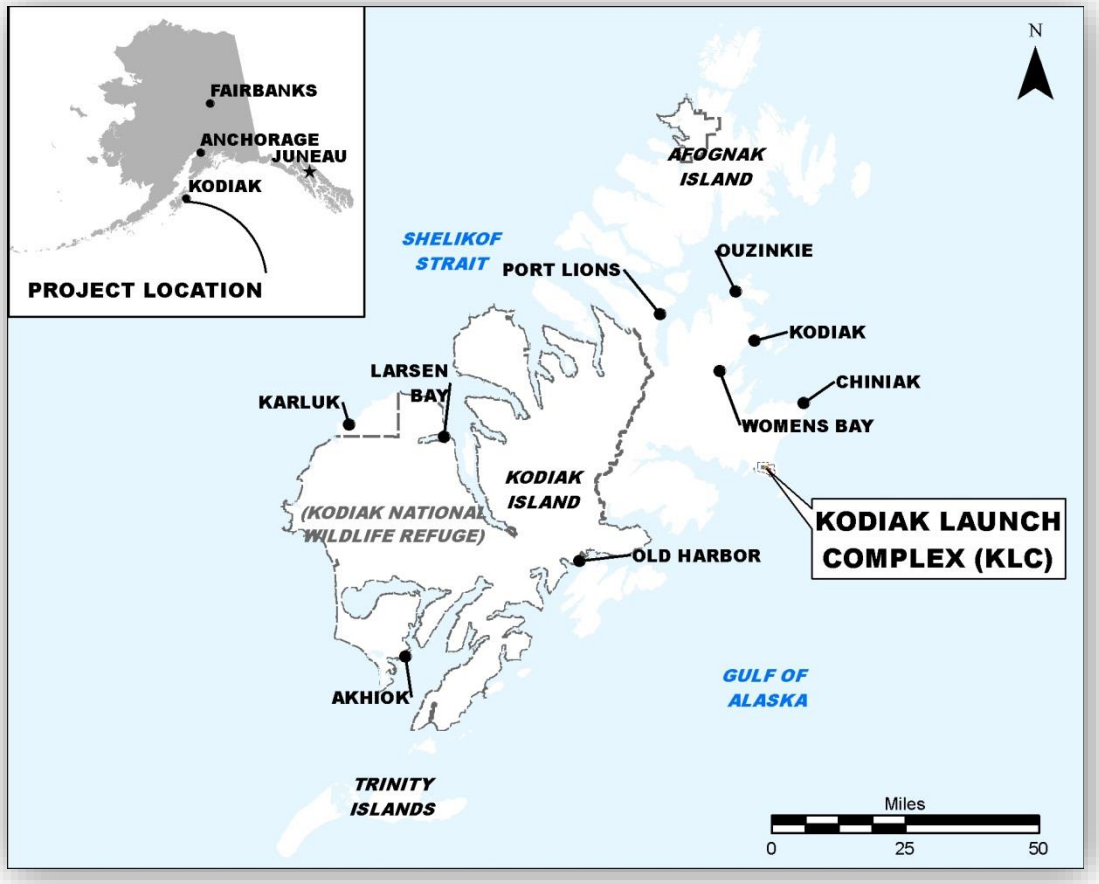

Figure 1: Kodiak Launch Complex: Location and Vicinity Map

Under 14 CFR Part 420, an applicant must provide enough information for the FAA/AST to analyze the potential environmental impacts associated with the proposed modification of the KLC Launch Site Operator License. The information provided by an applicant must be sufficient to enable the FAA to comply with the requirements of NEPA. This EA is intended to fulfill NEPA requirements for analyzing the potential environmental impacts of modifying AAC's Launch Site Operator License for the KLC. The successful completion of the environmental review process does not guarantee that the FAA/AST would modify the license. The project also must meet all FAA safety, risk, and financial responsibility requirements. Additional environmental analysis would be required for future proposed activities not addressed in this EA or in previous environmental analyses.

The environmental impacts of constructing and operating the KLC were initially analyzed in the FAA May 1996 *Environmental Assessment of the Kodiak Launch Complex* (1996 EA), based on which the FAA issued a *Finding of No Significant Impact* (FONSI). Since the 1996 EA, a number of NEPA documents have been developed that analyze the existing small-lift facilities and operations at KLC; these are listed below. Medium-lift launch services have not been analyzed at the KLC.

Some of the existing NEPA documentation for the KLC includes the following[1]:

- Missile Defense Agency (MDA), 2003 Ground-Based Midcourse Defense Extended Test Range Final EIS and Record of Decision (ROD).
    - Action(s) Considered: Missile launch sites, sensors, and other test equipment associated with the Ground-Based Midcourse Defense system.
- SMC 2006 Orbital/Sub-Orbital Program EA and FONSI.
    - Action(s) Considered: Space launch and target vehicles using excess Minuteman II and Peacekeeper rocket motors.
- MDA 2005 Test Resources Mobile Sensors EA and FONSI.
    - Action(s) Considered: Use of mobile land-based sensors and the use of airborne sensor systems to support Ballistic Missile Defense System testing.
- MDA 2007 Flexible Target Family EA and FONSI.
    - Action(s) Considered: Development, preparation, assembly, integration, testing, and transportation of target rockets to support missile defense testing.
- MDA 2008 Ballistic Missile Defense System Programmatic EIS and ROD.
    - Action(s) Considered: Development, testing, deployment, and planning for decommissioning of the Ballistic Missile Defense System.
- NASA 2011 Launch of NASA Routine Payloads EA and FONSI.
    - Action(s) Considered: Launching NASA routine spacecraft as payloads on expendable rockets.

In addition to the NEPA documents listed above, the KLC environs and operations have been studied and documented in the following:

- A four-volume report on the environmental baseline of Narrow Cape prepared by the Environmental and Natural Resources Institute (ENRI) (ENRI 1995a, ENRI 1995b, ENRI 1995c, ENRI 1995d and ENRI 1998)
- Sixteen environmental monitoring events and launch effects studies, corresponding to each KLC launch made to date (ENRI 2002b, ENRI 2005, R&M 2006, R&M 2006b, R&M 2007a, R&M 2007b, R&M 2008, R&M 2009, R&M 2011a, R&M 2011b)
- Site-specific KLC wetlands and vegetation mapping (ENRI 2003, ENRI 2004)
- Quarterly aerial surveys of marine mammals near KLC (AER Sep 2012, AER Feb 2013, AER Sep 2013, AER Sep 2013)
- Annual and five-year comprehensive analysis and summaries of marine mammal monitoring at KLC (ABR 2011, AAC 2012, AAC 2013)

Because the documents listed above were either prepared to comply with NEPA and/or characterize and analyze the environmental conditions at KLC, the information in these documents is relevant to the

[1] All MDA NEPA documents are available at: http://www.mda.mil/news/environmental_archive.html
The NASA Routine Payloads EA and FONSI are available at:
http://www.nasa.gov/agency/nepa/routinepayloadea.html

environmental analysis required for the FAA/AST Proposed Action being considered in this EA. Therefore, this EA incorporates by reference[2] such information where it is relevant, applicable, and appropriate to use in support of the affected environment and environmental analyses.

1.1 Kodiak Launch Complex

Originally constructed in 1998, the KLC has hosted 16 solid-propellant launches to date, most recently in September, 2011. The KLC provides a favorable location for space access into polar orbit (passing over or near both poles), sun synchronous orbit (tracking sun angle to continually pass over Earth's surface at a consistent time of day), and highly elliptical Molniya and Tundra orbits (suited to extended observation of high latitudes). The KLC offers downrange launch azimuths over the Pacific Ocean ranging from 110 to 220 degrees; it is the nation's highest latitude, full service launch complex (Figure 2 and Figure 3).

Figure 2: Existing Launch Pad Service Area

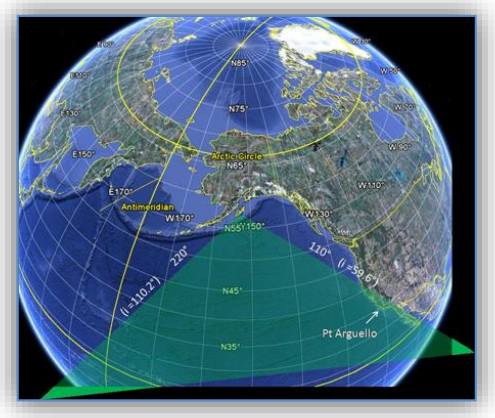

Figure 3: KLC Launch Azimuths

1.1.1 Existing KLC Facilities

Existing facilities at the KLC include seven primary installations with a network of supporting infrastructure. Figure 4 provides an overview of existing primary KLC installations. Supporting infrastructure for these facilities include: a site wide public water system, Pasagshak Point Road, several access roads leading from Pasagshak Point Road to the various installations, and other utilities.

[2] To ensure that the EA is both concise and clear about the bases for its conclusions, FAA may incorporate by reference other documents and analyses. An EA may incorporate by reference information or analysis that is reasonably available to the public, either in existing NEPA documents or in general background information, documents or studies prepared for other purposes (FAA Order 1050.1E, Change 1, Paragraph 404(d)).

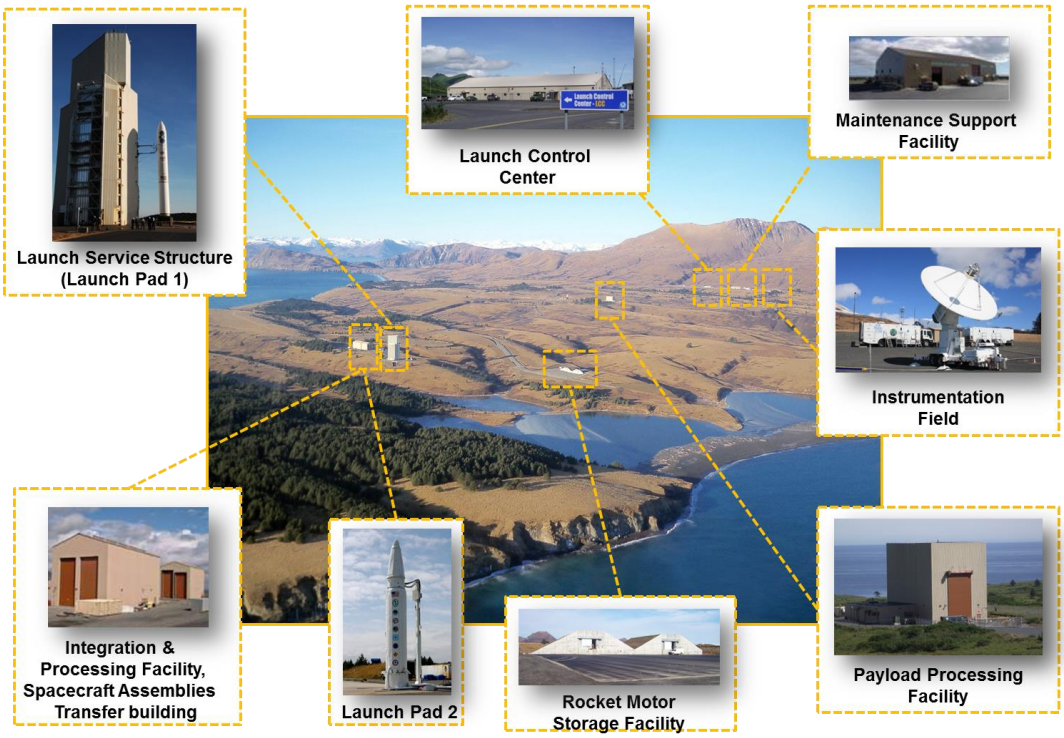

Figure 4: KLC Facility Overview

1.1.1.1 Launch Control Center

The Launch Control Center (LCC) is a 14,000 square-foot facility, which is the primary mission administration facility at KLC; containing customer offices and associated office equipment. It is the KLC communication center and the interface location for all fiber and copper connectivity range-wide. All site security including guards, camera monitoring, and secure storage are housed in or based from the LCC. The Launch Operations Control Center is KLC's launch control facility, which contains 49 console positions for the launch team, range control, and mission management. It is located within the LCC, approximately two miles from the existing launch pads and outside the pad area Explosive Safety Quantity Distance requirements.

1.1.1.2 Maintenance Support Facility

The Maintenance Support Facility (MSF) is a 19,000 square-foot building containing administrative office space for AAC staff, KLC maintenance shops, and storage bays for AAC's materials. Outside the MSF are two fabric buildings which serve as storage locations.

1.1.1.3 Instrumentation Field

The Instrumentation Field is a gravel pad area that accommodates a wide array of customer instrumentation equipment and antennas, as well as components of AAC's Range Safety and Telemetry System.

1.1.1.4 Payload Processing Facility

The Payload Processing Facility (PPF) is a 10,694 square-foot building which hosts general rocket payload processing operations, and also contains a clean room for specific operations. Its two 58-foot high bays

are equipped with containment trenches to support hypergolic fueling. A breathing air system capable of supporting four personnel in Self Contained Atmospheric Protective Ensemble is internal to the PPF, along with a hazardous vapor detection system to support hypergolic fueling

1.1.1.5 Rocket Motor Storage Facility

The Rocket Motor Storage Facility (RMSF) is a set of Earth Covered Magazines (ECM), operating under an Explosive Site Plan (ESP) allowing storage of up to 250,000 pounds of Hazard Division 1.1 ordnance in each ECM. There are currently two ECMs at KLC which may be expanded to a total of five depending on customer requirements.

Prior environmental reviews have addressed the construction and operation of the RMSF with up to five ECMs. The July 2003 MDA *Ground-Based Midcourse Defense Extended Test Range Final Environmental Impact Statement* (2003 EIS) analyzed the construction and operation of the RMSF (referred to in the 2003 EIS as the Missile Storage Facility) at KLC. In 2009, AAC proposed to change the location of the RMSF to about a half mile southeast of the location identified in the 2003 EIS. The FAA conducted an environmental review of the change in the RMSF location in an internal document called a Written Reevaluation, which analyzed the modification of AAC's Launch Site Operator License to include the RMSF at this new location[3]. The Written Reevaluation evaluated the new location of the RMSF with up to five ECMs, and the FAA determined that modifying AAC's Launch Site Operator License conformed to prior environmental documentation, and the data and analyses contained in the 2003 EIS for the construction and operation of RMSF remained substantially valid. The FAA's environmental review concluded that the preparation of a supplemental or new environmental document was not necessary under NEPA to include the new location of the RMSF in the AAC Launch Site Operator License for KLC. Because of the prior environmental reviews for the RMSF with up to five ECMs, the potential impacts of constructing the additional three ECMs is not included as part of this EA's Proposed Action. Data and analyses are incorporated by reference from the 2003 EIS as warranted.

1.1.1.6 Integration and Processing Facility

The Integration and Processing Facility (IPF) is a 7,010 square-foot, 50-foot high building for the processing of solid rocket motors before they are stacked on the launch pad. Processing includes activities such as receiving the motors, uncrating from shipping containers, removing packaging materials, inspecting the motors for serviceability, installing electrical components, installing flight termination pyrotechnics, installing and testing thrust vector systems, and preparation for stacking. The IPF is large enough to handle all small-lift solid-propellant vehicles. Solid motors can be processed on trailers or on a rail set. Transporter vehicles can interface with the rail set.

1.1.1.7 Launch Service Structure

The Launch Service Structure (LSS) is a 174-foot tall building housing Launch Pad 1 (LP1), which is used for orbital launches. The LSS is equipped with moveable work platforms and adjustable custom inserts that accommodate a variety of rocket diameters. LP1 is equipped with a mobile rail system for easy pullback of the structure. The launch tower is environmentally conditioned and enclosed for vehicle preparation during all seasons. The pad itself is flush with ground level, and equipped with a flame trench rated to 1.1 million pounds of thrust.

1.1.1.8 Spacecraft and Assemblies Transfer Building

The Spacecraft and Assemblies Transfer Building is a 3,558 square-foot, 50-foot-high, self-contained, environmentally controlled, rail-mounted rolling structure that is used to extend the work space in the IPF

[3] FAA Order 1050.1E, Change 1, *Environmental Impacts: Policies and Procedures*, paragraph 515.

or LSS to create expanded all weather indoor work space for both facilities (Figure 4). It also houses KLC's sub-orbital launch pad, Launch Pad 2 (LP2). LP2 is located between the IPF and the LSS and is used for the launch of smaller sub-orbital rockets. The Spacecraft and Assemblies Transfer Building provides an environmental enclosure around LP2 for the erection and processing of sub-orbital rockets and its crane is used to lift the rockets from the transporter-erector onto the launch stool. When final preparations are complete, the building is pulled clear of the launch area.

1.2 Purpose of and Need for the Proposed Action

1.1.1 1.3.1 FAA's Purpose and Need

The *purpose* of the FAA's Proposed Action in this EA is to fulfill the FAA/AST's responsibilities under the Commercial Space Launch Act, 51 U.S.C. Ch. 509, §§ 50901-23 (2011) for oversight of commercial space launch activities, including issuing launch site operator licenses for the operation of commercial space launch sites like the KLC. The Proposed Action would be consistent with the objectives of the Commercial Space Launch Act.

The *need* for the action results from the statutory direction from Congress under the Commercial Space Launch Act to protect the public health and safety, safety of property, and national security and foreign policy interest of the U.S. and to encourage, facilitate, and promote commercial space launch and reentry activities by the private sector in order to strengthen and expand U.S. space transportation infrastructure.

1.1.2 1.3.2 AAC's Purpose and Need.

The *purpose* of the Alaska Aerospace Corporation's Proposed Action in this EA is to fulfill the AAC charter as stated in Alaska Statute 26.27.090 to lead the development and exploration of space in the State of Alaska by developing the launch infrastructure to support space launch activity.

The *need* for the action is based on potential business ventures that are considering the Kodiak Launch Complex as the site to launch medium-lift launch vehicles for a variety of commercial, civil, and defense payloads. Currently, Vandenberg Air Force Base, California, is the only launch site in the United States that can launch medium-lift launch vehicles into Polar, Sun Synchronous, and Highly Elliptical orbits. Expanding the existing capabilities at the Kodiak Launch Complex is expected to provide commercial and government missions schedule flexibility, cost competition, launch site resilience, and may keep space launch missions from going overseas.

1.3 Request for Comments on the Draft EA

The FAA is initiating a public review and comment period for this Draft EA. The FAA invites interested agencies, organizations, Native American tribes, and members of the public to submit comments on all aspects of this Draft EA. The FAA will consider all comments on this Draft EA in preparing a Final EA. To facilitate FAA consideration and response to comments, it is critical that comments be as specific as possible and clearly state concerns or recommendations related to the issues addressed in this Draft EA.

The FAA will accept comments on this Draft EA, preferably in writing, through October 15. Comments can be submitted to Stacey M. Zee, Federal Aviation Administration, c/o ICF International, 9300 Lee Highway, Fairfax, VA 22031, or submitted by email to FAAKodiakEA@icfi.com.

In addition, the FAA will hold an open house public meeting on October 7, 2014 from 5:00 p.m. to 8:00 pm at the Katurwik Room of the Kodiak Inn Best Western, 236 E Rezanof Dr, Kodiak, AK 99615.

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2.0 PROPOSED ACTION AND NO ACTION ALTERNATIVE

2.1 Proposed Action

Alaska Aerospace Corporation proposes to expand the launch capabilities of the KLC, a commercial launch site currently operated under a FAA Launch Site Operator License (LSO-03-008). The expansion would include medium-lift launch capability at KLC and the addition of new infrastructure to support these launches. To operate KLC as a commercial launch site with expanded launch capabilities that include medium-lift launches in addition to the already authorized small-lift launches, AAC must obtain a modification to its existing Launch Site Operator License.

Under the Proposed Action, which is the preferred alternative, the FAA would modify AAC's Launch Site Operator License LSO-03-008 for KLC to include medium-lift launch capability, with the addition of new infrastructure necessary to support those launches. As part of the Proposed Action, AAC would make improvements to the KLC to add both solid and liquid-propellant, medium-lift launch capability, and to operate the KLC in the future as a small-lift and medium-lift launch complex. The proposed site improvements (see Figure 5) associated with the license modification are listed below and detailed in Section 2.1.1. Under the Proposed Action the KLC could be used to conduct up to six orbital small-lift launches and three medium-lift launches per year from the existing launch pads and from the proposed Launch Pad 3 (LP3). To be conservative in the analysis of potential environmental impacts in this Draft EA, nine medium-lift launches per year are used as inputs.

Proposed construction includes the following six primary modifications to the KLC:

1. Launch Pad 3 (LP3): The launch stool, flame trench, a new access road, security gate and lighting, water deluge system (for liquid-propellant rockets only), and all related surface and subsurface construction. See Section 2.1.1.1.
2. Vehicle Processing Facility (VPF): A roller mounted, moveable rectangular tower where assembly of the solid rockets motors would take place on top of the pad. See Section 2.1.1.2.
3. Rocket Staging Facility (RSF): A rectangular building for the staging of solid rocket motors and the processing of liquid-propellant rockets. See Section 2.1.1.3.
4. Liquid Fuel Facility (LFF): On-site plant used to produce liquid oxygen (LOX) and liquid nitrogen. The liquid fueling facility would include holding tanks for LOX, liquid and gaseous nitrogen, gaseous helium, highly refined kerosene (called Rocket Propellant One or RP1), and piping to fuel the rocket. See Section 2.1.1.4.
5. Mission Control Center (MCC): A new control center in the vicinity of the current Launch Control Center. See Section 2.1.1.5.
6. Modifications to Pasagshak Point Road: Straightening the curves and flattening the dips of Pasagshak Point Road within the KLC. See Section 2.1.1.6.

The solid-propellant rockets would have nearly identical propellant composition to those previously launched from the KLC, but with differently configured engines. Solid-propellant medium-lift rockets proposed for launch from the KLC would use motors similar to the Reusable Solid Rocket Motors (RSRM) that were launched with the Space Shuttle. Liquid-propellant rockets have not been launched from KLC, and the proposed rockets would use a combination of RP1 and LOX, a stable conventional oxidizer used in many rockets around the world.

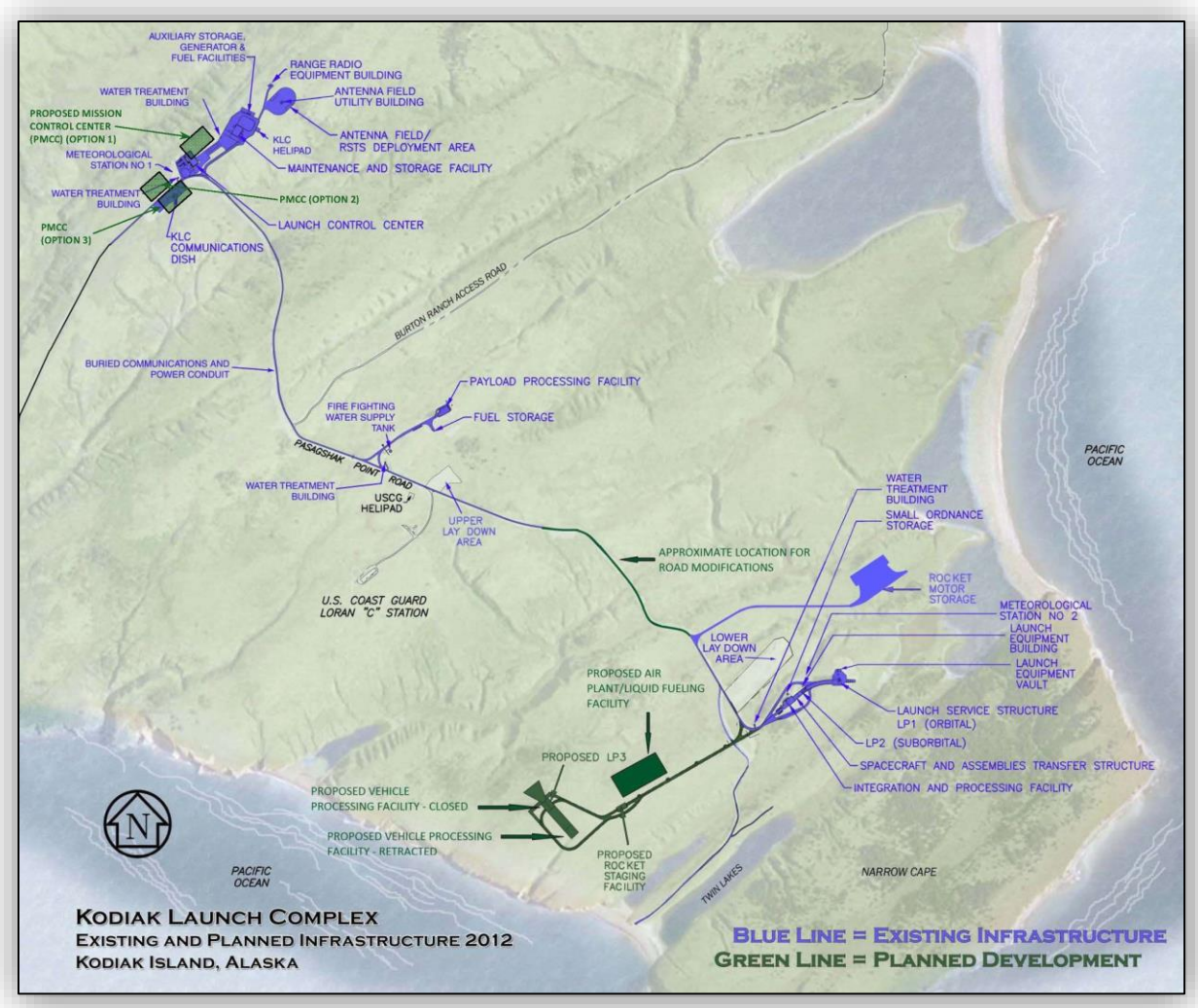

Figure 5: Existing and Proposed KLC Infrastructure

2.1.1 Site Improvements

Details of the specific site improvements under the Proposed Action are presented in Sections 2.1.1.1 through 2.1.1.6. The site improvements would take approximately three years to complete. Figure 6 shows the proposed design concept for Launch Pad 3, the Vehicle Processing Facility, Rocket Staging Facility, and the proposed new access roads.

Figure 6: Proposed Action Design Concept. From left to right are shown the Vehicle Assembly Building, Launch Pad 3 (with an Athena III), and the Rocket Staging Facility.

2.1.1.1 Launch Pad 3

LP3 would be an entirely new launch pad capable of accommodating medium-lift rockets and would be located on the western side of the current launch range. LP3 would include the launch stool, flame trench, new access road, security gate and lighting, and connections for liquid-propellant fueling operations. The launch stool would be a steel structure that can support the weight of the entire vehicle, secure the base of the vehicle during build up, and allow the vehicle to lift off freely during launch. For solid-propellant vehicles, the stool would generally be solid steel. For liquid-propellant vehicles, there would be plumbing connections between the stool and the rocket to fuel the vehicle and there would be a hold down mechanism to keep the rocket in place as the engines throttle up. The flame trench would be a 50 foot hole under the launch stool that curves from vertical to horizontal and exits to the north side of the launch pad in a wide fan. The purpose of the flame trench is to allow the exhaust from the ignition of the rocket to vent away from the nozzle in order to prevent choking the rocket engine. There would be a liquid oxygen evaporation containment pond near the pad, and, if required, there would be a water deluge system to reduce the acoustical energy produced at ignition. Water for the deluge system will be extracted from the existing KLC well and stored in pressure vessels near the pad. Before launch, the water will be pressurized by an inert gas and released just prior to ignition. The water would flow down the trench into a containment pond where it will be tested after the launch, and treated if necessary, before being released or allowed to evaporate. Underground and to the side of the launch stool would be two equipment rooms that provide electrical power, communications, and conditioned air to the vehicle prior to launch. Above ground would be a 200 foot fixed umbilical tower with cables and hoses to connect the underground utilities to various levels of the vehicle. The access road would be a 2,000 foot road branching off the existing Pasagshak Point Road that leads to the proposed new facilities. The security gate would be located just before the new facilities to minimize the size of the fenced area. LP3 would be

oriented so that the flame trench is directed away from surface waters and the seashore. Its location and orientation would meet proper explosive quantity distances (QDs) such that none of the unrelated facilities would be within the Inhabited Building Distance, thereby facilitating concurrent operations at LP1 or LP2.

2.1.1.2 Vehicle Processing Facility

The VPF would be required for processing solid-propellant and liquid-propellant medium-lift vehicles at KLC. The proposed VPF would be a rectangular structure approximately 300 feet tall, 140 feet long, and 110 feet wide, and would normally be located over LP3. It would be mounted on rollers so that it could be retracted to a safe distance for launches.

The VPF would support several different pre-flight processing operations. For processing of solid-propellant vehicles, each motor segment would be driven into the VPF where an overhead bridge crane would pick each motor, one at a time, rotate it from horizontal to vertical, and then place it in a build-up cell for inspections or directly on the launch stool as required. Interior platforms would be positioned to allow technicians to monitor the stacking of each motor and to complete assembly operations. For liquid-propellant vehicles, the empty liquid stages would also be picked by the bridge crane, rotated from horizontal to vertical, and be placed on the launch stool. Once all the motors are stacked and integrated, the encapsulated payload would be driven to the VPF in the vertical position, where it would be picked by the crane and placed on top of the rocket stack. In the event of an emergency or a mission delay, the payload and the rocket stages could be unstacked in reverse order.

2.1.1.3 Rocket Staging Facility

The RSF would be used for storage and assembly of rocket motors prior to movement to LP3. It would be comprised of a pre-fabricated metal building, approximately 120 feet long by 60 feet wide by 60 feet tall, roughly similar in size to the existing Integration Processing Facility. The RSF would be the reception area for medium-lift rocket components arriving at KLC. Rocket motors would be stored and inspected at the RSF prior to launch processing, due to the limited floor space available in the VPF. The RSF would also serve as the primary processing location for assembling liquid-propellant rockets prior to transport to LP3. The liquid-propellant medium-lift vehicles anticipated to be flown from KLC would be assembled in the horizontal position away from the launch pad.

2.1.1.4 Liquid Fuel Facility

The LFF would be located along the proposed new access road and would be accessible from LP3, facilitating fueling operations of a medium-lift, liquid-propellant vehicle. The LFF would be constructed near LP3 to produce and temporarily store LOX and liquid nitrogen on-site for the fueling processes. The LFF would consist of an industry standard air plant to extract oxygen and nitrogen from the air, and various storage tanks as detailed below. The LFF would occupy an area approximately 200 feet by 350 feet; the storage tanks would require small concrete pads to support their frame. The LFF would use existing power sources with a backup generator and be sited to allow Inhabited Building Distance QD requirements to be met on KLC. The ability to produce LOX and liquid nitrogen on-site would streamline fueling operations and would eliminate the need to ship those products to the site.

The LFF could include the following:

- One 28,000-gallon above-ground storage tank containing RP1.
- Two above-ground cryogenic storage tanks for LOX storage. One tank would have approximately 60,000 gallons of storage capacity; the second tank would hold approximately 1,500 gallons.

- One liquid nitrogen above-ground cryogenic storage tank (approximately 50,000 gallons). Liquid nitrogen would be used to cool the cryogenic systems as well as the LOX.
- Multiple high-pressure, above-ground steel tanks containing gaseous helium and nitrogen. Gaseous helium and nitrogen would be used for a variety of purposes, including pressurizing the fuel tanks. The exact number of tanks depends on the final design but could range from less than 10 large tanks to more than 40 smaller tanks.
- Support equipment would include vaporizers, valves, control systems, concrete pads, pedestals, piping, pumps, heat exchanger, and other miscellaneous equipment.

2.1.1.5 Mission Control Center

The MCC is a purpose built control center for medium-lift operations at KLC. The MCC would be a 14,000 square foot building similar in size and shape to the current LCC. The MCC would serve as the temporary administrative offices for launch teams and the operation control center during processing and the launch count down. It would be sized for a launch team of about 200 personnel and would have room for communication equipment, weather monitoring, security station, medical office, and a break room. The MCC would be located adjacent to the current LCC or in close proximity.

2.1.1.6 Pasagshak Point Road Improvements

Improvements to a section of Pasagshak Point Road are proposed within the KLC boundary. The vertical alignment of the existing section of road between the PPF and LSS would be corrected using excavated material from the proposed LP3 site. The curving road combined with a steep grade poses an elevated risk to the transportation of long rocket bodies that are extremely sensitive to torque and bending. Small bends in the flight hardware due to transportation over uneven roads can result in structural failure during flight, resulting in unsafe flight conditions and mission failure. Improving this section of the road would greatly increase the safety of rocket body transportation, facilitate access to LP3, and provide a location for disposal of excavated material. The improvement is anticipated to take 90,000 cubic yards of fill and require 4,000 square yards (0.83 acre) of new asphalt road paving. The fill area is 1.65 acres, of which 1.47 acres are delineated wetlands.

2.1.2 Launch Activities

Under the Proposed Action, it is assumed that a maximum of nine orbital-class launches per year would occur from the KLC. With the Delta II medium-lift rocket no longer in production, three new medium-lift launch vehicle providers have entered the launch market. The Athena III is a solid-propellant medium-lift vehicle, using aluminum powder and ammonium perchlorate. The Antares and the Notional Launch Vehicle use liquid-propellant consisting of RP1 and LOX. AAC intends to design LP3 so that any of these new rockets could be accommodated. The effects of each medium-lift rocket have been analyzed, and in situations where one rocket has a larger impact than the other two, that rocket is used as the benchmark for the analysis. Spacecraft reentry is not anticipated from LP-3 launches. If a specific mission does require reentry, the potential environmental impacts of that particular mission would be subsequently evaluated in the appropriate NEPA documentation. Launches may be conducted during any time of the year and at any time of the day or night. Figure 7 presents the current and proposed rockets for the KLC.

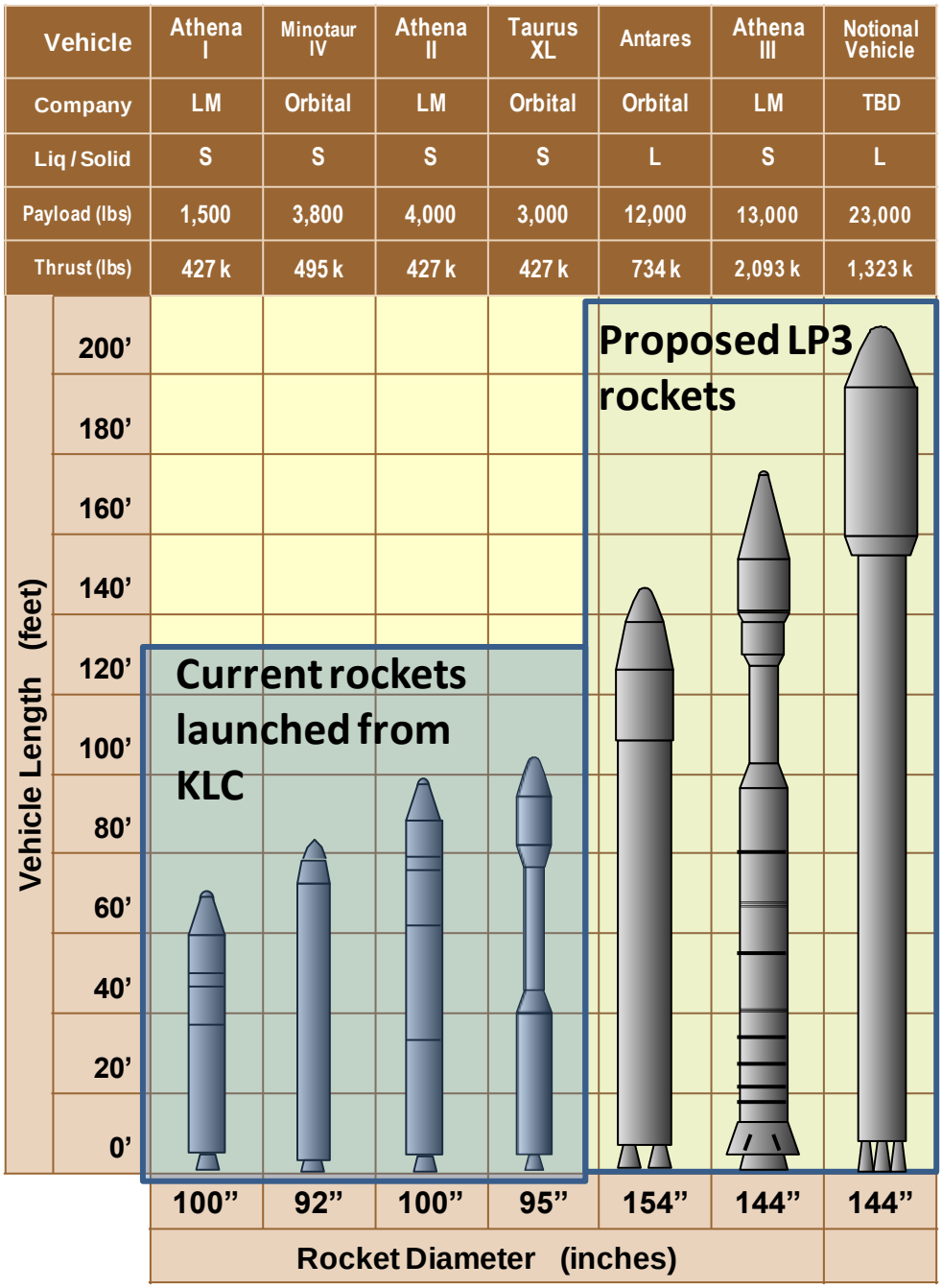

Figure 7: Kodiak Launch Complex- Current and Proposed Rockets

2.1.2.1 Athena III Launch Vehicle

The Athena III is a three-stage solid-propellant rocket. The first stage is based on the Reusable Solid Rocket Booster used by the Space Shuttle, the second stage is the commercial Castor 120 motor, and the third stage is the Castor 30. All three rocket motors are produced by ATK and the vehicle is integrated by Lockheed Martin. The Reusable Solid Rocket Booster solid motor propellant consists of three major components; aluminum powder (16%) as the fuel, ammonium perchlorate (~70%) as the oxidizer, and polybutadiene acrylic acid acrylonite (PBAN, ~12%) as a rubber-like binder. The second and third stages

use the same fuel and oxidizer, but a different binder called hydroxyl-terminated polybutadiene (HTPB). Solid-propellant motors are referred to by the binder they use, either PBAN or HTPB, because the fuel and oxidizers are the same. Additional specifications can be found in Table 1. At the time of the publication of this document, the Athena III has not flown.

Proposed Launch Vehicle (Provider):	Athena III (Lockheed Martin)
Primary Propellant type:	TP-H1148, PBAN (1st stage) TP-H1246, HTPB (2nd stage) Modified TP-H8299, HTPB (3rd stage)
Primary Propellant mass:	up to 1,300,000 pounds
Other propellants:	Hypergolic fuels for spacecraft, up to 200 gallons
Vehicle height:	up to 240 feet
Maximum recorded sound pressure at 30 feet as provided by the manufacturer:	154 dB

Table 1: Athena III Specifications

Notes: dB = Decibel

2.1.2.2 Antares Launch Vehicle

The Antares is typically a two-stage rocket with a gross lift-off weight of 640,000 pounds; however, an optional third stage can be added. Antares incorporates both solid and liquid stages; the first stage uses LOX and RP1 as the propellants, the second stage is a solid rocket motor (Castor 30 or Castor 30XL), and the optional third stage uses either nitrogen tetroxide and hydrazine, or a solid (Star 48) as propellant. The solid stages use aluminum powder as the fuel, ammonium perchlorate as the oxidizer, and HTPB as a rubber-like binder. Additional specification can be found in Table 2**Error! Reference source not found.**. The Antares has flown four times from Wallops Flight Facility, Virginia.

Proposed Launch Vehicle (Provider):	Antares (Orbital Sciences Corporation)
Primary Propellant type:	LOX, RP1 (1st stage)
Primary Propellant mass:	up to 400,000 pounds of LOX, up to 150,000 pounds of RP1
Other Propellants:	up to 80,000 pounds of HTPB (2nd stage) 4,500 pounds of HTPB (Optional 3rd stage) Hypergolic fuels for spacecraft, up to 200 gallons
Vehicle height:	up to 170 feet
Maximum recorded sound pressure at 50 feet as provided by the manufacturer:	151 dB

Table 2: Antares Specifications

Notes: dB = Decibel

2.1.2.3 Notional Liquid-Propellant Launch Vehicle

The Notional Liquid-Propellant Rocket is a two-stage rocket, with both stages using a RP1/LOX propellant. The rocket stands approximately 230 feet tall. Additional specifications can be found in Table 3. This vehicle is included to ensure its impacts are considered in the event that the vehicle operator decides to launch from KLC in the future.

Proposed Launch Vehicle (Provider):	TBD
Primary Propellant Type:	LOX, RP1 (1st stage, 2nd stage)
Primary Propellant Mass:	Up to 500,000 pounds of LOX, up to 225,000 pounds of RP1
Other Propellants:	Hypergolic fuels for spacecraft, up to 200 gallons
Vehicle Height:	Up to 227 feet
Maximum recorded sound pressure at 5000 feet as provided by the manufacturer:	123 dB

Table 3: Notional Liquid-Propellant Launch Vehicle Specifications

Notes: dB = Decibel

2.2 No Action Alternative

Under the No Action Alternative, the FAA would not modify the AAC's Launch Site Operator License for KLC to include medium-lift launch capability, and AAC would not proceed with the construction of medium-lift launch support infrastructure at KLC. Existing launch activities for up to nine orbital small-lift class launches per year from the existing launch pads would continue.

NEPA requires agencies to compare the effects of the Proposed Action and alternative(s) to the effects of the No Action.. Thus, the No Action Alternative serves as a baseline to compare the impacts of the Proposed Action. The No Action Alternative would not satisfy the purpose and need for the Proposed Action because it would not allow for operation of a commercial space launch site with expanded launch capabilities and thus would not facilitate or promote commercial space launch and reentry activities by the private sector.

2.3 Alternatives Considered

In considering the development of the Proposed Action, AAC considered five sites for LP3, including the proposed location Site C. Site C was the only site that met FAA siting requirements and KLC site constraints, and was also identified as the Preferred Alternative. The following section describes the FAA requirements, the KLC site constraints, and how they apply to the five potential sites.

2.3.1 FAA Siting Requirements

1. Launch pads must not be positioned so that the rocket launches fly over other facilities, regardless of who owns them. The purpose of this restriction is to prevent a launch failure from crashing into another structure, and the potential liability issues that result. The KLC launch azimuth is 110 to 220 degrees, SE to SW, which means that launch facilities need to be sited generally east to west to prevent overflight.

2. Launch pads must be outside of QD of other launch pads and processing facilities. QD varies by type and quantity of explosives/propellants. Current QD for the IPF and LP1 is 2,965 feet for 225,000 pounds of Hazard Class 1.1 explosives. Therefore, LP3 must be at least this far from the IPF and LP1 to allow concurrent operations at both sites.

3. Explosive operations at LP3 create a QD radius based on the amount of explosives anticipated. No non-related facilities, such as the decommissioned US Coast Guard Loran station, can be located within that circle. Anticipated amounts and the associated QD are presented in Table 4.

Launch Vehicle	Anticipated Net Explosive Weight (in pounds)	Hazard Class	Inhabited Building QD Radius (in feet)	Public Road QD Radius (in feet)
Athena III	1,242,397	1.3	860	860
Antares	159,449	1.1	2,431	1,458
Notional Launch Vehicle	119,064	1.1	2,054	1,232

Table 4: Explosive Quantity Distances

Note: All QD calculations are taken from DODM 6055.09-M-V5 (DoD Ammunition and Explosive Safety Standards) dated February 29, 2008 and incorporating change 1, September 2, 2011.

Note that the Athena III, while having more explosives, has a smaller QD because of the hazard classification. Also, the Antares and Notional Launch Vehicle use RP1 as a fuel and LOX as an oxidizer which are converted to a HC 1.1 equivalency using Table V5.E4.T5 from DODM 6055.09-M-V5. Exact explosive quantities may vary as these rockets mature.

2.3.2 KLC Site Specific Constraints

The KLC site-specific constraints are primarily based on the topography of Narrow Cape and the proximity of the decommissioned USCG (U.S. Coast Guard) Loran-C station.

1. No interference with the decommissioned Loran station:

2. Build on ridgeline: The ridgelines on Narrow Cape provide the best rock for structural support and avoid most of the wetland areas.

3. Build away from ocean cliffs: There is active erosion along the sea cliffs on Narrow Cape that are open to the Pacific Ocean. Therefore, it is best to build several hundred feet away from the cliffs.

4. Build close to existing road, but outside of the QD circle for public transportation routes: Building close to the road minimizes the environmental effect as well as the cost of building new roads. But the facilities must be outside of the Public Transportation Route QD distance (approximately 1,458 feet on either side of the road for the Antares rocket).

5. Maximize the distance away from the Launch Control Center: Although there is no exact criteria for the proper distance (other than QD), the further away LP3 is from the LCC the better the site, as it would provide standoff to protect personnel in the event of a launch failure.

6. Avoid crossing and minimize negative impacts to wetlands.

2.3.3 Analysis of Potential Sites for Launch Pad 3

The potential launch pad sites, with their primary requirements and constraints, are described below and depicted in Figure 8.

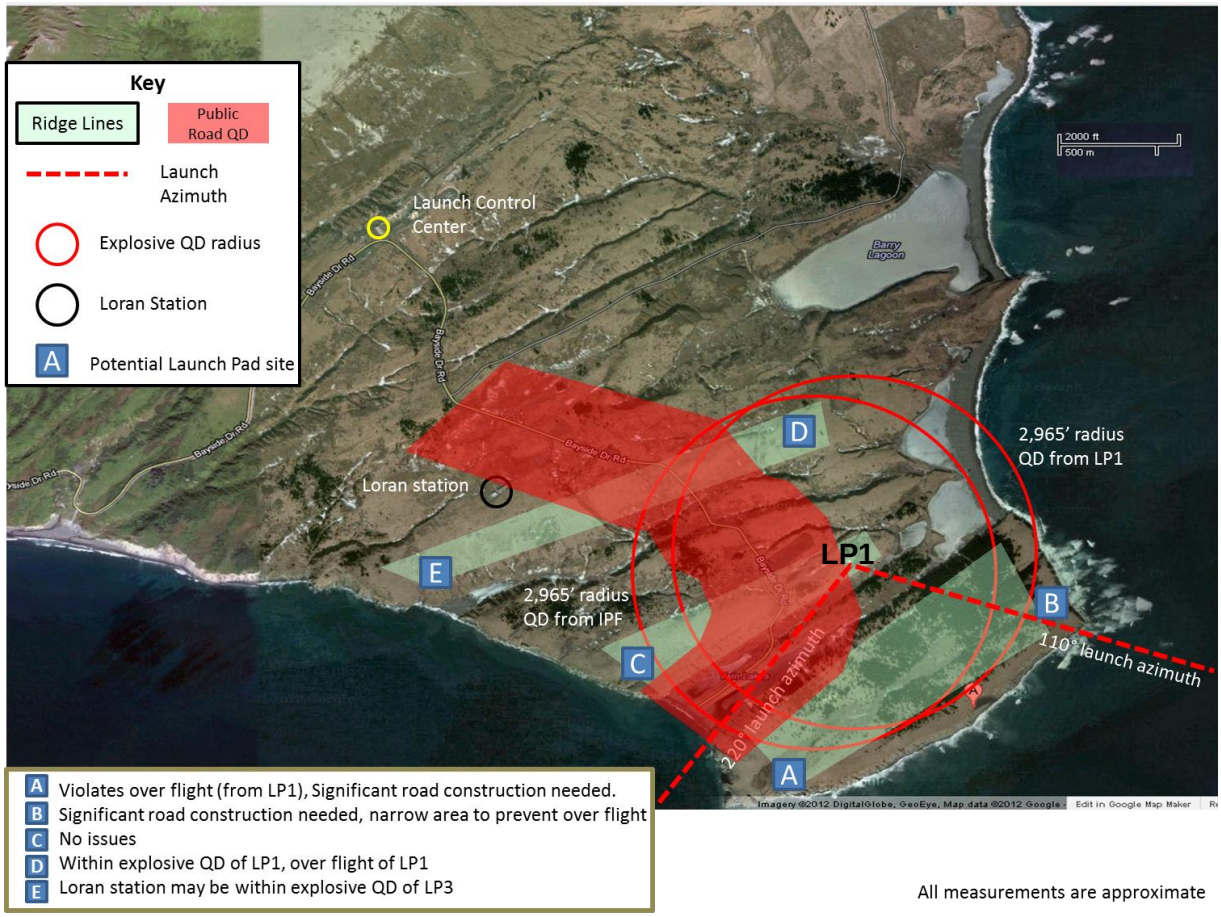

Figure 8: Constraint Analysis of Potential Launch Pad Sites at KLC

Site A. Site A is located on the southernmost ridgeline on Narrow Cape. This ridgeline presents three major issues. First, the majority of the ridge is located within the down range launch azimuth of LP1, which precludes operations at this site when there is a mission from LP1; this is an over flight issue. Secondly, the cost of cutting a road into this area would be extremely high because of the steep valley separating the LP1 ridge line from the southern ridge line and boggy terrain leading up to the site. There would need to be a significant amount of cut and fill to build a road capable of supporting the weight of a rocket motor. Third, there is a large area of wetlands that would have to be crossed to reach the site. These three issues make Site A unacceptable for the type of operations envisioned for LP3. Since Site A is inconsistent with the siting requirements, it is unreasonable and is eliminated from further study in this EA.

Site B. Site B is also located on the southernmost ridgeline on Narrow Cape. The eastern side is outside of the explosive QD circle and above the launch azimuth of LP1. However, Site B would still require expensive road construction to reach the site, the most of all the sites under consideration, and it would cut through a very large bog, negatively affecting wetlands. These issues make Site B unacceptable for LP3. Since Site B is inconsistent with the siting requirements, it is unreasonable and is eliminated from further study in this EA.

Site C. Site C is located on the same ridge line as LP1, the second ridge line from the southern point of Narrow Cape. It is outside of the explosive QD of LP1 and the launch azimuth. There are no unrelated facilities nearby and it is the closest site to the existing road, yet far enough away from the sea cliff that erosion is not an issue. Site C is outside of the Public Transportation Route QD radius for all potential rockets. There are no technical issues with Site C. Therefore, Site C is the preferred alternative and is carried forward for further analysis as the Proposed Action.

Site D. Site D is located on the eastern side of the third major ridge line from the southern point of Narrow Cape. It is within the explosive QD of LP1. Rockets launched from Site D would also overfly LP1. Therefore, Site D is unacceptable for LP3. Since Site D is inconsistent with the siting requirements, it is unreasonable and is eliminated from further study in this EA.

Site E. Site E is located on the western side of the third major ridge line from the southern point of Narrow Cape. The ridge line runs NE to SW, therefore, Site E is nearly at the same latitude as LP1, thus preventing overflight issues between the sites. Site E is away from the cliffs and outside of the Public Transportation QD, but the explosive QD circles of LP3 would encompass the Loran Station, which is not allowed. Therefore, Site E is unacceptable for LP3. Since Site D is inconsistent with the siting requirements, it is unreasonable and is eliminated from further study in this EA.

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3.0 AFFECTED ENVIRONMENT

This chapter provides a description of the existing environment on and around the Kodiak Launch Complex. The information presented herein serves as a baseline from which to identify and evaluate environmental effects resulting from activities associated with the Proposed Action. The environmental baseline for the potentially affected environment has been extensively evaluated and summarized in previous NEPA documents (Section 1.5). Existing information has been incorporated into this document by reference where appropriate. Data and observations from previous small-lift rocket launches at the KLC have been used to further characterize the existing facilities and environment at KLC.

3.1 Air Quality

The air quality at Narrow Cape can be generally classified as unimpaired. Existing launch activities at the KLC, ranching, and occasional vehicular traffic are the only human activities within the vicinity of Narrow Cape that typically affect background air quality (North Pacific Targets Program EA, 2001).

3.1.1 Regulatory Framework

The Clean Air Act (CAA) authorizes the Environmental Protection Agency (EPA) to establish National Ambient Air Quality Standards (NAAQS), codified under 40 CFR 50. Based on measured ambient data for certain criteria pollutants, the EPA designates all areas of the United States as having air quality either better than (attainment) or worse than (nonattainment) the NAAQS. Former nonattainment areas that have attained the NAAQS are designated as maintenance areas. The CAA requires each state that contains a nonattainment or maintenance area develop a State Implementation Plan (SIP) which serves as its primary mechanism for ensuring that the NAAQS are achieved and maintained within that state. The six criteria pollutants in the Alaska SIP are ozone, carbon monoxide (CO), nitrogen dioxide, sulfur dioxide, inhalable particulate matter (PM10), fine particulate matter (PM2.5), and lead. CO, PM2.5 and PM10 are specific pollutants of concern for Alaskan communities such as Anchorage and Fairbanks, with their larger populations, more automobiles, industries, and widespread use of wood heating.

The General Conformity Rule established under Section 176(c) of the CAA outlines procedures and criteria for identifying whether a Federal action conforms to State, Federal or Tribal air quality implementation plans; this rule applies only in areas that EPA has designated non-attainment or maintenance (previously designated as a non-attainment area). Kodiak Island is located within an air quality attainment area for all criteria pollutants; therefore, a General Conformity Review does not apply to the Proposed Action.

Air quality control regions are classified either as class I, II, or III to indicate the degree of air quality deterioration that the State/Federal government will allow while not exceeding NAAQS. ADEC classifies Kodiak Island as a class II area in attainment with the NAAQS (18 AAC 50.015). Kodiak's designation as a class II area means a moderate change in air quality would be allowed while still maintaining air quality that meets NAAQS. There are no air quality monitoring facilities in the vicinity of Narrow Cape and none on Kodiak Island.

3.1.2 Existing Emission Sources in the Project Area

Kodiak Electric Association provides power to the existing KLC facilities. Backup diesel generators are located at five installations at the KLC, the PPF, IPF, LCC, MSF, and RMSF (portable generator). The generators operate as backup for five hours during launches, one hour per week for testing during non-launch periods, and during commercial power outages (estimated maximum total 262 hours per year). The intermittent usage contributes to annual pollutant emissions of far less than the ADEC-regulated threshold of 100 tons.

Changes to the ADEC Air Quality Control Regulations (18 AAC 50) were adopted in October, 2004, which affected Pre Approved Emission Limits (PAELs). As of February 7, 2005, ADEC certified that the KLC was no longer subject to monitoring, record keeping, and reporting requirements established in their PAEL #00485. PAEL #00485 was rescinded at that time because stationary emission sources at the KLC were within ADEC-established thresholds. KLC is not currently required to operate under a PAEL or Minor Permit. There are low levels of emissions at and near KLC because of the sporadic use of generators, the low volume of vehicle traffic, and extremely sparse residential population, which generates low levels of emissions from building heating. There are no rocket engine static tests at KLC.

The launching of solid-propellant rockets produces emissions primarily of hydrogen chloride, carbon monoxide, carbon dioxide, nitrogen oxides (NOx), black carbon and aluminum oxide. Hydrogen chloride, NO_x, CO_2 and CO emissions are gaseous; aluminum oxide and black carbon are emitted as particulates as large as 4 millimeters (Dreschel and Hall, 1990). The primary emissions from liquid-propellant vehicles include carbon monoxide, carbon dioxide, hydrogen, water vapor and oxygen. Exhaust plumes are concentrated within the geographic area near the launch pad (known as the near field) where the ground cloud forms and begins its thermal rise process. The far field is considered to be the geographic area where the stabilized and neutrally buoyant cloud material mixes back to the ground. Because of the rapid acceleration of the rocket, the vast bulk of rocket exhaust products are expelled above the mixing layer where they disperse quickly, reducing ground-level impacts.

On a larger scale; the rocket emissions of CO_2 and black carbon are greenhouse gases contributing to global climate change and their emissions of HCl can cause short term localized damage to the stratospheric ozone layer. HCl emitted from launch vehicles remains in the stratosphere and is transported throughout the Northern Hemisphere where it continues to destroy ozone for about 6 years (Brady et al., 1997).

3.1.3 Meteorology

Climatic conditions at Narrow Cape, primarily wind speed/direction and precipitation, affect the dissipation of exhaust plumes from rocket launching. The climate at Narrow Cape is characterized as maritime, with long, mild winters and short, cool summers. Throughout the year, the weather is affected by cool and humid air masses due to Narrow Cape's location on the Pacific Ocean. Average annual precipitation is high at approximately 77 inches. The monthly average of precipitation ranges from approximately four to nine inches. The highest averages typically occur between September and March. The average annual wind speed is 11 miles per hour with prevailing wind directions from the northeast and southwest (KLC, 2012). Wind speeds are greatest in the winter months, between November and March, and lowest May through September; however even during the summer months the mean wind speed is 5 mph or greater, which is sufficient for good dispersion of air pollutants (VE Energy LLC, 2007). A visual depiction of wind direction and velocity is shown in Figure 9.

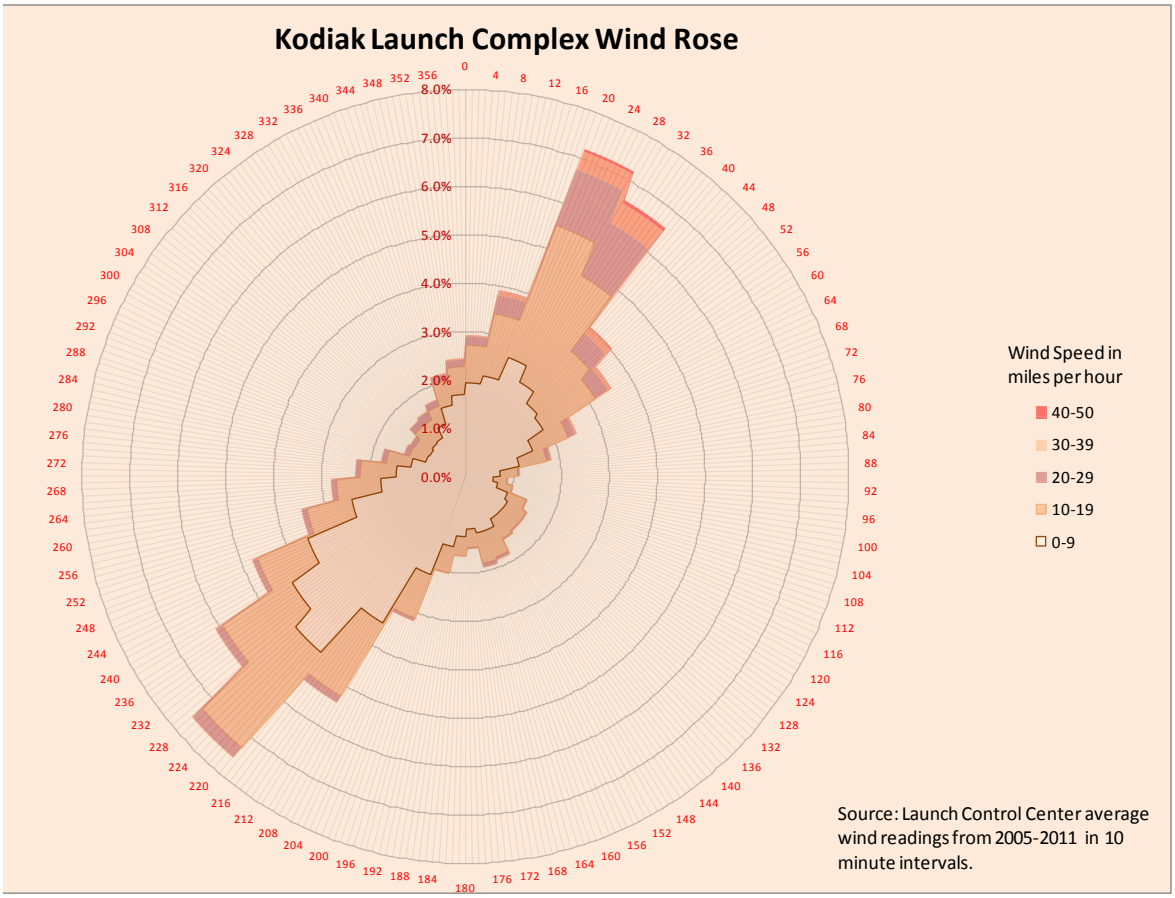

Figure 9: Wind model of wind speed and direction for Kodiak

3.2 Compatible Land Use

3.2.1 Regulatory Framework

FAA Order 1050.1E dictates that the compatibility of existing and planned land uses in the vicinity of the Proposed Action be assessed, particularly with respect to noise effects. The assessment of potential noise effects to land use is codified in Aviation Safety and Noise Abatement Act of 1979, as amended (49 U.S.C. 47501-47507).

3.2.2 Land Use and Noise Effects (as related to Land Use)

The Kodiak Archipelago includes approximately 3.2 million acres (5,000 square miles) of land, generally divided in ownership as follows (FAA, 1996):

- Federal 1,680,000 acres (2,625 square miles)
- Native corporations 935,480 acres (1,462 square miles)
- State of Alaska 482,580 acres (753 square miles)
- Local governments 70,000 acres (108 square miles)
- Private property 32,000 acres (50 square miles)

Kodiak Island has an area of about 2.2 million acres (3,400 square miles). The core Kodiak Launch Complex consists of 3,717 acres of state land assigned to AAC by the Alaska Department of Natural Resources

(ADNR) under Interagency Land Management Assignment (ILMA) ADL226285. This ILMA also includes an additional 7,048 acres of outlying areas including Ugak Island, which may be closed to public access for limited periods during hazardous operations for safety reasons. The areas of proposed improvements are within the boundaries of the existing core KLC. Lands assigned to KLC are co-occupied by the Burton Ranch, a commercial ranch, under a state-issued ranching lease (Figure 11). Narrow Cape is also the location of the decommissioned U.S. Coast Guard's (USCG) LORAN-C navigation transmitter station, which was decommissioned in 2010 (USDHS, 2012), and the 625 foot tall antenna was recently removed in July of 2012. Other man-made structures in the vicinity include the Kodiak Narrow Cape Lodge (a dedicated lodging facility to support KLC operations), a small number of ranch-related structures, two private homes and a business (Burton Ranch), a private residence that may be used as a church camp, and several WWII concrete bunkers (FAA, 1996). Both "grazing and missile launch activity" (Figure 10) are designated allowable uses within the KLC (AS 41.23.250 Management).

Figure 10: Bison graze in a flowering meadow at the Payload Processing Facility.

Due to the short duration of the rocket launches, the noise has no effect on the DNL noise levels at any of the nearby noise sensitive properties (Minor, 2012). A complete report on the existing noise values and land use compatibility are presented in Appendix A.

3.3 Department of Transportation Act Section 4(f)

3.3.1 Regulatory Framework

The U.S. Department of Transportation (USDOT) regulation commonly referred to as "Section 4(f)" was originally established in the U.S. Department of Transportation Act of 1966 (49 United States Code [U.S.C.] Section 1653(f) and later recodified as 49 USC Section 303(c). Section 4(f) requires consideration of:

- Parks and recreational areas of national, state, or local significance that are both publicly owned and open to the public,
- Publicly owned wildlife and waterfowl refuges of national, state, or local significance that are open to the public to the extent that public access does not interfere with the primary purpose of the refuge, and
- Historic sites of national, state, or local significance in public or private ownership regardless of whether they are open to the public.

Any part of a Section 4(f) property is presumed to be significant unless the official with jurisdiction over the property concludes that the entire property is not significant.

Under Section 4(f) , the Secretary of Transportation will not approve a transportation program or project requiring the "use" of a Section 4(f) property unless there is no feasible and prudent alternative to using that land and the project includes all possible planning to minimize harm to the resource resulting from the use. A "use" of Section 4(f) property occurs when the proposed action would result in a non-minimal, actual physical taking of land within a Section 4(f) property, or when there is a constructive use of a Section 4(f) property. A constructive use occurs when the transportation project does not incorporate land from a Section 4(f) property, but the project's proximity impacts are so severe that the protected activities, features, or attributes that qualify the property for protection under Section 4(f) are substantially impaired. Substantial impairment occurs only when the protected activities, features, or attributes of the property that contribute to its significance or enjoyment are substantially diminished. For purposes of NEPA, a significant impact to a Section 4(f) property occurs when a proposed action either involves more than a minimal physical use of a section 4(f) property or is deemed a "constructive use" substantially impairing the 4(f) property, and mitigation measures do not eliminate or reduce the effects of the use below the threshold of significance. To the extent relevant, the FAA may use as guidance the Federal Highway Administration's Federal Transit Administration's regulations regarding constructive use at 23 CFR Part 774.

3.3.2 Section 4(f) Resources

The 1996 EA for KLC did not include analysis of Section 4(f) resources specifically, though it did cover recreational resources. For this EA, therefore, a thorough review was conducted of online resources and maps – coupled with local knowledge of the authors of this EA – to document known and potential 4(f) resources that have the potential to be affected by the Proposed Action, in the vicinity of Narrow Cape and beyond, as presented below.

The Pasagshak River State Recreation Site is a 4(f) resource located approximately 6 miles west of the proposed LP3 at the KLC (Figure 11). The recreation site comprises seven campsites, picnic areas, potable water, and one latrine, located on 20 acres of land. The Pasagshak River runs through the site, supporting runs of silver salmon and making the site a popular fishing destination during the summer and fall salmon runs. In recognition of the increase in visitation at the site since the opening of KLC and the improvements to the road system that have resulted, ADNR and AAC signed an agreement in 2007 to improve site maintenance and share operational costs of the site through an Adopt-A-Park type program. KLC agreed to the following actions (ADNR, 2007a):

1. To "Adopt" the site for the purposes of offsetting some of the operational costs of the park due to increased traffic flow and use of the park resulting from the development of the launch complex at Narrow Cape.
2. To communicate with and receive prior authorization first from any Kodiak Park representative regarding any activity that KLC might propose for the site.

The Kodiak National Wildlife Refuge is another 4(f) resource that occupies roughly the southwest half of Kodiak Island, but it is located approximately 30 miles to the west of KLC at its closest point (Figure 1).

There are no other formally designated parks/recreational areas, wildlife or waterfowl refuges, or historic sites in the vicinity of the KLC. However, there are other resources of a recreational nature that deserve mention, either due to their presence within the boundaries of KLC or their proximity to KLC. But, as subsequently discussed, the FAA has determined that these resources do not constitute Section 4(f) properties. These resources are part of public lands (owned either by the State or Federal government) on Kodiak Island, which are generally open to recreational uses such as fishing, hunting, surfing, hiking, camping, boating, beachcombing, flightseeing, and wildlife and scenic viewing.

Narrow Cape is surrounded by and comprised of State of Alaska Lands (KIB GIS Mapper, 2012). Specific resources of a recreational nature within and near KLC include:

East Twin Lake: Fishing is available at East Twin Lake (the southeastern most lake of the two adjacent Twin Lakes, both of which are located within the boundaries of KLC), which is stocked with rainbow trout (*Oncorhynchus mykiss*) (ADF&G, 2012), as described further in Section 3.4.2. This lake is located approximately 0.2 miles southeast of the proposed LP3 site.

Narrow Cape and KLC: Narrow Cape is easily accessed by the island's road network and offers recreational opportunities. The area includes sandy beaches on the eastern coast of Narrow Cape (~1.25 miles northeast of LP3), and Fossil Beach on the west (~0.2 miles southeast of LP3 and within KLC boundaries) where fossilized marine organisms can be dug from the cliffs or found on the beach. Additional activities in the area generally include beachcombing, surfing at Surf Beach (~2 miles west of LP3 and within KLC boundaries), picnicking, and wildlife sighting of whales, birds and harbor seals and occasionally sea lions and sea otters. Hunting in the Narrow Cape area focuses on Sitka black-tailed deer during the late summer and fall. In addition, Burton Ranch offers for-fee bison hunting, wild game hunting guide service, and horseback riding.

Waters Near Narrow Cape: Approximately three miles southeast of Narrow Cape, the area around Ugak Island is visited by sport fishing boats in pursuit of halibut, rock fish, and salmon.

Though these sites represent public land used for recreation, none of these properties is used primarily for recreation, and the FAA has determined that none of them are Section 4(f) properties. The FAA bases this determination on State of Alaska legislation regarding the management of these properties. As codified in Alaska Statute AS 41.23.250, Narrow Cape is managed as a public use area with primary allowable uses of grazing and missile launch activity. Also allowed as additional uses are the land-based recreational pursuits mentioned above. Though recreational pursuits do occur on the lands and water of Narrow Cape, these pursuits are not primary uses, and the lands are not managed specifically for that purpose. In addition, Alaska Statute 41.23.250(e) states that the commissioner may not manage the Kodiak Narrow Cape Public Use Area as a unit of the state park system. Additionally, as described in Appendix H, the Alaska Department of Natural Resources determined that KLC (which encompasses East Twin Lake, Fossil Beach, and Surf Beach) did not meet the requirements to be considered a 4(f) property according to the definition in the U.S. Department of Transportation Act of 1966 (ADNR, 2013).

Based on the foregoing, only the Pasagshak State Recreation Site is analyzed in this EA as a 4(f) resource close enough to the Proposed Action to be analyzed. In addition, potential impacts on additional Narrow Cape recreational opportunities are also discussed.

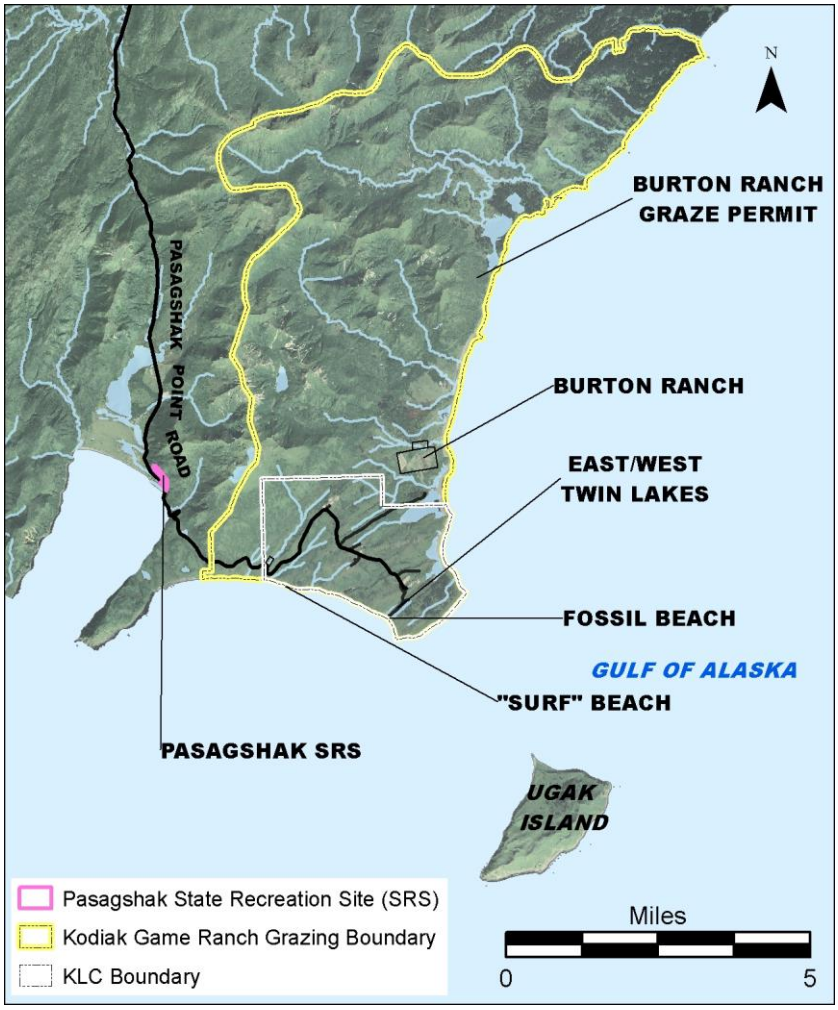

Figure 11: Section 4(f) Overview

3.4 Fish and Wildlife

3.4.1 Regulatory Framework

Many statutes, regulations, and Executive Orders protect biotic resources, including the Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA), Fish and Wildlife Coordination Act (FWCA), Marine Mammal Protection Act (MMPA), Magnuson-Stevens Fishery Conservation and Management Act, and the Bald and Golden Eagle Protection Act.

3.4.2 Fish

There are no fish-bearing streams at any existing or proposed facility at KLC. Streams and lakes within the KLC are relatively small and shallow, limiting freshwater fishery resources. As discussed below, limited

resident fish populations may include stickleback (*Gasterosteus aculeatus* or *Pungitius pungitius)*, Dolly Varden char (*Salvelinus malma)*, rainbow trout, and sculpin (*Cottus sp*.) (ENRI, 1995c).

AAC contracted ENRI to conduct baseline natural resource inventories for the originally proposed KLC site. ENRI was established by the Alaska state legislature in 1973 to provide information and data without advocacy to citizens and government agencies. As part of the resource inventory, ENRI conducted a baseline fish survey in 1994. Based on ENRI's survey and information from the Alaska Department of Fish and Game (ADF&G) Fish Resource Monitor, there are three anadromous streams in the vicinity of the KLC: 259-41-10004 (unnamed), 259-41-10005 (unnamed), and 259-30-10060 (Burton Creek) (Figure 12) (ADF&G, 2012a). The ENRI survey documented Dolly Varden char in all three streams, coho salmon (*Oncorhynchus kisutch*) juveniles in streams 259-41-10004 and 259-41-10005, sculpin in stream 259-41-10004, and stickleback in Burton Creek and in East Twin Lake (ENRI, 1995b). ADF&G added spawning coho salmon in 2004 to all three streams and spawning, rearing, and present pink salmon (*Oncorhynchus gorbuscha*) to Burton Creek in 2009 (ADF&G, 2012a).

Stream 259-41-10004 crosses Pasagshak Point Road near the western boundary of the KLC and passes behind the proposed MCC sites and the existing MSF and LCC. Fish traps were set by ENRI upstream as far as the LCC; however, beaver dams located approximately 1,500 feet north of the road preclude upstream salmon access. Therefore, the closest proposed facility is over one mile northeast of the anadromous reach of stream 259-41-10004. Stream 259-41-1005 is outside of the KLC boundary and approximately 1.25 miles southwest of the nearest proposed LP3 facility (the MCC). Burton Creek is also located outside of the KLC boundary and is over 1.5 miles northeast of the nearest proposed LP3 facility (the MCC).

As stated in Section 3.3.2, ADF&G Sport Fish Division stocks East Twin Lake – which lies within the KLC boundary – with rainbow trout (Figure 13). The lake is currently scheduled for annual stocking of 4,000 sterile rainbow trout fingerlings from 2009-2014 (ADF&G, 2012b). East Twin Lake must be stocked on an annual basis as there is no overwinter survival due to oxygen depletion of this very shallow lake. The fish stocking occurs – as in many road-accessible Kodiak lakes – to provide an opportunity for sport fishing.

Additionally, numerous species of fish and invertebrates inhabit nearshore and offshore waters around Kodiak Island. The most common marine fish are salmon, flounder, sole, pollock, skate, cod, and halibut. Other marine organisms that inhabit the shallow continental shelf water around Kodiak Island are crabs (king, tanner, Dungeness, kelp, rock, and hermit), scallops, octopus, shrimp, cockles, razor and butter clams, sea anemones, chitons, jellyfish, sea urchins, limpets, snails, mussels, sea cucumber, starfish, and barnacles (ENRI 1995c). Fish inhabiting waters in the immediate area of the proposed KLC are typical of those in the waters of Kodiak Island as a whole (FAA, 1996).

According to the National Oceanic and Atmospheric Administration's National Marine Fisheries Service, Essential Fish Habitat (EFH) for all lifestages (marine immature and maturing adults, and marine juvenile) of chinook, chum, coho, pink, and sockeye salmon is present in marine waters up to the shoreline around Narrow Cape and portions of anadromous streams on Narrow Cape (NOAA, 2012). In addition, EFH for all lifestages (larvae, late juvenile, and mature) of over fifteen species of groundfish is present in marine waters up to the shoreline around Narrow Cape (Figure 13).

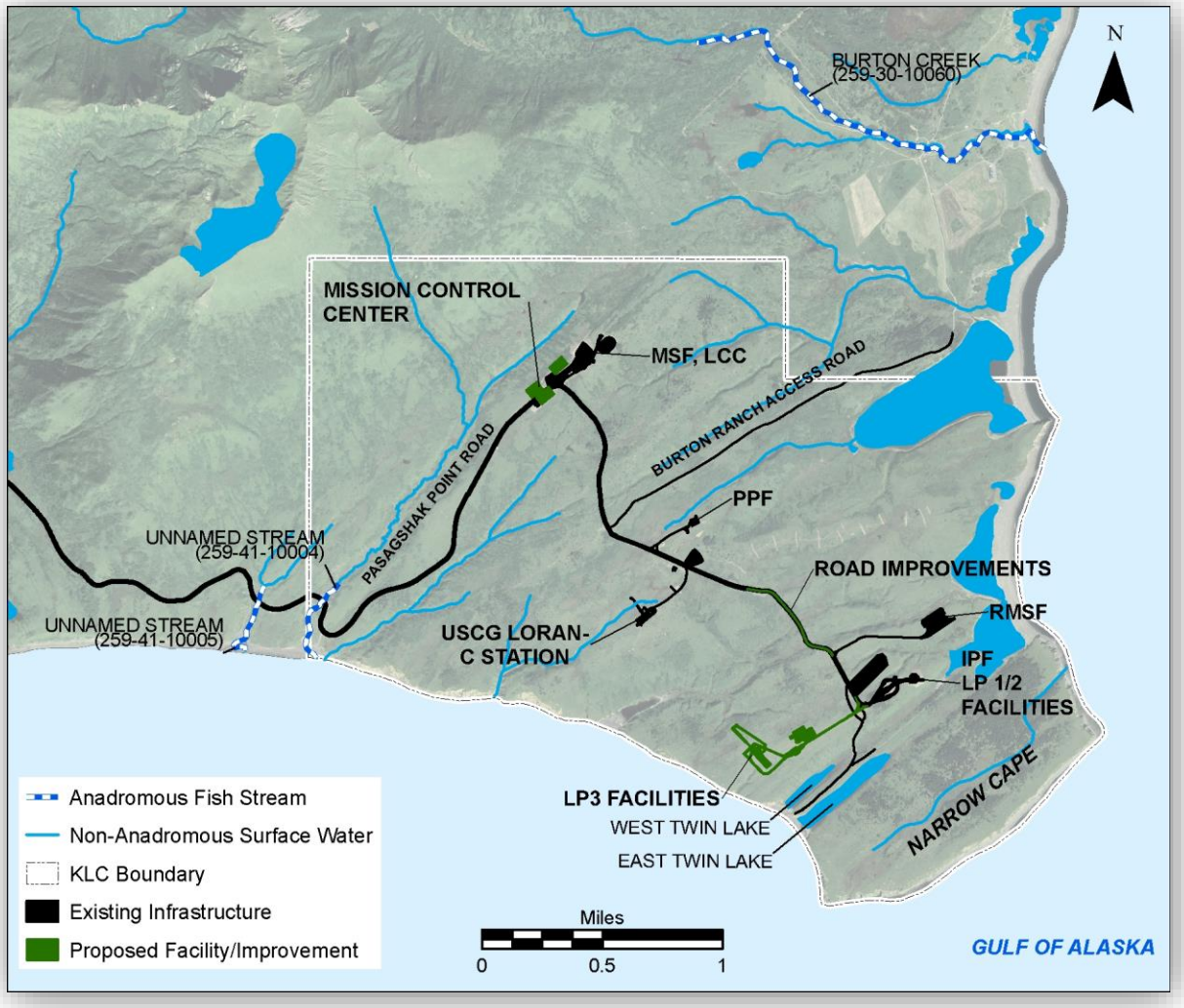

Figure 12: Fish Bearing Waters Near the KLC

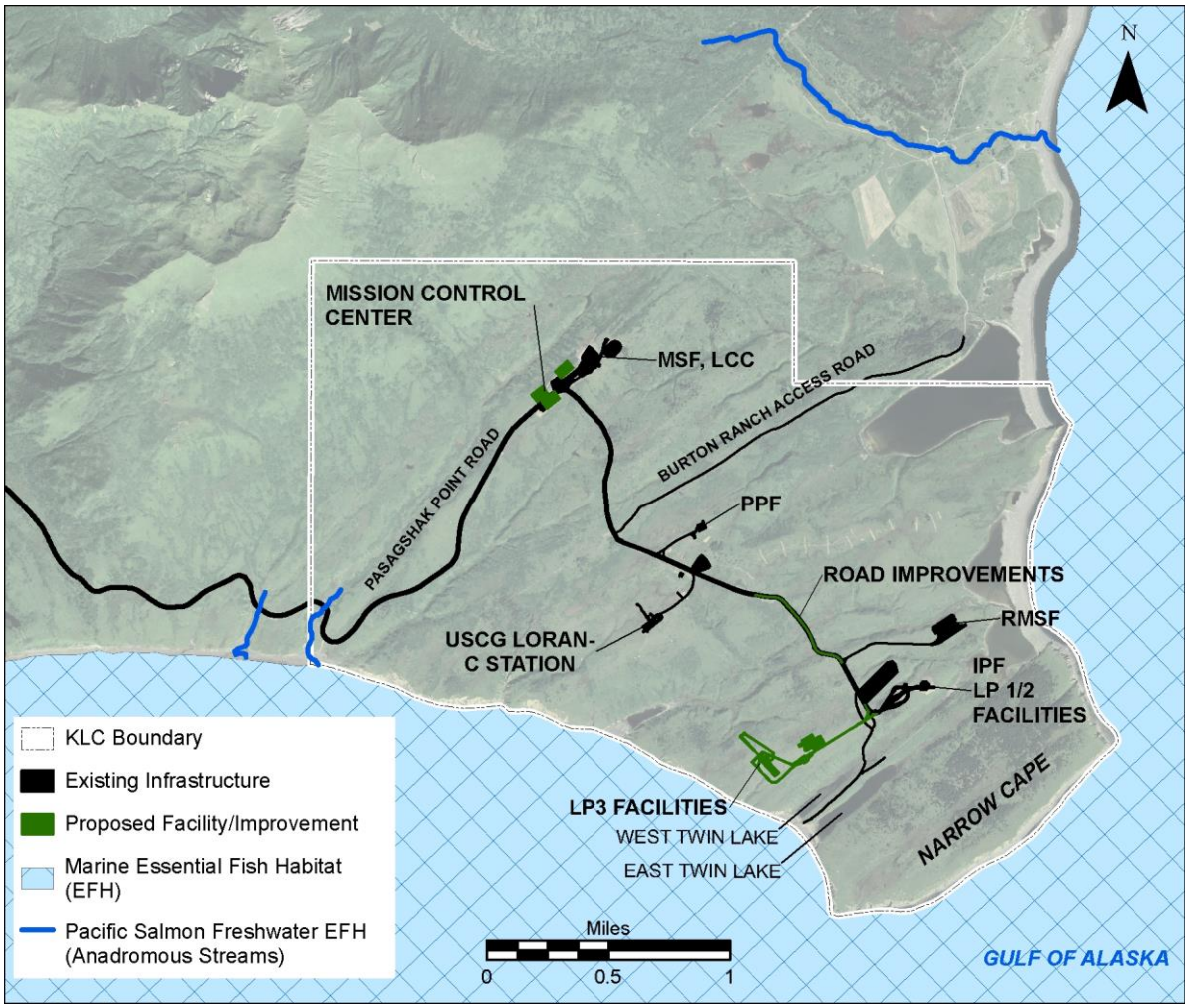

Figure 13: Essential Fish Habitat

3.4.3 Birds

Kodiak Island provides habitat for 221 documented bird species (ENRI, 1995c), and 237 species have been recorded in the Kodiak archipelago (MacIntosh, 1998). ENRI conducted extensive bird surveys within the KLC and adjacent on and off-shore locations in 1994, which revealed that the KLC provides seasonal habitat for approximately 143 species of terrestrial and marine-oriented birds (ENRI, 1995c). During the offshore surveys conducted in 1994, 38 different species were observed in June and July. Detailed survey results and species descriptions are presented in the 1996 EA (see Section 3.5.1.2 of the 1996 EA) and are incorporated by reference (FAA, 1996). Habitats and environmental quality have remained stable over time limiting potential for changes in the avifauna. The distribution, abundance, and species composition of birds using the Narrow Cape area remains comparable to the baseline surveys performed in 1994. Although no more recent formal bird surveys have been conducted specific to Narrow Cape or KLC, there are multiple citizen science forums for documenting bird presence and abundance, namely eBird and the National Audubon Society Christmas Bird Count (ebird, 2012; Audubon, 2010). These resources reveal anticipated fluctuations in species occurrence, but no obvious differences in population trends.

The bald eagle, which is protected by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act, is common throughout the year on Kodiak Island and is often seen in the Narrow Cape area. Aerial surveys were conducted in the spring of 1999, 2000, and 2001 to document bald eagle nesting

activities near the KLC. During the surveys, eagles were observed in the Narrow Cape area, and three nests were identified within 5 miles of the KLC (ENRI, 2002a). Nest sites were monitored during the first five launches from KLC in accordance with the Environmental Monitoring Plan developed with U.S. Fish and Wildlife Service (USFWS) input. Bald eagles continued to successfully use the sites during the period of observation, and the USFWS removed the monitoring requirement.

In response to AAC's current proposal, the USFWS performed an aerial nesting bald eagle survey, included as Appendix E, on 10 May 2013 in the area surrounding the KLC to provide current nesting information (USFWS, 2013). The survey area (approximately 10 square miles) included all suitable habitats that could be affected by construction of the proposed Launch Pad 3 and associated infrastructure. A total of seven bald eagles (six adult and one subadult) and three nests were recorded. The three nests were located on KLC property, approximately 1.3, 1.4, and 1.9 miles from the proposed site for Launch Pad 3 (see Figure 14).

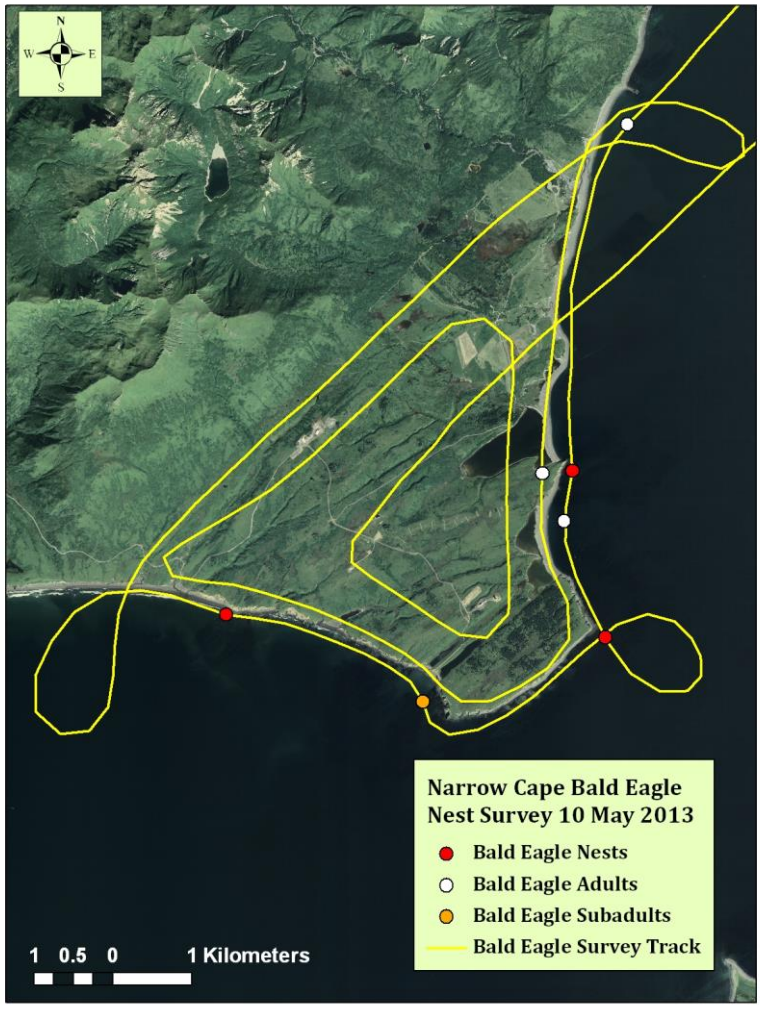

Figure 14: Location of Bald Eagle Nests at the KLC

3.4.4 Mammals

Terrestrial Mammals

The Narrow Cape area supports 12 species of terrestrial mammals, six native and six introduced (ENRI, 1995c) (Table 5). During a 1994 survey by ENRI, 11 of the 12 terrestrial species were observed in the proposed KLC area. Although the mountain goat was not observed, this species has been observed by others in the vicinity of Shaft Peak, approximately two and a half miles northwest of the proposed KLC site boundary (ENRI, 1995c). Horses, cattle, and bison graze nearby under lease to a local ranch. A seven-foot chain link fence surrounds each of the structures at KLC to prevent animals from wandering onto the launch complex. The fence and nearby steep topography keep grazing animals away from the existing launch pads. The 1996 EA presents a more detailed description of typical mammal occurrence on and near the KLC (see Section 3.5.1.3 of the 1996 EA).

Common Name:	**Scientific Name:**
Little brown bat	*Myotis lucifugus*
Snowshoe hare[a]	*Lepus americanus*
Red squirrel[a]	*Tamiasciurus hudsonicus*
Tundra vole	*Microtus oeconomus*
Muskrat[a]	*Ondatra zibethicus*
Beaver[a]	*Castor canadensis*
Red fox	*Vulpes vulpes*
Brown bear	*Ursus arctos*
Short-tailed weasel	*Mustela ermine*
River otter	*Lutra canadensis*
Sitka black-tailed deer[a]	*Odocoileus hemionus*
Mountain goat[a]	*Oreamnos americanus*

[a.] Introduced to Kodiak Island.

Table 5: Terrestrial Mammals of Narrow Cape

Marine Mammals

Marine mammals that occur in the vicinity of KLC include the Steller sea lion, harbor seal, gray whale, humpback whale, northern sea otter, northern fur seal, and a number of other cetacean species including Dall's and harbor porpoise, and orcas (NASA, 2011). Although seven species of whales can be found in the waters of the Kodiak Archipelago, only the gray and humpback whale use the nearshore waters of Narrow Cape and Ugak Island on a regular basis (ENRI, 1995c). Detailed marine mammal studies conducted prior to construction of the KLC are presented in the 1996 EA (see Section 3.5.2.3 of the 1996 EA), and are incorporated by reference. Monitoring and survey activities specific to marine mammals have been ongoing since operational activities began at the KLC.

The harbor seal is widely distributed in the Gulf of Alaska, an area that includes Narrow Cape. Harbor seals are the most abundant year-round marine mammal species found near the KLC, as determined during the ENRI baseline survey and confirmed during AAC monitoring activities. Harbor seals are not listed as threatened or endangered under the ESA or as depleted under the MMPA. Based on the AAC's aerial

survey counts from launch monitoring reports conducted since January 2006, approximately 97 percent of all observed harbor seals are found on the eastern shore of Ugak Island, approximately five miles from the launch pad complex (Figure 15). The eastern shore is backed by high steep cliffs that reach up to 1,000 feet above sea level. Because physical access to Ugak Island harbor seal haulouts is difficult and dangerous, the only abundance and behavior data of these seals have been derived from aerial surveys conducted by the AAC. Harbor seals generally breed and molt where they haul out, so it is assumed that both of these activities take place on Ugak Island, and young seals have routinely been seen there during launch-related aerial surveys. Pupping in Alaska takes place generally in the May to June time frame; molting occurs generally from June to October. Both periods contain peaks in haulout attendance. Total counts on Ugak Island have increased steadily since the 1990s from several hundred (ENRI 1995–1998) up to an average of about 1,500 today (R&M 2007a, 2007b, 2008, 2009, AER 2012a, 2012b, 2013a, 2013b).

Figure 15: Harbor Seals on the southeast shore of Ugak Island (Source: AAC, 2012)

Marine Mammal Protection Act

All marine mammals are protected under the MMPA and therefore coordination with the NMFS (or USFWS in the case of the northern sea otter) is required (marine mammal species that are also protected under the ESA are mentioned again in Section 3.4.5). In 2011, NMFS issued their Final Rule (50 CFR Part 217) governing the unintentional taking of marine mammals incidental to rocket launch operations at KLC. The Final Rule covers the period from 2011 to 2016 for up to 32 small-lift solid propellant rockets and up to three medium-lift liquid-propellant rockets. Under the rule, NMFS issues annual Letters of Authorization (LOAs) with specific monitoring and reporting requirements. The current LOA was issued to

AAC on August 1, 2013 and expires July 31, 2014. The LOA requires AAC to conduct quarterly marine mammal surveys, launch-specific video monitoring of a haulout on Ugak Island, and prepare launch-specific and annual reports. The quarterly surveys count the number of harbor seals and Steller sea lions that are hauled out on Ugak Island, which is three miles south of Narrow Cape. Other marine mammal species are noted if observed during these surveys. Reported information is reviewed prior to issuance of an annual LOA and upon renewal of the Final Rule (every five years).

The Final Rule also addressed three additional marine mammals potentially occurring in the defined action area: gray whales, humpback whales, and sea otters. NMFS did not anticipate take of the whales incidental to the specified launch activity, and sea otters are managed by the USFWS; therefore, only the Steller sea lions and harbor seals were included in the LOAs. In 2011, USFWS was contacted to determine if an Incidental Harassment Authorization was required under the MMPA for the northern sea otter. USFWS determined that authorization for incidental take under the MMPA would not be required (USFWS, 2011b) due to the infrequency of the launches and the temporary disturbances.

3.4.5 Threatened and Endangered Species

There are no federally-listed threatened, endangered, or candidate *plant or terrestrial animal* species within the vicinity of Narrow Cape or within the KLC (USFWS, 2011a). However, there are several threatened, endangered, and candidate *avian and marine mammal* species that may inhabit or transit the waters and nearshore environment of Narrow Cape and Ugak Island (Table 6). Although candidate species are provided, they have no statutory protection under the ESA. They are species for which there is sufficient information to support a proposal to list as endangered or threatened, and therefore may be listed in the future.

Species	Status	Managing Federal Agency
Fin whale (*Balaenoptera physalus*)	Endangered	NMFS
Humpback whale (*Megaptera novaeangliae*)	Endangered	NMFS
Kittlitz's murrelet (*Brachyramphus brevirostris*)	Candidate	USFWS
North Pacific right whale (*Eubalaena japonica*)	Endangered	NMFS
Northern sea otter (*Enhydra lutris*)	Threatened	USFWS
Short-tailed albatross (*Phoebastria albatrus*)	Endangered	USFWS
Steller's eider (*Polysticta stelleri*)	Threatened	USFWS
Steller sea lion (*Eumetopias jubatus*)	Endangered	NMFS
Yellow-billed loon (*Gavia adamsii*).	Candidate	USFWS

Table 6: Special status species near the KLC (USFWS 2011, NMFS 2011)

Critical Habitat

The waters off of Narrow Cape – up to the mean high tide (MHT) line – are designated critical habitat for the Southwest Alaska distinct population segment of the Northern sea otter. Steller sea lion critical habitat includes the offshore areas up to MHT surrounding Narrow Cape including Ugak Island. The critical habitat also includes an air zone that extends 3,000 feet above the terrestrial zone (area extending 3,000 feet landward from the base point of a haulout) of the Ugak Island haulout (50 CFR 226.202). The proposed LP3 footprint is located approximately 0.2 mile inland from the nearest coastline – designated critical habitat areas – and over 100 feet higher in elevation than MHT.

Consultation History - USFWS

FAA and AAC (as the designated non-Federal representative) have consulted with the USFWS on multiple occasions in the past when projects have been proposed at KLC with the potential to impact federally-listed threatened or endangered species or designated critical habitat. The following paragraphs summarize USFWS consultation history for KLC to date.

In a 2004 USFWS letter to FAA and AAC (consultation number 2004-093), the USFWS addressed threatened and endangered species for the ongoing and proposed activities at KLC. The letter specifically responded to numerous documents related to federally-listed species around KLC, which included:

- Final EIS/ROD for the Ground-Based Midcourse Defense Extended Test Range, July 2003;
- Report of the Environmental Monitoring Studies for the QRLV-2 Launch, conducted by the Environmental and Natural Resources Institute (ENRI), July 2002;
- Summary Findings of Environmental Monitoring Studies for the Kodiak Launch Complex, 1998-2001 (ENRI), April 2002;
- Biological Assessment for the Kodiak Launch Complex (ENRI), 1998: and
- Environmental Monitoring Plan, included as Appendix B in the Natural Resources Management Plan for the Kodiak Launch Complex, June 1998.

The USFWS determined that the endangered short-tailed albatross and the threatened Alaska-breeding population of Steller's eider could occur in the vicinity of KLC, and concurred with the FAA determination that the noise associated with launching rockets was ***not likely to adversely affect*** these species.

In response to the listing of the Northern sea otter as threatened in 2005, AAC reinitiated consultation with USFWS on potential effects of ongoing operations at KLC, specifically rocket launches. The USFWS responded with a letter (consultation number 2006-065) that addressed all federally-listed species that could be in the vicinity of KLC. The USFWS determined that the threatened Steller's eider and threatened Northern sea otter could occur in the vicinity of KLC, and concurred that the launch of rockets from KLC was ***not likely to adversely affect*** these species. The USFWS letter did not mention the endangered short-tailed albatross during this consultation. The FAA reinitiated consultation with the USFWS during the scoping phase in June, 2012 for the Proposed Action. On September 27, 2012, the USFWS concurred with the proposed list of ESA species under their jurisdiction (Table 6) that could potentially occur in the action area. Additional consultation with the USFWS provided the basis for the effect determinations presented in Section 4.1.4.4 as they pertain to the Proposed Action (consultation number 2012-0127).

Consultation History - NMFS

The KLC currently operates in accordance with the NMFS's Biological Opinion (BO) (issued March 18, 2011; ESA compliance) and regulations (issued March 23, 2011; MMPA compliance) both of which are valid for five years from the date of issuance (see Appendix G).

Because the Steller sea lion is listed as endangered under ESA, the takings (under MMPA) required authorization under the ESA. As a result of the NMFS's proposed action of issuing regulations and subsequent LOAs for the takings under the MMPA, NMFS conducted internal formal consultation and prepared the necessary BO to meet their obligations under the ESA for the take of Steller sea lions.

The BO analyzed rocket noise impacts to Steller sea lions based on 45 launches over the 5-year period with an average of 9 launches per year. For 42 of these launches, the small-lift Castor 120 rocket engine was the loudest engine covered in the BO. The BO also considered 3 launches from the medium-lift class of rockets, specifically the liquid-propelled Taurus II (synonymous with the Antares that is currently described in Section 2.1.2.2). The BO concluded that the proposed action would ***not likely jeopardize*** the

continued existence of the species or adversely modify its critical habitat. Three additional endangered species were considered in the BO with the potential to occur within the defined action area: fin whale, humpback whale, and North Pacific right whale. However, NMFS determined that these species were ***not likely to be adversely affected*** by launch operations because they are not in the area (fin whale and North Pacific right whale) or would be below the surface of the water (humpback whale), and therefore not likely to be exposed to launch noise that would significantly disrupt normal behavioral patterns.

The FAA consulted with NMFS in 2013 to determine if the Proposed Action is beyond the scope identified in the BO (see Section 4.1.4.4 for the conclusions).

Monitoring Efforts

In addition to initial baseline avian and marine mammal surveys of the Narrow Cape area, specific monitoring efforts were conducted for the first five launches from KLC. Avian surveys continued for the following two launches (through 2004). Launch-specific aerial marine mammal surveys continued through 2010 as mandated by NMFS. Since that time, non-launch specific aerial marine mammal surveys have been conducted quarterly. Although the marine mammal surveys focus on Steller sea lions and harbor seals, the presence and abundance of northern sea otters was documented during each launch-specific survey. Similarly, although Steller's eiders were the primary focus for the avian surveys, all species of birds identified during the surveys were documented.

Marine Mammal Species

Steller Sea Lion

The Stellar sea lions western distinct population segment near Kodiak Island was included in the population classified as endangered in 1997. There are two major rookeries (breeding grounds) in the Kodiak Archipelago and fourteen sea lion haulouts on Kodiak Island (50 CFR 226.202). Three of these haulouts, Cape Chiniak, Ugak Island, and Gull Point, occur within 15.5 miles of the proposed KLC site. Ugak Island, approximately three miles southeast of the KLC, is the closest haulout. No Stellar sea lion rookeries occur within the six-mile anticipated effects radius that was established through reviewing agency input to the 1996 EA (FAA, 1996). Based on the noise analysis for medium-lift rockets, the established six-mile radius is still valid and applicable to the Proposed Action (see Appendix A).

Northern Sea Otter

The southwest Alaska population of the Northern sea otter was listed as a threatened species in 2005; its critical habitat was designated in 2009. Sea otters are generally common in Alaskan waters and account for a large percentage of the world total; however, sea otter populations near Narrow Cape have been historically low. AAC voluntarily conducted one sea otter-specific aerial survey during the FT-04-1 launch campaign to close the administrative consultation record. Small numbers of sea otters (maximum count = 8 sea otters) were seen on that survey (R&M, 2006). Aerial sea otter surveys were discontinued after that launch.

Launch-specific and quarterly marine mammal monitoring surveys have only identified small numbers of otters, generally zero to 3 individuals. A higher peak was recorded in 2001, when as many as 95 otters were counted collectively over four surveys in March of that year, though over an area stretching from Lone Point (north of Narrow Cape), south to include Ugak Island, and west to include Pasagshak Bay (ENRI, 2005). The reason for this temporary peak is not known, but it was not seen in prior years (back to 1997 when marine mammal observations started) and has not been seen since. The presence of sea otters in the vicinity of the KLC is sporadic based on multiple years of survey and monitoring efforts. Pre- and post-

launch counts of otters are comparable and do not indicate that rocket launch noise has been affecting otters.

In summary, marine mammal surveys have generally identified small numbers of otters within the vicinity of KLC; maximum otter counts ranged between zero and eight individuals in all but one aerial survey (ENRI, 2005; ABR, 2011). The few otters that were observed seem to prefer the waters around Ugak Island or Long Island near Pasagshak Bay, rather than the cliffs of Narrow Cape.

Whales

Humpback whales move north to the Gulf of Alaska in the summer and appear to have a high affinity for nearshore waters. In summer months, humpbacks can generally be found in the nearshore areas of Kodiak Island, Prince William Sound, and in southeastern Alaska. Groups of humpback whales are occasionally observed in the Narrow Cape and Ugak Island area in the late spring, summer, and fall (FAA, 1996).

The North Pacific right whale is a rare, large, baleen whale found in the Gulf of Alaska in addition to the southern Bering Sea and Aleutian Islands (ENRI, 1995c). Within the Gulf of Alaska, this species is primarily found in the shelf waters to the east and south of Kodiak Island. This species is rarely observed around Kodiak Island and has not been observed in waters near Ugak Bay (NMFS, 2011). Designated critical habitat for the North Pacific right whale is over 18 miles south of Narrow Cape (50 CFR Part 226).

Fin whales can be found in the Gulf of Alaska during the summer months in waters around Kodiak Island and south of Prince William Sound. These whales typically spend the winter in subtropical and temperate waters where they breed and calve before migrating north. Fin whale observations in waters near Ugak Bay are considered rare (NMFS, 2011).

Avian Species

Kittlitz's Murrelet

Kittlitz's murrelet was listed as a candidate species under the ESA in 2004. This species of seabird is an uncommon resident of Kodiak Island that is reported to be a rare visitor to the Narrow Cape area (ENRI, 1995c). It was observed in small numbers (less than five birds) in previous pre- and post-launch avian surveys; however, individuals were not observed in most of these surveys (ENRI, 2002a).

Steller's Eider

Steller's eiders occur in the Kodiak Island area primarily during the winter months (mid-October through March); however they are not common in the nearshore areas around Narrow Cape (FAA, 1996). Detailed, systematic aerial and shore-based point counts were conducted for seven launches from KLC. Small rafts[4] of Steller eiders were seen on two occasions totaling approximately 30-60 individuals. The pre- and post-launch monitoring studies for Steller's eiders determined that rocket launches did not result in large order (>50%) reductions in their numbers near Narrow Cape (ENRI, 2002c). In their summary document for the first five launches from KLC (ENRI 2002c), ENRI indicated that "it was apparent from the data that rocket launches were not affecting bird numbers to any significant degree, and certainly not to the degree attributable to natural factors such as weather." ENRI (1998) also cited studies indicating that responses of breeding birds to launches of space shuttle and Titan rockets (both much larger than previous or currently proposed rockets launched at KLC) were temporary, with the birds returning to their nests in 2 to 4 minutes. In 2004, the USFWS concluded that launch operations were *not likely to adversely affect* the Steller's eiders and ended the launch monitoring requirement (USFWS, 2004).

[4] an aggregation of animals (as waterfowl) resting on the water

Short-tailed Albatross

The short-tailed albatross, which breeds on remote Japanese volcanic islands, was once a regular visitor to Alaskan waters (USFWS, 2006a). Sightings of single individuals happen occasionally in the pelagic waters of the North Pacific Ocean; however, there have been no documented sightings of this seabird in either the baseline avian surveys or in the seven subsequent launch-specific avian surveys of the Narrow Cape area.

Yellow-billed Loons

Yellow-billed loons were listed as a candidate species under the ESA in 2009 throughout their range (USFWS, 2009). This species' wintering range includes the KLC, however no sightings are known in the Narrow Cape area. This species of loon was not identified in any of the baseline avian surveys or in any subsequent launch-specific monitoring surveys through 2005.

3.5 Plants

Detailed vegetation studies are presented in the 1996 EA (see Section 3.5.1.1 of the 1996 EA) and are adopted by reference. Plant types and groundcover classifications presented in the Vegetation Inventory and Mapping report from November 1994 (ENRI, 1995b) and updated by ENRI in 2004 (ENRI 2004), continue to provide an accurate representation of conditions within the KLC. Hairgrass-mixed forb meadows represent the most prevalent plant communities at the KLC, while alder and mixed alder-willow shrublands, lupine meadow, and Palustrine wetlands are also present. The proposed facilities and road improvements would occur primarily within hairgrass-mixed forb meadows and closed mixed alder/willow shrubland plant communities (ENRI, 1995a). Small areas of saturated Palustrine wetlands also occur within the footprint of the proposed KLC improvements. There are several stands of spruce trees which have been used in monitoring studies (Section 4.1.5.1) of plant health within the KLC (ENRI, 2002b).

There are no plant species protected under the Endangered Species Act on or near the KLC.

3.6 Hazardous Materials, Pollution Prevention, and Solid Waste

Hazardous materials are substances defined as hazardous by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Toxic Substances Control Act (TSCA), and the Hazardous Materials Transportation Act (HMTA). In general, hazardous materials include substances that, because of their quantity, concentration, or physical, chemical, or infectious characteristics, may present substantial danger to public health or welfare, or to the environment, when released. The FAA requires that each commercial launch site and each launch operation have a safety review that includes a complete disclosure of each hazardous material in the ground safety analysis report, as well as a hazardous materials management plan (FAA, 2009).

Management of hazardous waste must comply with the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA). The EPA administers RCRA, which requires that hazardous wastes be treated, stored, and disposed of to minimize the present and future threat to human health and the environment.

3.6.1 Hazardous Materials Management

Hazardous material use, storage, and disposal are managed in accordance with the KLC Safety Policy, the KLC Emergency Response Plan, the KLC General Compliance Plan for Emergency Planning and Community Right to Know Act, AAC's Hazardous Communication Program, the Kodiak Area Emergency Operation Plan, the Explosive Site Plan (as required by 14 CFR Part 420), and applicable state and Federal environmental laws, in such a way as to minimize impacts to the environment. Hazardous material present at KLC is listed

in the AAC Hazardous Communication Program by type. A record of specific quantities is maintained by the KLC Operations Manager. All mission specific hazardous waste, such as propellants and explosives, is removed at the end of the mission by the launch vehicle provider. Additionally, the KLC maintains a Spill Prevention, Control, and Countermeasure (SPCC) Plan covering the fuel/oil storage facilities (R&M, 2011) (Table 7).

The KLC Vice-President and General Manager serve as the point of contact for all matters pertaining to hazardous materials at KLC and AAC standard operating procedures requires notification before the arrival of any hazardous materials. All contractors provide hazardous materials information in the form of Material Safety Data Sheets labels and warning signs, and a plan indicating material handling/storage procedures, spill/release prevention measures, and emergency response protocol, including cleanup and disposal procedures and first aid/medical treatment procedures (NASA, 2011).

The KLC currently stores and uses over 18,000 gallons of petroleum products ranging from gasoline and lubricating fluids to diesel fuel.

Some rocket payloads, both small-lift and medium-lift, require hydrazine-based hypergolic fuels for maneuvering in space (not for rocket propellant). The KLC is equipped to store up to 550 gallons of hypergolic fuels during launch processing, and is approved by the Department of Defense Explosive Safety Board to store up to 1,190 gallons.

AAC is currently authorized to operate KLC as a Conditionally Exempt Small Quantity Generator (CESQG) regulated by 40 CFR 262 (USEPA Standards Applicable to Generation of Hazardous Wastes). With this designation, KLC can produce no more than 220 pounds of hazardous waste per month (NASA, 2011). This classification is applicable for both medium-lift and small-lift launches from KLC.

3.6.2 Pollution Prevention

Pollution prevention, waste minimization and recycling procedures are defined in the KLC SPCC Plan, Emergency Response Plan and Contamination Control Procedures; all include best management practices (BMPs).

3.6.3 Solid Waste Management

Solid Wastes of a non-hazardous nature are containerized at the KLC and periodically picked up by approved carriers and disposed of at the Kodiak Island Borough Landfill.

3.6.4 Existing Environmental Contamination

No National Priorities List (NPL) site is listed for the Narrow Cape area in the EPA's CERCLA Information System database (NASA, 2011).

Location	Storage Capacity (gal)	Content	Description
Stationary ASTs			
LCC	2,500	Diesel (Fuel Oil)	Saddle or skid mounted above-ground horizontal tank with double-wall secondary containment
LCC	150	Diesel (Fuel Oil)	Above-ground day tank with diked secondary containment
MSF (Dispensary)	2,000	Diesel	Saddle or skid mounted above-ground horizontal tank contained in sealed concrete vault
MSF (Heating)	3,000	Diesel (Fuel Oil)	Saddle or skid mounted above-ground horizontal tank contained in sealed concrete vault
MSF	1,000	Gasoline	Saddle or skid mounted above-ground horizontal tank contained in sealed concrete vault
MSF	350	Diesel/Fuel Oil	Two above-ground day tanks with diked secondary containment
PPF	2,500	Diesel (Fuel Oil)	Saddle or skid mounted above-ground horizontal tank with double-wall secondary containment
PPF	150	Diesel (Fuel Oil)	Above-ground day tank with diked secondary containment
RMSF	3,000	Diesel (Fuel Oil)	Saddle or skid mounted above-ground horizontal tank contained in sealed concrete vault
RMSF	50	Diesel (Fuel Oil)	Above-ground day tank with diked secondary containment
IPF	2,500	Diesel (Fuel Oil)	Saddle or skid mounted above-ground horizontal tank with double-wall secondary containment
IPF	150	Diesel (Fuel Oil)	Above-ground day tank with diked secondary containment
Portable Storage Tanks			
MSF	400	Diesel	100 and 300-gallon truck mounted tanks utilized as mobile refuelers
MSF	220	Assorted Lubricating Fluids	55-gallon dispensary storage drums situated on spill pallets
MSF	55	Used Oil	55-gallon used oil storage drum situated on spill pallet

Table 7: Facility Fuel/Oil Storage Summary

Source: KLC Spill Prevention, Control, and Countermeasure Plan (R&M, 2011).

A search of the ADEC Contaminated Sites Database did not reveal any open or closed sites with known environmental contamination near existing KLC installations. The nearest "Active" site is located at the decommissioned USCG LORAN-C Station on Narrow Cape. The ADEC database does not provide a detailed location of the site, but the USCG LORAN-C Station is approximately 0.8 miles northwest of the proposed LP3 (Figure 4). Based on the ADEC site cleanup chronology, there were two known releases from an underground storage tank (UST) at the USCG LORAN-C facility; one spill of over 20,000 gallons of diesel in 1982 and another of approximately 8,000 gallons of diesel in 1987. The contamination was confirmed in 1995, and a site assessment and characterization report was conducted in 1998. According to ADEC, 402 tons of contaminated soils was excavated and treated in 2002 (ADEC, 2012a). Contamination remains under the USCG LORAN-C array, as the above-ground instrumentation could not be disturbed for excavation at the time. This site is under the regulatory oversight of the ADEC.

3.7 Historical, Architectural, Archaeological, and Cultural Resources

The National Historic Preservation Act of 1966, as amended (NHPA) established the National Register of Historic Places (NRHP). The NHPA established guidelines by which sites are evaluated for their archeological and historic value and integrity. Section 106 of the NHPA guides the process of research and evaluation to establish which sites are eligible for the NRHP. Any potentially historic properties (generally sites over 50 years of age and/or possessing unique significance) within a project's Area of Potential Effect (APE) are evaluated. For all prior work at the KLC, determinations of "No Historic Properties Affected" Pursuant to 36 CFR 800.4(d)(1) of Section 106 of the NHPA have received concurrence from the State Historic Preservation Office (SHPO).

3.7.1 Historic and Cultural Resources

Kodiak Island has documented archaeological, historical, and cultural resources. Prior to its discovery by Russian explorers, Native settlements were transitory, moving in response to the availability of resources. As a result, archaeological and traditional use resource sites are fairly well distributed along the coastline but are concentrated along major bays and the mouths of fish streams. Historical sites on the island are often related to Russian occupation, the period of transition to American governance, and defense facilities built during World War II (FAA, 1996).

Cultural resources surveys were conducted by the Alaska Department of Natural Resources Office of History and Archeology (OHA) in 1994 and 2005. The OHA Alaska Heritage Resources Survey (AHRS) database was most recently reviewed in 2010 to support previous coordination and consultation efforts for development of the KLC and off-KLC Pasagshak Point Road improvements.

The 1994 survey included walking transects, excavating seven test pits, and examining disturbances that indicated subsurface deposits. A number of shovel probes were also excavated in several key areas across the KLC site, including at or near the improvements proposed for the LP3 project. In addition, OHA staff inspected numerous geotechnical test pits that were excavated at the time in the area of the currently proposed LP3. No evidence of cultural resources was found during any of these activities. However, two archaeological sites (KOD-81 and KOD-441) and one historic World War II era bunker complex (KOD-456) were identified within approximately one mile of the KLC (ADNR, 1994 and ENRI, 1995).

An additional OHA survey was conducted in 2005 to the west-northwest of the KLC, in association with Pasagshak Point Road Improvements (MP 0 – 13.75). That effort encountered no new archaeological resources (ADNR, 2005).

In 2010, the OHA AHRS database was reviewed for information pertinent to the development of the LP3 site. A thorough review of the AHRS database revealed no historic properties within an approximately 0.5-mile radius of the then-proposed LP3 location. Five known AHRS sites in the general vicinity of the proposed improvements were noted during that research; three previously identified sites (from the 1994 survey): KOD-81, KOD-441, KOD-456, and two new sites: an archeological site two miles from the LP3 site (KOD-66), and the USCG LORAN-C Station (KOD-75).

The archaeological sites are known and catalogued by the SHPO; however, their exact location and nature are maintained as confidential to prevent looting or unauthorized excavation. The World War II complex consists of reinforced concrete bunkers used as lookout posts during World War II. The USCG LORAN-C Station consists of 1970-1990s era communication equipment and buildings.

3.8 Light Emissions & Visual Impacts

There are no Federal statutory or regulatory requirements for classifying and assessing light emissions and visual impacts. For the majority of the year, light emissions from the KLC are minimal, primarily because most of the KLC installations are only in full operation during launch-related activities. There is no overhead street lighting at the KLC or other high-powered light sources used on a daily basis. Operational activity and the associated need for external lighting are minimal during idle (non-launch) periods at the KLC; security lighting is essentially the only source of light emissions during these times. Light emissions increase during launch preparation when portable, external, high-powered lights are required (Figure 16). These external lights are used only at key installations on an as-needed basis for approximately four to five days surrounding a launch campaign.

Figure 16: Typical Launch-related Lighting

Scenic values in the vicinity of KLC at Narrow Cape are interpreted as high. Natural vistas dominate, with low, grass-covered mountains that level to flatlands or raised plateaus near the seashore. The mountains and plateaus are covered with wildflowers in season, with patches of Sitka spruce, alder and willow. Bedrock beaches border Narrow Cape, and barrier beaches and lagoon systems dominate the eastern shoreline. The pre-KLC visual setting is further described in the 1996 EA (FAA, 1996).

Structures near the KLC include the decommissioned USCG Loran-C Station and associated buildings. AAC currently has seven permanent buildings, several smaller support structures, an antenna field, access roads, a water tank, and related small infrastructure (utility vaults and the like) visible at the KLC; a state-owned highway also traverses the KLC. The Launch Service Structure, which is 174 feet in height, is visible over most of the cape and from offshore. The structures have been painted in earth tones that blend into the background of the most common viewing angles (Figure 17).

Figure 17: Visual Setting at Narrow Cape

3.9 Natural Resources and Energy Supply

3.9.1 Regulatory Framework

Potential impacts on supplies of energy and natural resources must be evaluated per E.O. 13123 *Greening the Government Through Efficient Energy Management*, and 40 CFR 1502.016. E.O. 13123 also requires each Federal agency to reduce petroleum use, total energy use and associated air emissions, and water consumption in its facilities. It is also the policy of the FAA, consistent with NEPA and the CEQ regulations, to encourage the development of facilities that exemplify the highest standards of design including principles of sustainability." (from Order 1050.1E Section 13.1b)

3.9.2 Energy Supply

The main energy supply for Narrow Cape and the KLC is provided by Kodiak Electric Association (KEA). The existing KLC facility was designed for a maximum electrical use of approximately two megawatt-hours per year with a design load of 1,570 kilowatts.

KEA operates an isolated grid system which currently derives approximately 93% of the local electricity supply from renewable sources. The main power source comes from two hydroelectric turbine generators at Terror Lake. KEA also operates four independent diesel power generation facilities. KEA added wind power in July 2009 with the completion of Phase I of the Pillar Mountain Wind Project. As of July 2012, KEAs power supply was approximately 85% hydroelectric power, 7.8% wind power, and 7.2% diesel. It is KEAs goal to produce 95% of its energy from renewable power solutions by 2020 (KEA, 2012). The KLC operates all site facilities using peak electricity up to nine times per year during launches, with lesser amounts of electricity used at the KLC year-round by support functions (30% to 50% less electricity on average).

Backup, on-site power generation at the KLC comes from diesel generators. Number 2 diesel fuel is stored within above-ground, self-diked storage tanks, and fuel piping is above ground. The generators generally operate as backup for approximately five hours during launches to assure the power supply is uninterrupted in the case of a power outage; for one hour per week for testing during non-launch periods; and during commercial power outages (estimated maximum total of 262 hours per year). Additionally, diesel fuel is used to heat the facilities. Current fuel storage onsite is detailed in Table 7 in Section 3.6.1.

3.9.3 Natural Resources

The KLC Non-Transient Non-Community “Class A” Public Water System (PWS) operates under PWSID #250655, issued by the Alaska Department of Environmental Conservation (see section 3.12.3 for additional information on the KLC water supply infrastructure and usage). AAC has secured its right to use of the groundwater with a Certificate of Appropriation from the State of Alaska Department of Natural Resources number LAS 24062, authorizing AAC to use 1.03 acre-feet (335,627 gallons) per year of groundwater (ADNR, 2007b). AAC currently uses approximately 0.34 acre-feet (110,000 gallons) annually. Groundwater at the KLC is used to fill a 150,000-gallon storage tank for emergency fire suppression activities, as well as supply the facilities with water “on-demand” as needed.

3.10 Noise

3.10.1 Regulatory Framework

Noise is usually defined as unwanted sound, and it is recognized as an environmental pollutant. The United States Secretary of Transportation is required to issue regulations establishing a system for measuring and assessing noise effects on individuals near FAA operations. The regulations must also identify land uses normally compatible with various exposures of individuals to noise. FAA published these regulations at 14 CFR Part 150. Noise can produce physiological or psychological damage and/or interfere with communication, work, rest, recreation, and sleep. In wildlife, it can interrupt normal use of habitat and migration patterns. Sound pressure level is measured in units called decibels (dB). Detailed information on other noise measurement descriptors and how they are calculated can be found in Appendix A.

3.10.2 Existing Noise Analysis

A technical noise report has been prepared for this EA, the 2012 Noise Report; it is included as Appendix A. The following general discussion is excerpted from that document, and the reader is referred there for additional details.

Local noise sensitive areas include a private property and structures that may be occasionally used as a church camp, the Burton Ranch, several areas on Narrow Cape used for recreation, Pasagshak State Recreation Area, and private homes along Pasagshak Bay.

Noise levels near the KLC during most of the year are governed by noise from traffic along Pasagshak Point Road. Other local noise sources include local residences, ongoing activities at the KLC, animals, wind and rain. Non-local noise sources include boating activities and aircraft over-flights, (Minor, 2012). Detailed noise studies and existing conditions are presented in Appendix A.

Noise levels at the KLC vary greatly depending on the level of work happening at the facility. Launch related noise effects are infrequent (up to nine times per year) and short lived, with a return to ambient noise levels within one to two minutes of a launch (Minor, 2012). Based on measured data, and the level of activity at the KLC, noise levels at all noise sensitive properties are well below the FAA residential land use compatibility level of 65 dBA (A-weighted decibel) day-night average sound level (Minor, 2012).

3.11 Socio-Economic, Environmental Justice, and Children's Environmental Health and Safety Risk

3.11.1 Regulatory Framework

E.O. 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," requires that Federal agencies identify and address, as appropriate, disproportionately high and adverse human health, or environmental effects of their activities on minority populations and low-income populations. An associated memorandum from President Clinton requires an environmental justice analysis of all environmental effects considered in NEPA documents, including human health, economic and social effects (EPA, 1994).

EO 13045, Protection of Children from Environmental Health Risks and Safety Risks, requires federal agencies to identify and assess environmental health and safety risks that may disproportionately affect children.

Section 810 of the Alaska National Interest Lands Conservation Act (ANILCA) requires Federal agencies to evaluate the potential effect that proposed actions may have on customary rural subsistence practices.

3.11.2 Environmental Justice

The population on Kodiak Island is concentrated primarily within the city of Kodiak and in other smaller population centers along the roadway on the northeastern portion of the island. Several small villages are located off the road system as well (see Figure 18). The rest of the island is largely uninhabited, with roughly two thirds of the western side being made up of the Kodiak National Wildlife Refuge (ENRI, 1995c). As shown in Table 8, the 2011 total estimated population for the Kodiak Island Borough was approximately 13,872. The most populous areas are Kodiak, with approximately 50 percent of the population, and the USCG Base, with about 13 percent of the total population (NASA, 2011).

Census Year	Kodiak Island Borough Population
1950	6,264
1960	7,174
1970	9,409
1980	9,939
1990	13,309
2000	13,913
2011	13,872*

*U.S. Census Bureau Estimate

(Source: USCB, 2012)

Table 8: Kodiak Island Borough Population Growth

Between 1980 and 1990, the Kodiak Island Borough population increased approximately 34 percent (Table 9). Between 1990 and 2000, growth in the Kodiak Island Borough continued, but at a much slower rate than seen between 1980 and 1990. Between 2000 and 2011, the population of the Kodiak Island Borough saw a minor decrease of approximately 41 people (USCB, 2012).

The year 2010 Census data was used by the Census Bureau to calculate estimated 2011 populations by race for the Kodiak Island Borough, which are presented in Table 9. This shows the Borough population as 48.2 percent minority.

Race	Kodiak Estimate	Alaska Estimate
White (Non-Hispanic)	51.8%	63.1%
Alaska Native or American Indian	13.4%	14.8%
Black	1.1%	3.7%
Asian	19.1%	5.7%
Hawaiian Native	0.8%	1.2%
Hispanic	7.9%	6.1%
Two or More Races	7.2%	7.1%
Total Minorities	48.2%	36.9%
Population in 2011	13,872*	730,307

*U.S. Census Bureau Estimate

(Source: USCB, 2012)

Table 9: Kodiak Island Borough Population Demographics

There are no population centers on Narrow Cape, where KLC is located. The closest communities are the mainly seasonal town of Pasagshak (about 50 people) four miles from Launch Pad 3, and 47 people in Chiniak, about 12 miles away. According to the 2010 Census, the Chiniak Census Demographic Profile, 43

residents are Non-Hispanic White, two are Alaska Native, and two identify by multiple races (USCB, 2012). There is no census information specific to the Pasagshak population.

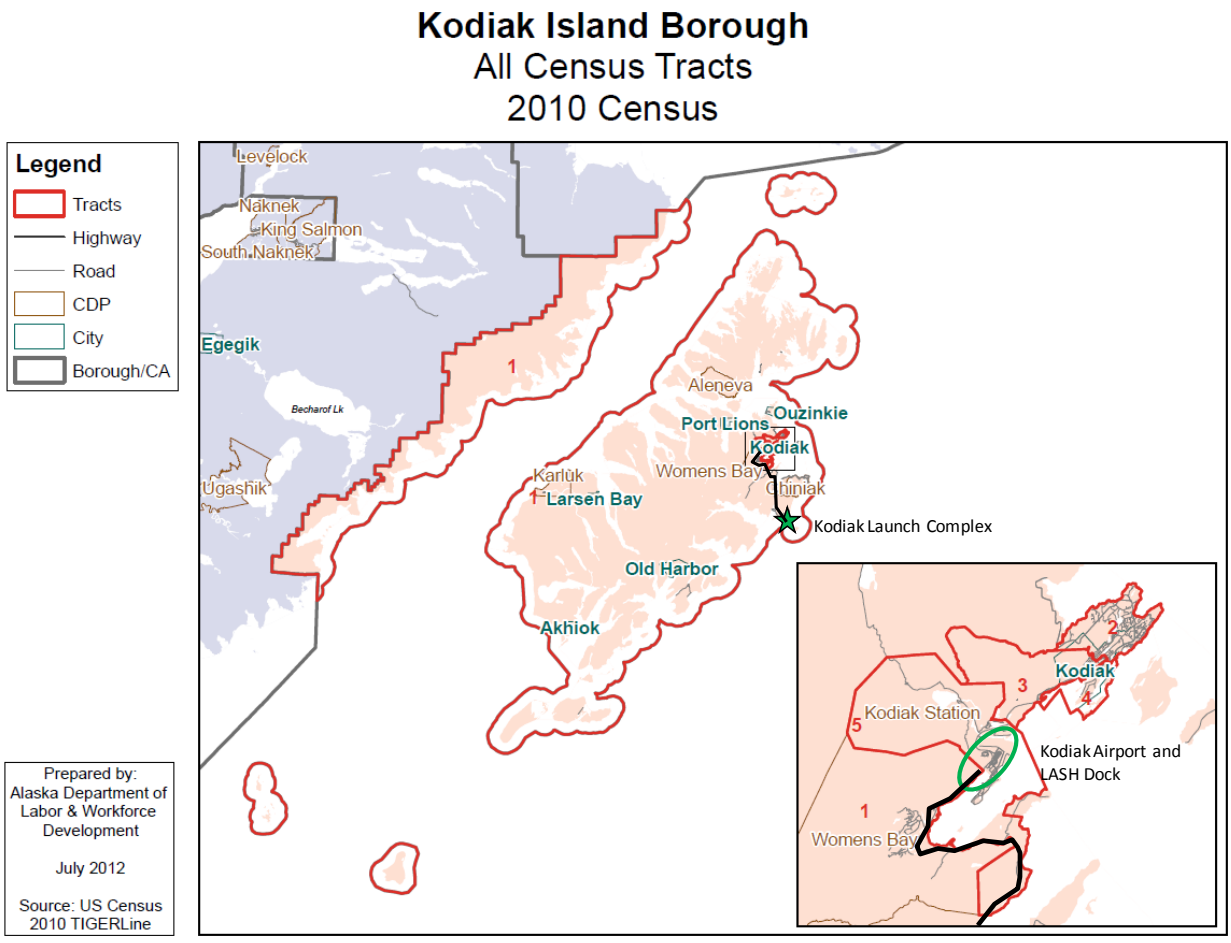

Figure 18: Kodiak Island Borough Census Tracts 2010

The area from the Kodiak Airport and LASH Corporation Dock (where rockets arrive) to KLC (not including Chiniak) is encompassed by Census Tract 5, Kodiak Island Borough, Census Demographic Profile (CDP) for Womens Bay, and Census Tract 1 (Figure 18). These areas may experience traffic delays up to nine times a year as rockets and payloads are transported from the airport and dock to KLC. In the 2010 census, 327 households were in Census Tract 5 with a median household income of $53,792, and there were 286 households were in Womens Bay with a median household income of $94,412. For the Borough as a whole in 2012, the median household income was $70,976 (when deflated at .95%, results in a median household income of $67,427 in 2010 for comparison to the other figures) (U.S. Census Bureau 2014a). The poverty threshold for a family of four in Alaska in 2012 is $28,820 (Federal Register, 2012). The demographics of Census Tract 5 and Women's Bay CDP are as follows:

Race	Tract 5	Womens Bay	Estimate
White	1,035	615	81.7%
Alaska Native or American Indian	10	34	2.2%
Black	30	2	1.6%
Asian	17	8	1.2%
Hawaiian Native	3	1	0.2%
Hispanic	127	7	6.6%
Two or More Races	79	59	6.8%
Total Minorities	266	111	18.7%
Population in 2010	1,301	719	2,020*

*U.S. Census Bureau Estimate

(Source: USCB, 2012)

Table 10: Kodiak Island Tract 5 and Womens Bay CDP Population Demographics

The demographic information for Tract 5 and Womens Bay populations indicate that it is a majority White population at 81.7% with the white non-hispanic population for Census Tract 5 at 75.3% and for Womens Bay CDP at 76.1% (U.S. Census Bureau 2014b; 2014c). The median income is 86% to 227% over the Alaska poverty level.

Additional information is not available about the race, ethnicity, or income of the communities that could experience interruptions in traffic when rockets are being transported to KLC. However, the racial, ethnic and income characteristics of populations affected by specific impacts (such as temporary road closures) are expected to be similar to those of the general population in the area.

The population density in the immediate vicinity of the KLC is very low (Figure 19). There is one permanent residence at the Burton Ranch within the boundaries of the KLC. About four miles away is the village of Pasagshak. The population of Pasagshak is combined with Census Tract 1 of the Kodiak Borough and no official population records specific to Pasagshak can be found. Based on local employee knowledge, the permanent population of Pasagshak is about ten, with a seasonal population around 100. There are no other permanent residences between Pasagshak and Kalsin Bay and Chiniak, about 11 miles and further from the proposed launch pad.

3.11.3 Environmental Health and Safety Risks for Children

There are no playgrounds or schools within the KLC. A small church camp was previously identified in the 1996 EA, approximately two and a half miles west of LP1 along Pasagshak Point Road (FAA, 1996). The camp is located on private land within the KLC ILMA boundary and is used periodically. Families with children may travel to Surf Beach, Fossil Beach, Twin Lakes and other recreation areas near the KLC. Due to the KLC's distance from any population centers children are generally only present in the area if accompanied by an adult. No children are present within the KLC at the time of a launch when the facilities and surrounding areas are closed to the general public.

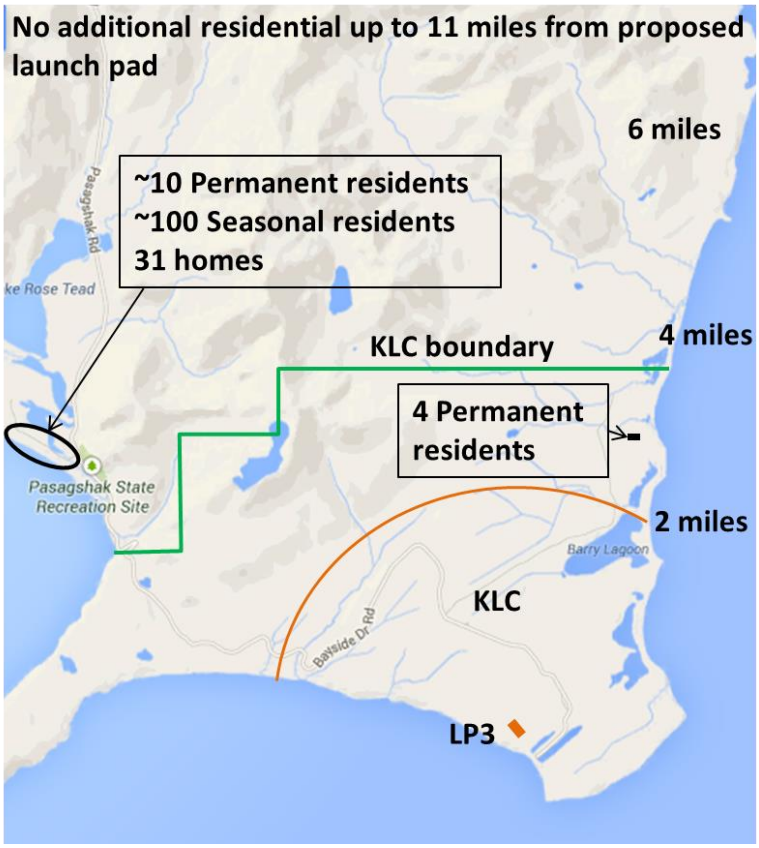

Figure 19: Population Density around KLC

3.11.4 Economy

Kodiak is one of the Nation's largest producers of seafood. The City of Kodiak has the largest and most diversified fishing port in Alaska and is consistently ranked in the top three largest fishing ports in the U.S. in terms of value landed (Kodiak, 2012). State commercial fisheries are located from shore to three nautical miles off of Kodiak, and Federal commercial fisheries extend from three to 200 nautical miles from Kodiak. The down range hazard areas during launch would encompass portions of these fisheries south of Kodiak. The dates that these fisheries are open vary each year.

Landings to the Port of Kodiak in 2010 were 313 million pounds, with a wholesale value of $132.3 million. Salmon is traditionally the largest fishery in Kodiak in terms of wholesale value. The closest salmon stream to Narrow Cape is the Pasagshak River (Figure 20) approximately six miles west of LP1/2, which has small commercial and subsistence salmon fisheries (ENRI, 1995c). Ground fish are becoming increasingly important. In 2010, the value of the ground fisheries accounted for 44% of the total wholesale (Kodiak, 2012).

Area residents hold 1,158 commercial fishing permits. Kodiak's processing plants employed approximately 1,598 people and had a combined payroll of over $68 million in 2010. Fishing seasons around Kodiak are presented in Table 11 (Kodiak, 2012).

Species	Opening Date	Length of Season
Tanner crab	January 15	3 weeks
Herring (food and bait)	August	Through February
Herring (roe)	April	Through June
Salmon	June	Through September
Dungeness crab	May	Through December
Sablefish	April	Through July
Halibut	March	Through November
Groundfish	January	Through December
Shrimp	June	Through February
Scallops	July	Through December
Cod	Variable	Variable

Table 11: Major Commercial Fisheries around Kodiak Island

(Source: FAA, 1996)

The Kodiak Chamber of Commerce calculated employment statistics based on available data in 2010. Based on this information, the U.S. Coast Guard and other government entities are the dominant industry in terms of employment, with 35% of the total. The seafood industry (includes fish harvesting and seafood processing) is the next largest employment sector, with 20% of the total. Retail trade/transportation/utilities accounted for about 10%, education/health 9%, financial/information/professional & business 6%, leisure & hospitality 6%, natural resources/construction 4% and other services 3%. Unemployment fluctuates seasonally, but averaged around 7% in 2010.

Kodiak's employment varies throughout the year due to the seasonal nature of the fishing industry. Employment usually peaks during the months of July, August and September when fish harvesting is busiest, and declines in November and December as yearly fishing quotas are reached. For this reason, Kodiak is characterized by large swings in its monthly unemployment rate throughout the year, from as low as 5.4% to as high as 11.3% in 2009. The average annual unemployment rate for the Kodiak Island Borough in 2010 was 7.1%, almost the same as in 2009 (7.2%). In 2011, the unemployment rates went from a low of 5.5% in September to a high of 7.4% during June. In September of 2011, Kodiak's unemployment rate was significantly lower than the state (7.1%) and national unemployment rates (9.1%) (Kodiak, 2012).

3.11.5 Subsistence

Subsistence is an important aspect of social, cultural, and economic life on Kodiak Island, especially in the isolated traditional villages (Akhiok, Karluk, Larsen Bay, Old Harbor, Ouzinkie, and Port Lions) where for-cash employment opportunities are limited and populations are predominately Alaska Native. All of these communities are located on the coast, away from Kodiak Island's road-connected areas. According to subsistence use maps and surveys developed by the ADF&G Division of Subsistence, a small number of residents from Old Harbor (Figure 1) use the coastal and adjacent inland areas around Narrow Cape for subsistence. Maps showing the historical subsistence harvesting area for Old Harbor residents depict the

area immediately offshore from Narrow Cape as being on the edge of the harvest area of marine resources. However, according to the AFD&G, this use pattern no longer occurs (ENRI, 1995b). Resources typically harvested by these residents include salmon, halibut, crab, waterfowl, seal, sea lion, and deer (FAA, 1996). The Narrow Cape area is currently used as a working ranch.

3.11.6 Other Socioeconomic Factors

During rocket launch preparation, rocket motors and other equipment are transported over-land from Womens Bay, (about 44 miles north of KLC) to the KLC. At the dock in Womens Bay, the motors can be rolled off the barge, or lifted by mobile cranes off of the barge and lowered onto a wheeled transporter on the dock. This process is considered a hazardous operation because it involves lifting explosives and transferring explosives from one mode of transportation (water) to another (land). The dock in Womens Bay is adjacent to Rezanof Road, the only road that connects the town of Kodiak with the surrounding population. This makes scheduling rocket shipments difficult as the road is shut down during hazardous operations, which may take several hours to perform. Once the motors are secured on the transporters the operation ceases to be classified as hazardous, and the convoy with flaggers escorts the motors down the dual lane road to KLC. The journey usually lasts about six hours, during which localized traffic on Rezanof Road is temporarily disrupted for typically less than an hour. This process usually occurs once or twice for each launch, depending on the number of rocket motors in one shipment. A similar process occurs when rocket equipment is transported to Kodiak Island by air via the Kodiak Airport. The airport is temporarily closed while the shipment is received and transitioned to a wheeled transporter for overland transport approximately 40 miles south to the KLC.

3.12 Water Quality

3.12.1 Regulatory Framework

The Federal Clean Water Act (CWA) establishes a comprehensive approach to maintaining the quality of the nation's surface waters. Under Section 402 of the CWA, the National Pollutant Discharge Elimination System (NPDES) regulates point source discharge of pollutants into waters of the United States. The CWA authorizes delegation of the NPDES permitting program to qualified states and federally recognized tribes; Alaska has been delegated NPDES permitting authority under the Alaska Pollutant Discharge Elimination System (APDES). Ground disturbing construction projects greater than 1 acre in size within Alaska must be authorized under the APDES Construction General Permit. The CWA, in Section 404, also creates a wetlands permitting program, which has been delegated by EPA to the U.S. Army Corps of Engineers. ADEC issues Section 401 Water Quality Certifications in conjunction with Section 404 permits. A related statute, the Safe Drinking Water Act, establishes federally delegated state-implemented programs for regulating groundwater quality.

3.12.2 Surface Water Monitoring

Numerous streams and lakes are located on Kodiak Island and within the KLC (Figure 20). The principal streams on Kodiak Island flow from the mountains and hills into the steep-walled bays located along the irregular coastline. These streams are generally less than ten miles long and generally flow through fairly narrow, flat-bottomed valleys bordered by strips of rolling or hilly land (ENRI, 1995b). At the proposed LP3 site, the topography is a relatively flat upland plateau, with adjacent wetlands and incised drainages; the streams draining this area are generally less than two miles in length, small in size, and have an average discharge of less than 46 cubic feet per second (ENRI, 1995b).

Lakes located within the KLC boundary include West and East Twin Lakes, which are freshwater lakes, and Triple Lakes and Barry Lagoon, which are considered to be salt water-influenced lagoons (ENRI, 1995b) (Figure 12).

According to the ADEC-maintained List of Impaired Waters (Section 303(d) list), there are no listed impaired waterbodies located within the KLC (ADEC, 2012b). In 1994, baseline surface water quality assessments were conducted within the local vicinity of what is now the KLC (ENRI, 1995a; 1995b). Figure 20 depicts the surface water sampling locations including freshwater streams, West and East Twin Lakes, and Triple Lakes and Barry Lagoon. This baseline study determined that the specific conductivity, pH, dissolved oxygen, and alkalinity (measure of capacity to neutralize acid) of the surface water in the vicinity of the KLC were within typical ranges found throughout Kodiak Island (ENRI 1995a, 1995b). The specific conductivity, pH, and dissolved oxygen content of the surface waters near the KLC are suitable for a range of aquatic organisms. In addition, biological toxicity testing of sediments collected from these surface water sampling sites indicates that the sediments had no potential toxicity (ENRI, 1995a).

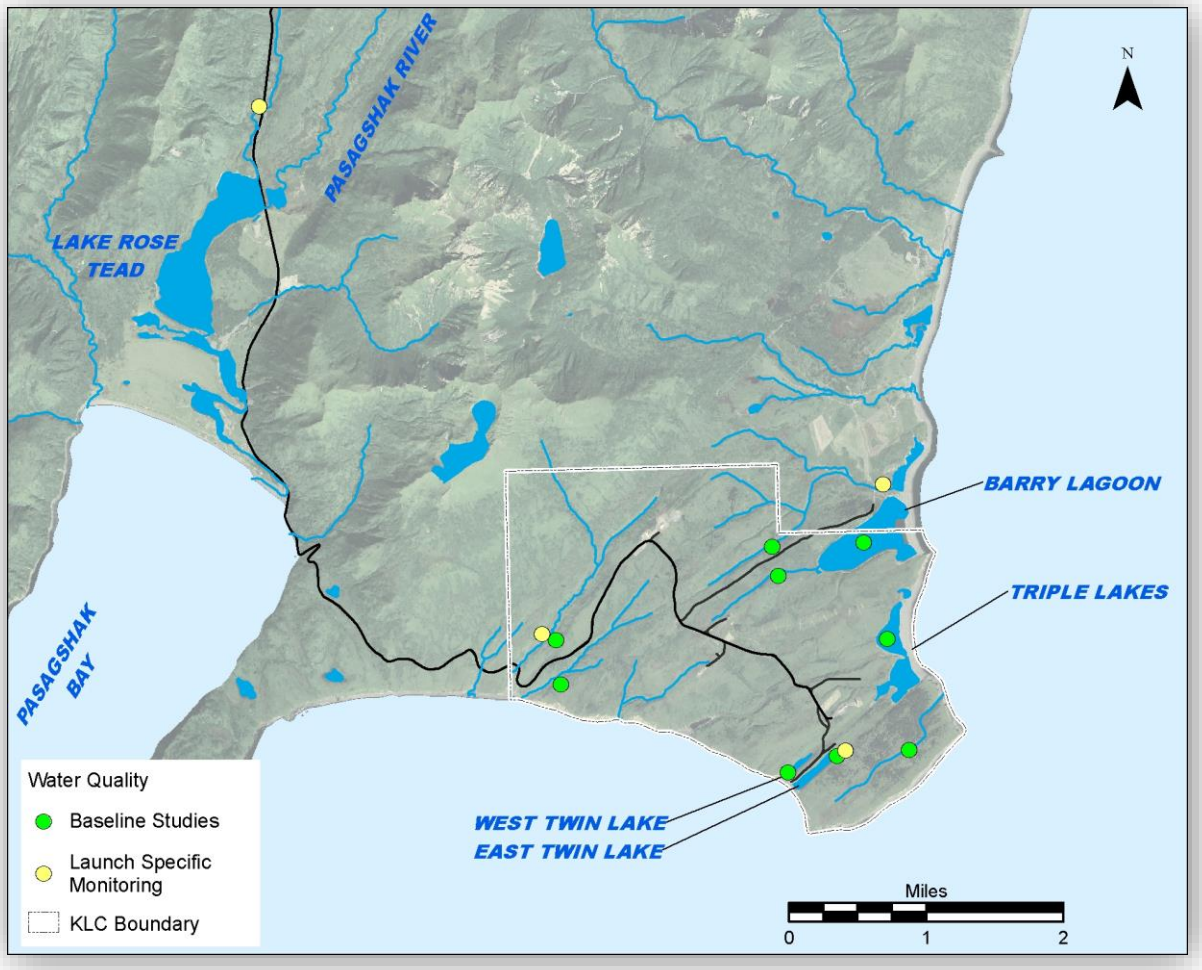

Figure 20: Surface Water Quality Sampling Locations

Additional analyses of surface water collected from East Twin Lake and Triple Lakes in 1994 showed that none of the following contaminants were detected (ENRI 1995b):

- Volatile organic compounds
- Pesticides/herbicides
- Polychlorinated biphenyls

- Nitrates or nitrites
- Gross alpha radioactivity
- Total cyanide
- Metals including barium, nickel, antimony, arsenic, chromium, mercury, selenium, thallium, and fluoride

More recent environmental monitoring for the KLC has focused on the lands and waters within a circular area having approximately a six-mile radius from the existing launch pads at KLC. This area was set in a September 1996 meeting of AAC with representatives of the USFWS, NMFS, U.S. Department of Transportation (USDOT), Federal Aviation Administration, and ENRI. Following this meeting, an Environmental Monitoring Plan was developed and attached to the KLC's site operator license (ENRI, 1998).

Surface water quality monitoring efforts have continued in conjunction with each rocket launch through September 2011. Four streams have been sampled prior to and soon after each launch (Figure 20). At each sampling location, surface water temperature, specific conductivity, and pH were measured in-situ and real-time. A requirement for detailed water chemistry analysis was added in January 2002 by the Alaska Division of Governmental Coordination, who in turn designated the Alaska Department of Environmental Conservation as the recipient of the data. Water samples beyond 2002 were collected to be laboratory-analyzed for perchlorate, total alkalinity, and aluminum.

In 2011, the Alaska Department of Environmental Conservation elected to end its imposed water quality monitoring program after long-term results showed that launch operations were having no effect on local water bodies; in all cases, water chemistry results pre- and post-launch were similar, allowing for seasonal and precipitation-induced variation. For reference, existing launch facilities (LP1/LP2) are closer to monitored surface waters than the proposed LP3 footprint.

3.12.3 Water Use

The KLC operates a site-wide public water system classified as Non-Transient Non-Community (Class A) by the ADEC, who has designated it PWSID #250655; it is currently supplied by a well located at the MSF. A back-up well at the LCC can be used to supply the water system if needed. Individual installations treat incoming water using a packaged domestic water system that provides bag filtration, disinfection by chlorination, and corrosion control. The 150,000-gallon fire suppression water tank near the PPF is also supplied by the public water system. The source of water for the public water system is classified as groundwater not under the influence of surface water. AAC has secured its right to use the groundwater with a Certificate of Appropriation from ADNR – LAS 24062 in May 2007 (ADNR, 2007b). AAC is currently entitled to use 335,627 gallons (1.03 acre feet) per year of groundwater.

3.13 Wetlands

3.13.1 Regulatory Framework

Wetlands are a natural resource protected by Executive Order 11990, *Protection of Wetlands* and the U.S. Department of Transportation (DOT) Order 5660.1A, *Preservation of the Nation's Wetlands.* Wetlands determined to be jurisdictional by the USACE are also protected under Section 404 of the Clean Water Act (CWA).

Three key attributes define a wetland: (1) the presence of wetland plants (hydrophytes), (2) the presence of wet soils (hydric soils), and (3) soil saturation or flooding (hydrology).

Once wetlands have been delineated, a determination is made on whether the wetlands fall under the jurisdiction of the USACE under Section 404 of the CWA, which regulates the dredging and filling of waters of the U.S. Waters of the U.S. are those waters (including wetlands) that are subject to the ebb and flow of the tide and/or are used, have been used in the past, or may be susceptible to use to transport interstate or foreign commerce, or are connected to a navigable water by a "significant nexus" (33 CFR Section 329.4). A USACE permit is required for any dredge or fill activity within jurisdictional wetlands. KLC wetlands have been previously defined as jurisdictional by the USACE. The most current jurisdictional determination for KLC wetlands was issued on April 6, 2009.

3.13.2 Wetland Assessment

Detailed hydrology, vegetation and soil assessment, and wetland delineation and mapping for Narrow Cape was conducted by ENRI in 1994 with the aid of a differential GPS (ENRI, 1995a). Wetlands were delineated and classified according to the *USFWS Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin, 1979). ENRI later expanded the initial mapping area and performed additional field delineation in 2002 and 2003 (ENRI, 2003), and digitized the wetlands and vegetation mapping into GIS in 2004 (ENRI, 2004) (see Figure 21). A detailed description of wetland vegetation types is outlined in the 1996 EA (see Section 3.5.1.1 and Appendix C of the 1996 EA) and is incorporated by reference (FAA, 1996). In addition to showing the ENRI-mapped wetlands, a map of the USFWS National Wetlands Inventory data is provided (Figure 22: Wetlands around the Proposed Action .

Discrete wetlands are scattered across the entire Narrow Cape area, and much of Kodiak Island. No rare, unique, or unusual Alaskan plant communities are found in the KLC area. Vegetated wetlands near the proposed KLC improvements are generally Palustrine wetlands (Figure 21). Small wetland areas made up of saturated/seasonally flooded emergent meadows (Cowardin classification: PEM1B/PEM1C) occur within the footprints of LP3 and the proposed road improvements. There are no wetlands within the footprint of the proposed MCC locations.

3.14 Resource Categories Excluded from Further Analysis

Several impact categories have been excluded from further detailed study, either due to no potential impacts to these resources, or as directed in the FAA Order 1050.1E. These impact categories include Coastal Resources, Wild and Scenic Rivers, Farmlands, and Floodplains.

3.14.1 Coastal Resources

There is no approved Coastal Zone Management Program in Alaska, nor are there coastal barrier resources or coral reefs. Therefore, projects in Alaska do not fall under the jurisdiction of the Coastal Zone Management Act. Nevertheless, the FAA has consulted with the appropriate state and federal agencies with jurisdiction over or expertise on potentially affected coastal resources (see Section 4.1.3 for recreational resources and Section 4.1.4 for fish and wildlife resources).

3.14.2 Wild and Scenic Rivers

The Wild and Scenic Rivers Act of 1968, defines "Wild and Scenic Rivers" as those rivers having remarkable scenic, recreational, geologic, fish, wildlife, historic, or cultural values. When a river is given "Wild and Scenic" status, it is added to a database maintained by the National Park Service. There are no rivers with this designation located on Kodiak Island. Therefore, "Wild and Scenic Rivers" need not be evaluated.

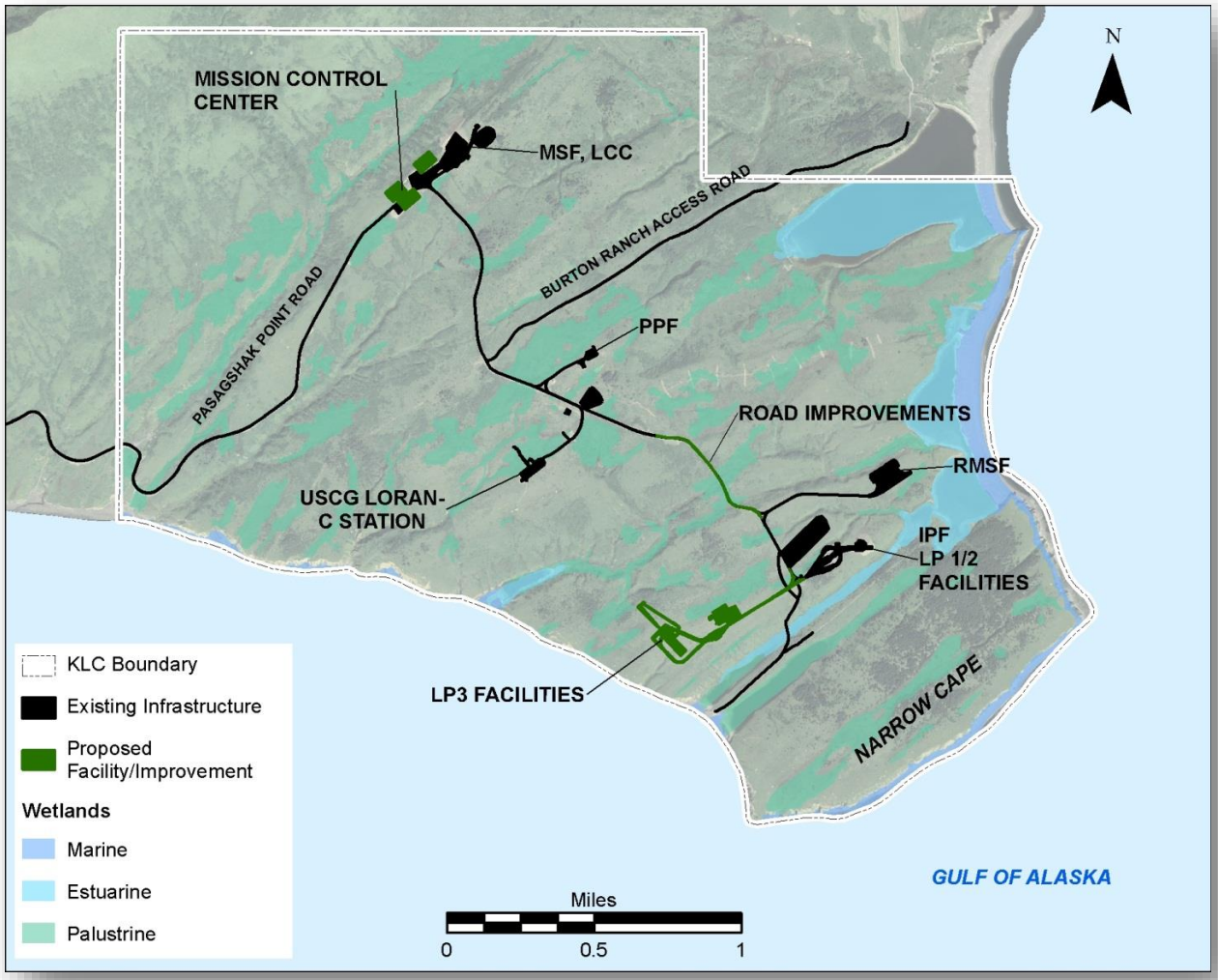

Figure 21: Wetlands within the KLC Boundary

Figure 22: Wetlands around the Proposed Action (USFWS 2014)

3.14.3 Farmlands

Prime and important farmland includes all land that is defined as prime, unique, or farmlands of statewide or local importance. There are no designated prime/unique farmlands or farmlands of local/statewide importance located on Kodiak Island. Therefore, "Farmland" under the jurisdiction of the Farmland Protection Policy Act need not be evaluated.

3.14.4 Floodplains

E.O. 11988, Floodplains Management, seeks to avoid impacts associated with the occupancy and modification of floodplains. Federal Emergency Management Agency Flood Insurance Rate Maps are not available for this area; however, localized studies were conducted by ENRI, and the coastal plateau of the proposed KLC LP3 and associated structures is not within a floodplain (ENRI, 1995). Therefore, "Floodplains" need not be evaluated.

4.0 ENVIRONMENTAL CONSEQUENCES

This chapter describes potential environmental effects that would result from the Proposed Action and the No Action alternative. NEPA documentation for all currently authorized KLC launching activities has been previously completed and has been used to characterize the effects of and provide a baseline for the No Action alternative (Section 1.5). Direct and indirect effects analyzed below are solely a result of the action being evaluated and occur at the same time and place (direct effect) or at a later time or outside of the area directly affected (indirect effect) (40 CFR 1508.8).

Cumulative effects are those resulting from the incremental effects of an action when added to other past, present, and reasonably foreseeable future actions, regardless of the agencies or parties responsible for the action (40 CFR 1508.7). Cumulative effects can result from individually minor, but collectively substantial, actions occurring over a period of time within the potentially affected area. Past, present, and reasonably foreseeable future actions at KLC and the surrounding area that may affect the same resources as the Proposed Action include an increase in rocket launches from KLC. The subsections in this chapter include a discussion of potential construction and operational effects. Construction effects are also addressed specifically in section 4.1.14.

4.1 Proposed Action

4.1.1 Air Quality

4.1.1.1 Direct and Indirect Effects

The potential for air quality effects related to current launching activities at the KLC (and other similar facilities) has been evaluated in previous NEPA documents (Section 1.5). Permanent air quality effects due to rocket launches were not expected at the time of the 1996 EA and have not been documented as a result of the previous 16 rocket launches that have occurred at the KLC. Since 1996 a one-hour NAAQS for Nitrogen dioxide and annual and 24-hour standards for $PM_{2.5}$ have been established. Both NO_2 and $PM_{2.5}$ disperse readily; NO_2 is a gas and the tiny particles of $PM_{2.5}$ diffuse widely under the generally windy conditions present at KLC. Ground level concentrations of these two pollutants are not expected to approach or exceed the NAAQS at the KLC property lines due to the short period of time the rockets are close enough to the ground to emit these pollutants.

The emissions of concern from launching solid-propellant rockets are hydrogen chloride, carbon monoxide, nitrogen oxides, black carbon and aluminum oxide. Hydrogen chloride emissions are gaseous; aluminum oxide is emitted as a particulate (FAA, 1996). Hydrogen chloride combines with water in the atmosphere or from a deluge system to create hydrochloric acid (HCl) (FAA, 1996). No water deluge system has previously been used at the KLC and is not currently proposed for solid-propellant rockets. The omission of a water deluge system for solid rocket motors greatly reduces the amount of HCl that would contact the ground during a launch and minimizes associated environmental effects. Based on research performed for the U.S Air Force for the very large Titan IV rocket, concentrations of HCl would be less than 10 ppm for a rocket flyby of 2 minutes. The far smaller rockets (Athena III has 2.098 million pounds thrust compared to 3.85 million pounds for the Titan IV) planned for the KLC would have far smaller emissions and produce far lower concentrations of HCl (Commission on Life Sciences' Assessment of Exposure Response Functions for Rocket Emission Toxicants", 1998). HCl concentrations would be less than OSHA permissible exposure limit of 5 ppm. The potential concentrations that the general public could experience would be much lower due to the large distances between the KLC and areas accessible to the general public; no individual may be within two miles of a launching rocket, and the general public are not allowed on the KLC until the launch has occurred and the launch pad area has been cleared for hazards by qualified personnel. The HCl emissions do create holes in the ozone layer, but these holes are filled in

from the adjacent atmosphere. For the very large Titan IV rockets this repair may take "a few weeks" (Prof. Toohey, Atmospheric & Oceanic Science, Univ. of Colorado, 2009). For the much smaller rockets proposed for the KLC, the damage and repair time would be less. Further, HCl emitted from launch vehicles remains in the stratosphere and is transported throughout the Northern Hemisphere where it continues to destroy ozone for about 6 years (Brady et al., 1997). However, based on the proposed launch vehicles and launch activity, the impact of the Proposed Action on stratospheric ozone concentrations would be relatively small.

Historic launches from the KLC have included solid-propellant rockets only. The chemical composition of the exhaust products from the proposed medium-lift solid-propellant rockets would be the same when compared to small-lift rockets previously launched from the KLC, however in larger quantities. Air quality effects from previous launches have been temporary and very localized. On-site personnel may safely return to the launch pad without air quality concerns as soon as the pad has been visually cleared by the pad safety officer, usually after 10 minutes. Security checkpoints on mission day prevent the general public from approaching the launch pad closer than two miles. Short-term effects within the area immediately surrounding the launch pad include high temperature exhaust gas mixture and elevated carbon monoxide concentrations (NASA, 2011). Previous observations indicate that ambient air temperature at the launch pad returns to pre-launch conditions within 10 minutes, and so would the pollutant concentrations. The exhaust clouds dissipate after each launch and are generally carried seaward by prevailing winds from the northwest (FAA, 1996). The nearest residential populations are two miles from LP3 and are unlikely to experience pollutant concentrations approaching or exceeding the NAAQS. Even people near the property-line fence or marine traffic directly offshore would be extremely unlikely to be subjected to pollutant concentrations exceeding the NAAQS. Launch-specific environmental monitoring studies have shown that chemical exhaust products are not accumulating in surface waters or affecting the localized environment (FAA, 1996; R&M, 2007a, 2007b; R&M 2008; R&M, 2009; R&M, 2011). Given that previous launches have had no measurable adverse effect on air quality, and considering the foregoing analysis, the launching of medium-lift solid-propellant rockets is not expected to produce pollutant concentrations approaching or exceeding the short-term NAAQS. Supporting this conclusion is the Supplemental Environmental Assessment for the California Spaceport at Vandenberg AFB (FAA August 2011), where a proposed launching of 24 Athena III rockets a year was found to produce 2.48 tons/ year of ozone precursors (NO_2). This quantity is well below the de minimis level of 100 tons that triggers a requirement for a Conformity analysis in non-attainment and maintenance areas. The nine launches a year at the KLC would produce less than 1 ton/year (i.e. 9/24x 2.48).

Even though the Proposed Action would increase total annual emissions compared to the current operations, the emissions from nine rocket launches a year would be separated in time and thus pollutant concentrations on an annual basis would not exceed the NAAQS.

The liquid-propellant rockets proposed for the KLC utilize a first stage propellant composed of RP1 and liquid oxygen. The primary chemical exhaust constituent of concern from a toxicity standpoint is carbon monoxide (ACTA, 2009). In the case of liquid-propellant rockets, a water deluge system is utilized to reduce the vibration loads experienced by the satellite on top of the rocket, as well as to reduce the acoustic reflections from the flame trench into the rocket. Deluge water also cools the exhaust plume and acts as an oxidizer by converting CO to CO2 in the plume while releasing hydrogen gas (ACTA, 2009). For liquid-propellant rockets, elevated ground level CO concentrations near the launch pad are estimated to be in the 4,000 to 20,000 ppm range; however these concentrations dissipate quickly and the effects are extremely localized. Peak instantaneous CO concentrations beyond the immediate vicinity of the launch pad are estimated at typically less than 1 ppm but have the potential to reach 20 ppm. These

concentration levels would be well below the one-hour CO NAAQS of 35 ppm and the 8-hour NAAQS of 9 ppm.

The propellant formulation and pollutant composition are the same for medium and small-lift rocket launches; however, the medium-lift rockets would produce a greater quantity of pollutants. The vehicle is generally on the edge of the mixing layer within a minute or so of launch. Dispersion of the pollutants would vary depending upon the local meteorological conditions of wind speed and mixing height. As a location, Kodiak Island is well suited to the dispersion of pollutants due to the prevailing wind conditions, as described previously (Section 3.1.3 Meteorology). No more than nine launches per year would occur at the KLC, as analyzed in previous NEPA documents (Section 1.5). The additional emissions would not have long-term negative atmospheric effects, particularly given the typical wind conditions and low occurrence of "calms" at the site.

A liquid fueled rocket would likely use cryogenic liquid oxygen and inert pressurizing gasses such as nitrogen and helium. The pressurizing gasses have no impact on air quality if released due to their inert nature. Under certain conditions, the liquid oxygen may be released into an evaporation containment pond where it will boil off into the atmosphere as gaseous oxygen. Gaseous oxygen would not impact air quality, but in high concentrations would cause safety concerns until the oxygen concentration dissipates. To ensure safety during LOX boil off, all ignition sources will be in a safe condition and there will be no access to the launch pad area until it is determined to be safe by the Ground Safety Officer.

The receipt and handling of hydrazine-based hypergolic fuels and oxidizers would occur only under controlled conditions and in accordance with established safety procedures (Section 3.6). The hydrazine is currently stored near the PPF in a secured vault in accordance with KLC's explosive site plan. The amount of hydrazine that AAC is currently authorized to store on site (1,190 gallons) and specific handling procedures would not be changed. As demonstrated over previous launches from KLC, emissions of toxic air pollutants from handling of hypergolic fuels are not anticipated.

Additional portable and fixed back-up diesel generators would be installed to support the proposed MCC, LP3 (would also support LFF), and RSF facilities. Usage data for the existing generators indicates they are used on an infrequent, intermittent, and short-term basis. The levels of emissions emitted from this source under the Proposed Action would increase negligibly, and would remain far below levels requiring a permit; therefore this source is not anticipated to have a direct or indirect effect on air quality.

A temporary, localized degradation of air quality would occur from the increased airborne particulate levels and emissions from heavy equipment and dust during construction activities. Air impacts from construction are temporary and do not create a long term effect since they are small in quantity (about a dozen vehicles) and short duration (about two construction seasons). Ships and aircraft that deliver rocket motors and components to KLC would use existing cargo carriers on established routes to the extent possible, which would minimize the amount of vehicle emissions due to transportation. Additional emissions would be generated by truck traffic and marine freighters or barges bringing materials to the site. Given that the nearest residences are more than two miles away, there would be no pollutant levels that approach or exceed the NAAQS. People adjacent to the property-line and marine traffic directly offshore would be highly unlikely to experience pollutant concentrations exceeding the NAAQS.

4.1.1.2 Cumulative Effects

As shown in the findings of long term water quality monitoring, emissions from rocket launches dissipate after each launch and short-term effects are minor and temporary in nature. The expanded

launch capabilities at the KLC would not increase the total number of launches per year. Individual launches do not result in anything other than transitory, highly localized adverse effects to air quality; therefore the cumulative effects resulting from previous, current, and reasonably foreseeable launch activities or other reasonably foreseeable projects would not be significant.

CO_2 and black carbon ("soot") are emitted rocket exhaust products that have the potential to contribute to climate change. The KLC project would slightly increase these emissions due to the larger rockets that would be launched. These emissions would be negligible compared to the amount of these pollutants emitted by Alaska's transportation system, industry, and forest fires, and are not significant.

4.1.1.3 Mitigation

Temporary air quality effects during proposed construction activities would be managed through regular equipment maintenance and implementing PM10 control measures such as watering the disturbed, trafficked areas.

4.1.2 Compatible Land Use

4.1.2.1 Direct and Indirect Effects

The Proposed Action is expected to have a negligible effect on compatible land use as there would be no change in land use, and a negligible increase in temporary noise effects when compared to the existing launch effects. See Appendix A for a detailed description of the noise effects.

The Proposed Action is within the boundaries of the existing KLC ILMA. As there would be no additional land acquisition or use conversions, no changes to the ILMA are proposed.

As required by FAA Order 1050.1E, noise effects associated with the new class of rockets are analyzed in Section 4.1.10 and in Appendix A. There are "noise sensitive areas" including the KLC launch control operations, a private residence that may be used as a church camp, the Burton Ranch, several areas on Narrow Cape used for recreation, Pasagshak State Recreation Area, and private homes along Pasagshak Bay. As stated in Section 4.1.10, the projected noise increase associated with medium-lift rockets on local noise receptors would only represent a minor increase from the documented effects associated with small-lift rockets (Minor, 2012). DNL values at noise sensitive areas in the vicinity of the KLC and would have no change when averaged over time, except for the church camp which may experience an increase from 45 to 49 dBA, well below the 65 dBA threshold for residences. These values are compatible with all land uses. Appendix A provides additional detail.

4.1.2.2 Cumulative Effects

The Proposed Action would have no cumulative effects on compatible land use when considering past, present, and reasonably foreseeable future actions. Launch related minor and temporary noise effects have occurred in the past and would continue, however, there would be no overall land use compatibility effects.

4.1.2.3 Mitigation

There are no identified adverse effects, therefore mitigation is not proposed.

4.1.3 Department of Transportation Act Section 4(f)

4.1.3.1 Direct and Indirect Effects

Section 4(f) Resources

Referring to Section 3.3.2, the only 4(f) resource that occurs in the vicinity of KLC is the Pasagshak State Recreation Site. No construction associated with LP 3 would occur within or adjacent to this 4(f) resource therefore, no direct "use" of this 4(f) property (as defined in Section 3.3.1) would occur.

Proximity impacts leading to a "constructive use" (as defined in Section 3.3.1) of a 4(f) resource also must be considered. The Pasagshak State Recreation Site is 6 miles from the KLC. The Proposed Action would not involve an increase in launch frequency, and no additional KLC-related increases in visitation (and hence road traffic passing the recreation site) are anticipated. Launch noise would increase slightly at the Pasagshak State Recreation Site under the Proposed Action, as depicted in the noise level contour map in Appendix A (see Figure 11 of Appendix A). The 90 decibel (A-weighted) contour essentially grows slightly to encompass the Pasagshak State Recreation Site completely, whereas previously that contour included only part of the recreation site. Because noise impacts would be very minor, temporary, and would only occur 9 times a year at a maximum (as under current conditions), the recreational value of the Pasagshak State Recreation Site, would not be substantially impaired. Therefore, there would be no constructive use of this 4(f) resource. FAA is consulting with the ADNR to determine whether they agree with FAA's conclusion of no constructive use of the Pasagshak State Recreation Site. Results of the consultation will be included in the Final EA.

Because there would be no direct or constructive use of any 4(f) resource, there would be no significant impacts to 4(f) resources from the Proposed Action.

Though not considered 4(f) resources, the additional Narrow Cape area recreational opportunities mentioned in Section 3.3.2 are discussed here in terms of general effect on recreation. The Proposed Action is expected to have a minor effect on recreation, identical to what has occurred during previous KLC activities. For public safety, the Narrow Cape area is closed to the public immediately before and during launch activities but remains open for recreational activities at all other times. A two-mile radius safety area around the launch pad is closed 8 hours prior to a launch, which involves closing the Pasagshak Point Road where it enters the KLC. During these brief closure periods, Fossil Beach, Surf Beach, Twin Lakes and other state land used for recreation on Narrow Cape are not accessible to the public.

Also, temporary safety closures to marine waters and airspace would continue to take place concurrently with the ground closures. These closures would be temporary (8 hours) and would not exceed 9 per year.

The construction-related effects on recreation in the area would be temporary and minor. Construction effects may involve traffic delays and temporary road closures as large construction equipment and supplies are transported to the KLC facility. Construction impacts would also involve temporary noise increases due to the operation of heavy equipment.

Temporary road closures during transport of rockets and other supplies to the KLC facility currently occur, and would continue prior to launches. These temporary road closures can result in a temporary delay to recreational traffic along Pasagshak Point Road.

KLC launch activity provides positive effects in the form of unique recreational opportunities, as there are relatively few places in the world where the public can witness rocket launches.

4.1.3.2 Cumulative Effects

The Proposed Action would have no effect on 4(f) resources, and so no cumulative effects to Section 4(f). The Proposed Action would not contribute to cumulative effects on other recreational resources, as the number (maximum of 9 per year) of launches and their associated effects on recreation would not differ from what was already proposed for the existing Launch Site Operator License and accompanying Environmental Assessment (FAA, 1996). There are no reasonably foreseeable future plans to increase the number of launches per year, or any plans to acquire recreational lands for the KLC.

4.1.3.3 Mitigation

AAC works with ADNR to mitigate any effect on the Pasagshak State Recreation Site due to proximity to the KLC.

AAC would also continue to work with state and local recreation and tourism authorities to provide adequate advance notice and viewing opportunities for launches. Launches provide unique recreational opportunities, as there are relatively few places in the U.S. where the public can witness rocket launches. AAC, through consultation with Alaska Department of Natural Resources, encourages public viewing of launches from KLC at designated places.

Should cultural, archaeological, or historical resources be encountered during the course of any construction activity, work would cease immediately and the SHPO would be contacted.

4.1.4 Fish and Wildlife

4.1.4.1 Fish

4.1.4.1.1 Direct and Indirect Effects

The Proposed Action does not involve construction within any fish-bearing stream or water body and would not directly or indirectly affect fish populations. As described in Section 4.1.12, the Proposed Action would not result in measurable degradation of surface water quality or changes to macro-invertebrate availability and diversity. As a result, EFH and available food sources within surface waters near the KLC would not be compromised by the Proposed Action. Anadromous, fresh-water, and marine fish would not be affected by the proposed operational changes and construction activities at the KLC.

4.1.4.1.2 Cumulative Effects

Since the Proposed Action would not result in direct or indirect impacts on fish, the Proposed Action would not contribute to a cumulative effect on fish populations when considering past, present, and reasonably foreseeable actions.

4.1.4.1.3 Mitigation

Mitigation is not required because there would be no impacts to mitigate.

4.1.4.2 Birds

This section discusses the potential effects on non-ESA-listed bird species. Threatened, endangered, and candidate species are covered in Section 4.1.4.4.

4.1.4.2.1 Direct and Indirect Effects

Terrestrial

Long-term adverse effects to land birds are not anticipated from the Proposed Action. The potential effect to land birds from launch-related noise and emissions associated with small-lift launch rockets at the KLC was evaluated in the 1996 EA (see Section 4.5.1.2 of the 1996 EA). Effects were determined to be minor and temporary within a 6-mile radius of the launch pad. During previous launches, birds were typically flushed from the area in response to the noise of the launch but returned within minutes. Monitoring studies of birds during the breeding season at the time of Space Shuttle launches also showed initial startle responses, but no long-term effects or nest abandonment were observed (USAF, 1994).

A noise report, Appendix A was prepared to analyze potential noise-related effects of the Proposed Action. The maximum projected noise levels associated with medium-lift rockets is slightly louder than the current small-lift rockets, and does not represent a significant increase over small-lift rockets (Minor, 2012). The

anticipated increase in noise is 6 dBA (per launch using the maximum sound level, called Lmax). See Appendix A, Figure 12 and Table 7 for recorded small-lift noise and projected medium-lift noise. The extended duration over which the elevated noise levels occur would be minimal, about an additional 60 seconds. As such, additional noise-related effects on birds from launching medium-lift rockets are not anticipated.

As described in Section 4.1.1, the vehicle launch emission products of concern include hydrogen chloride, carbon monoxide, and aluminum oxide. Birds flying directly through the exhaust plume immediately post-launch could be exposed to minor concentrations of hydrochloric acid (HCl), which would irritate eye and respiratory tract membranes (FAA, 1996). Liquid fuels generate high concentrations of carbon monoxide near the launch pad. However, it is assumed that most birds would be frightened away by the noise of the launch and would not come into direct contact with the exhaust plume. Downwind HCl concentrations are expected to be benign for humans and therefore physiological effects to birds are not expected (FAA, 1996). Aluminum oxide is known to have a low toxicity for humans and would not be expected to affect resident wildlife populations (USAF, 1989).

Vegetation clearing during proposed construction would result in a minor loss of habitat and foraging areas available to land birds. Construction activities would comply with the Migratory Bird Treaty Act "No Clearing" guidelines for the Kodiak Archipelago from April 15 through July 15, as applicable for vegetated areas. Approximately 22 acres would be disturbed, of which 16 acres would be replanted. The remaining six acres would contain the new construction, to include buildings, launch pad, roads, and utilities. The areas proposed to be cleared of vegetation consist primarily of hairgrass-mixed forb meadow. Optimal bird habitats on Narrow Cape are primarily found near lacustrine/fluvial waters, spruce forest, shrub thickets, wetlands, beaches/tidal float, and along rocky shores or coastal cliffs (FAA, 1996). Based on the large availability of remaining habitat, clearing activities would not have an adverse effect on local or regional bird populations (FAA, 1996).

Construction activities would include the use of heavy equipment and might increase traffic through the KLC and vicinity, which might have a temporary effect on birds. Construction-related effects on local bird populations were evaluated in the 1996 EA, and it was determined that effects would be minor (habitat loss) and temporary (flushing effects from construction noise). Proposed construction activities are minimal when compared with original construction for the entire KLC facility. As a result, effects (if any) from the Proposed Action are anticipated to be temporary and minor.

Marine

The potential for rocket-launching activities to affect seabirds within the vicinity of the KLC was extensively analyzed in the 1996 EA (see Section 4.5.2.2 of the 1996 EA). In general, disturbances caused by a launch would be brief and would not be expected to have a measurable adverse effect (FAA, 1996). Under the Proposed Action, the total annual number of launches occurring at the KLC would remain the same. The projected increase in noise level associated with medium-lift rockets (6 dBA) would not represent a notable significant increase over small-lift rockets, and the extended duration over which the elevated noise levels occur would be minimal (Minor, 2012). Therefore, operational effects to marine birds are not anticipated. See Appendix A, Figure 12 and Table 7 for recorded small-lift noise and projected medium-lift noise.

Potential effects from construction activities at Narrow Cape were previously evaluated prior to construction of the KLC (FAA, 1996). Although noise levels in construction areas could be high, they are not expected to propagate far beyond the immediate boundaries of the construction site, about 1,000 feet. Construction noise may reach the ocean, but this noise is unlikely to disturb any seabirds due to the

tall, sheer cliffs along Narrow Cape. Construction related noise would be temporary and only last the duration of construction. As such, anticipated construction would have little to no effect on marine birds.

Bald Eagles

Construction activities would comply with the Migratory Bird Treaty Act "No Clearing" guidelines for the Kodiak Archipelago from April 15 through July 15, as applicable for vegetated areas.

The eagle "take" permit regulation codified at 50 CFR 22.26 (effective 2009) defines one form of take as disturbance; "disturb" is defined as "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available: (1) injury to an eagle, (2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or (3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." Launch activities have occurred at the KLC since 1998. Known nest sites were monitored during the first five launches from KLC in accordance with the Environmental Monitoring Plan developed with USFWS input (ENRI, 1998). Bald eagles continued to successfully use the sites during the period of observation and the USFWS concluded that launch operations were not likely to affect the species and ended the launch-specific monitoring requirement. As part of assessing potential impacts on bald eagles from AAC's current proposal, AAC requested from the USFWS recommendations to minimize potential impacts. Based on the available information, the USFWS stated it cannot predict how eagles might respond to noise levels associated with medium-lift rockets (see Appendix D). The USFWS's guidelines for protection of bald eagles recommend avoiding loud intermittent sounds within ½ mile of active nests (or within 1 mile in open areas). The closest eagle nest is located approximately 1.3 miles from the proposed site for Launch Pad 3. The best way to ensure nesting eagles are not disturbed is to avoid scheduling launches during the eagle nesting season, between February 1 and August 30. The USFWS stated a permit is not clearly necessary for medium-lift launches, but AAC may wish to apply for a permit to ensure AAC has appropriate protections in place if take were to occur.

4.1.4.2.2 Cumulative Effects

The Proposed Action would contribute to a minor cumulative effect when considering past, present, and reasonably foreseeable actions. Some bird habitat was lost during construction of the KLC in 1998 and additional habitat loss would occur under the Proposed Action. As stated above, these effects are minor considering the amount of available habitat within the immediate vicinity of the KLC.

Since the Proposed Action would not likely result in direct or indirect impacts on marine birds or bald eagles, the Proposed Action would not likely have a cumulative effect on marine birds or bald eagles.

4.1.4.2.3 Mitigation

There are no current monitoring requirements for bald eagles near the KLC. The expansion of KLC to medium lift is not anticipated to result in a take of a bald eagle, because there are no active nests within ½ mile of the proposed site for Launch Pad 3.

4.1.4.3 Mammals

This section discusses the potential effects on non-ESA-listed mammalian species. Threatened, endangered, and candidate species are covered in Section 4.1.4.4.

4.1.4.3.1 Direct and Indirect Effects

Terrestrial Mammals

Potential direct and indirect effects on terrestrial mammals, if any, would be minor and isolated. Wildlife generally exhibit a startle response to sudden loud, uncommon, short-term noise such as a rocket launch

(AAC, 2010). Disturbances from rocket launches would be brief and are not expected to have a lasting adverse effect on wildlife. An eight foot security fence would surround the facility which would keep out large animals, such as the local buffalo and bears. There is a slight possibility that a small animal could be close enough to the launch pad at the time of launch to be harmed or killed; however, the likelihood is low. The Proposed Action is not anticipated to affect local mammal populations.

Marine Mammals

Potential noise effects to marine mammals could be physical – temporary or permanent auditory impairment – or behavioral. Based on previous rocket launches at the KLC, NMFS concluded that physical effects are not anticipated. Permanent hearing loss would not occur in pinnipeds on Ugak Island (50 CFR Part 217). Behavioral effects to pinnipeds are the primary concern with regard to rocket launches. Wildlife generally exhibit a startle response to sudden loud, uncommon, short-term noise such as a rocket launch (AAC, 2010). Marine mammal reactions to rocket launches are highly variable and may be attributable to the species type, age class, time of year, and potential habituation to noise. Noise levels above 100 dBA is the threshold at which pinnipeds are likely to demonstrate short-term behavioral responses (USAF, 1997), and the proposed injury threshold for pinnipeds on shore is 144 dB sound exposure level (SEL) in a 24-hour period (Southall et all, 2007). Noise levels from previous rocket launches at the KLC and anticipated noise levels from launching medium-lift rockets were estimated (Appendix A; Section 4.1.10). Increases in anticipated noise intensities and durations from the medium-lift rockets are small when compared to small-lift rockets (Minor, 2012; Appendix A, Addendum 1, Table A2), and do not exceed the 101.4 dBA level for which NMFS' analysis was based upon in its BO and LOA (Appendix A; Addendum 1, Table AD1-2). Therefore, no additional noise effects to marine mammals from the Proposed Action are anticipated.

Spent rocket motors would fall into the open ocean over deep water and could possibly injure a marine mammal (NASA, 2011). However, the probability of this occurring is very remote and potential impacts with marine wildlife do not pose a realistic threat. Further, for an annual launch rate of 18 launches at the Mid Atlantic Regional Spaceport, NMFS determined that no letter of incidental take was required because the probability of falling debris hitting marine mammals is extremely unlikely to occur (NMFS, 2009). Sonic booms would occur beyond the edge of the Outer Continental Shelf break over the deep ocean and would occur at a high altitude (several miles above the ocean depending on specific mission parameters) and far offshore, and thus would not adversely affect marine mammals (NASA, 2011).

In 2011, NMFS issued a final rule to address potential marine mammal effects resulting from rocket launches at the KLC for the 5-year period from 2011 to 2016 (50 CFR 217). LOAs mandated by the final rule are issued annually within this 5-year period for the incidental take of marine mammals. The final rule concluded that rocket launches at KLC could result in the incidental take of a small number of marine mammals (Steller sea lions and harbor seals), but that the total taking would have a negligible impact on the species or stocks (76 FR 16311). NMFS did not include monitoring requirements for species other than harbor seals and Steller sea lions (50 CFR 217). In addition, the final rule determined that KLC launch activities would not reach the level of take for any cetaceans (whales and dolphins) and that any noise that could reach these species would be discountable (76 FR 16311). The potential for the Proposed Action to affect harbor seals is discussed below; Steller sea lions and threatened and endangered species of whales are discussed in Section 4.1.4.4.

Harbor Seal

Previous rocket launches from the KLC do not appear to be affecting harbor seals or influencing their use of haulouts near Narrow Cape (ABR, 2011). Harbor seal numbers in the waters around Narrow Cape have increased over time, indicating that rocket launch operations are not having long-term adverse effects on

the species (AAC, 2010). Pre- and post-launch surveillance indicate that any disturbance from launch operations is of limited duration (AAC, 2010).

In addition to the medium-lift rocket already considered by NMFS (the Antares, aka Taurus II), the new rockets proposed to be launched from KLC include the Athena III and a Notional Liquid-Propellant Launch Vehicle.

Compared to the small-lift rockets launched at KLC, the medium-lift rockets produce slightly higher noise levels; however, the increase in noise between the two launch rockets is minimal. The analysis in Appendix A shows that the overall increase in noise levels over a typical launch day is small, and the increase in the average daily or annual noise levels is slight. As shown in Appendix A, Figures 8, 12, and Table 7, increases in anticipated noise intensities and durations from the medium-lift rockets would be 5 to 6 dBA (Lmax [maximum instantaneous sound pressure]) higher at Ugak Island when compared to small-lift rockets, which is a small increase (Minor, 2012). Elevated sound levels would last approximately 90 to 120 seconds after launch. No direct or indirect noise effects on harbor seals are anticipated from the Proposed Action.

Spent rocket motors would fall into the open ocean over deep water, far from known haulout locations, and do not pose a threat to harbor seals (NASA, 2011).

For airborne noise, currently NMFS uses an in-air noise disturbance threshold of 90 dB_{rms} re 20 µPa (unweighted) for harbor seals. Based on the rocket launch noise analysis for the Proposed Action, the maximum unweighted noise level at Ugak Island from a proposed medium-lift rocket launch would be 106 dB (the Athena III; see Table 6 in Appendix A). However, the highest noise level at Ugak Island from the entire sequence of a proposed medium-lift rocket launch would be a maximum sound exposure level of 93.4 dBA, or 8 dBA less than the 101.4 dBA maximum sound exposure level threshold used to calculate take in 50 CFR 217 Subpart H and associated LOAs. In addition, the Proposed Action would maintain the maximum allowance of nine vehicle launches per year at KLC. Therefore, the FAA believes 50 CFR 217 Subpart H and the current LOA remain valid for the Proposed Action. The FAA sent a letter (dated January 29, 2013; see Appendix I) to the NMFS stating the FAA believes 50 CFR 217 Subpart H and associated LOA remain valid for the Proposed Action and requested the NMFS to contact the FAA if the NMFS disagrees. NMFS has concurred with FAA's conclusion. and no further consultation with the NMFS is necessary under the MMPA.

Gray Whale

The noise from rocket launching activities at the KLC does not appear to be affecting gray whales (AAC, 2010). Grey whales continue their twice yearly migration through the nearshore waters adjacent to KLC. The total annual number of launches occurring at the KLC would remain the same. Future noise levels with the launches from Pad 3 are not predicted to be substantially different than current launches (Minor, 2012). Airborne noise is generally reflected at the sea surface outside of a 26 degree diameter cone extending downward from the ascending rocket (Richardson et al., 1995). Due to the great difference in acoustical properties, little sound energy passes into the sea across the air-water boundary (Richardson et al., 1995). Submerged animals would have to be directly underneath the rocket to hear it, and given the hypersonic velocity of rockets in the atmosphere, the duration of sounds reaching gray whales would be negligible (AAC, 2010). Given the limited ocean surface area exposed, the very short time a cetacean would be exposed to the noise, and the attenuation that occurs at the sea-air interface, gray whales would not be affected by launch operations (AAC, 2010). Furthermore, because the NMFS did not anticipate take of whales, whales are excluded from the LOAs.

4.1.4.3.2 Cumulative Effects

Potential direct and indirect effects on marine mammals from rocket launches are minor and temporary, with no lasting effects to populations. Therefore, the Proposed Action would not notably contribute to cumulative effects on marine mammals.

4.1.4.3.3 Mitigation

An LOA must be acquired each year under the current NMFS Rule (50 CFR 217). The annual LOA prescribes a quarterly survey of seal and sea lion populations on Ugak Island, monitoring of the seal and sea lions during launch, and an annual report. The LOA authorizes incidental take with restrictions for the year in which it is issued. In addition, noise analysis including real-time sound pressure and sound exposure records is required whenever a new class of rocket is flown. This would be conducted the first time a medium-lift rocket is flown from the KLC, and subsequently thereafter whenever a new type of vehicle (e.g. liquid fuel) is flown. The current LOA for 2013-2014 can be found in Appendix B.

Regarding terrestrial mammals, fencing around the launch pad and nearby steep topography would provide deterrence, which would help minimize the already very low potential for wildlife mortality.

4.1.4.4 Threatened and Endangered Species

There are no federally-listed threatened, endangered, or candidate avian or terrestrial mammal species within the vicinity of the KLC (USFWS, 2011a). However, there are several federally-listed marine mammals present in waters offshore and on Ugak Island (see Section 3.4.5). Additionally, there are two bird species listed as threatened or endangered within the action area: Steller's eider and short-tailed albatross. Two candidate bird species could occur within the vicinity of Narrow Cape: Kittlitz's murrelet and yellow-billed loons. However, occurrences of these candidate species are uncommon or rare near Narrow Cape, and potential effects are anticipated to be negligible.

The USFWS stated in previous consultations that if future launches from KLC would include rockets larger than the small-lift Athena I were planned, then FAA would need to reinitiate consultation. The current proposal for Launch Pad 3 involves new construction, and launches of medium-lift rockets that are larger than the Athena I; in addition, liquid-propelled rockets are being proposed for the first time at KLC. Thus, the FAA reinitiated Section 7 consultation with the USFWS in October, 2012. Regarding ESA-listed species under NMFS jurisdiction (three whale species and Steller sea lion), the FAA sent a letter to NMFS on January 29, 2013 to determine if the Proposed Action (namely projected noise levels) falls within the scope of the NMFS BO.

The comprehensive noise analysis presented in Appendix A characterizes the anticipated increases in noise maximums and durations associated with medium-lift rockets when compared to small-lift rockets previously launched from the KLC. The maximum noise levels are predicted to increase by only 5 to 6 dBA Lmax (for a few seconds longer during each launch (Minor, 2012). Maximum noise levels would occur for 2 to 3 seconds per launch and existing ambient noise levels would be reached within 2 minutes after a launch (Minor, 2012). See Appendix A, Figure 12 and Table 7 for recorded small-lift noise and projected medium-lift noise.

Prior effect determinations (Section 3.4.5), information from site-specific launch-related avian and marine mammal surveys, and recent noise analysis provide the basis for the following determinations.

4.1.4.4.1 Direct and Indirect Effects

Marine Mammals

Steller Sea Lion

The noise from a rocket launch might induce a startle response in Steller sea lions. Reactions among individual sea lions would vary from no response to leaving haulouts for the water (AAC, 2010). However, pre- and post-launch counts of Steller sea lions indicate that disturbances from launch operations are of limited duration (AAC, 2010). Furthermore, based on noise analyses from previous launches, along with the infrequent and brief nature of the noise, rocket launches are not expected to affect the population dynamics of Steller sea lions which use Ugak Island as a haulout site (50 CFR Part 217). The projected noise levels associated with medium-lift rockets do not represent a significant increase over small-lift rockets, and the extended duration under which the elevated noise levels occur is minimal (Minor, 2012). Spent rocket motors would fall into the open ocean over deep water, far from known haulout locations, and do not pose a threat to Steller sea lions (NASA, 2011). Potential effects to the Steller sea lion would be temporary, consisting of brief behavioral reactions to noise.

For airborne noise, currently NMFS uses an in-air noise disturbance threshold of 100 dB_{rms} re 20 µPa (unweighted) for all pinnipeds except harbor seals. Based on the rocket launch noise analysis for the Proposed Action, the maximum unweighted noise level at Ugak Island from a proposed medium-lift rocket launch would be 106 dB (the Athena III; see Table 6 in Appendix A). However, the highest noise level at Ugak Island from the entire sequence of a proposed medium-lift rocket launch would be a maximum sound exposure level of 93.4 dBA, or 8 dBA less than the 101.4 dBA maximum sound exposure level threshold used to calculate take in the NMFS BO. In addition, the Proposed Action would maintain the maximum allowance of nine vehicle launches per year at KLC. Therefore, the FAA believes the BO remains valid for the Proposed Action. The FAA sent a letter (dated January 29, 2013; see Appendix I) to the NMFS stating the FAA believes the NMFS BO remains valid for the Proposed Action and requested the NMFS to contact the FAA if the NMFS disagrees. NMFS has concurred with FAA's conclusion. and no further consultation with the NMFS is necessary under the ESA.

Northern Sea Otter

Marine mammal surveys have generally identified small numbers of otters within the vicinity of KLC; maximum otter counts ranged between zero and eight individuals in all but one aerial survey (ENRI, 2005b; ABR, 2011). The few otters that have been seen seem to prefer the waters around Ugak Island or Long Island near Pasagshak Bay, rather than the cliffs of Narrow Cape. Considering that the number of annual launches would remain constant (not to exceed the currently authorized nine per year) and that the increase in noise associated with medium-lift rockets (compared to small-lift rockets) is small, the FAA determined the Proposed Action is ***not likely to adversely affect*** the Northern sea otter.

The proposed LP3 footprint is located approximately 0.2 mile inland from the nearest coastline – designated critical habitat area – and over 100 feet higher in elevation than MHT. Construction and operational activities associated with the Proposed Action would have ***no effect on designated critical habitat***. The USFWS concurred with these species and critical habitat determinations on December 14, 2012 (USFWS 2012; see Appendix C).

Whales

Noise associated with the proposed medium-lift rockets does not represent a significant increase over small-lift rockets, and the duration under which the elevated noise levels occur is minimal (Minor, 2012). As was previously discussed with respect to gray whales, direct or indirect noise effects to endangered cetaceans are not anticipated due to the limited surface area in which effects could occur, the very short time a cetacean might be exposed to noise, and the attenuation that occurs at the sea-air interface. In its 2011 BO, the NMFS determined that these whale species would be ***not likely to be adversely affected*** by the construction and operation of the KLC because the whales are not in the area (fin whale and North

Pacific right whale) or would be below the surface of the water, and therefore not likely to be exposed to launch noise (humpback whale) that would significantly disrupt normal behavioral patterns.

Based on the rocket launch noise analysis for the Proposed Action, the highest noise levels at Ugak Island from the proposed medium-lift launches would be a maximum sound exposure level of 93.4 dBA, or 8 dBA less than the 101.4 dBA maximum sound exposure level threshold used to calculate take in the NMFS BO. In addition, the Proposed Action would maintain the maximum allowance of nine vehicle launches per year at KLC. Therefore, the FAA believes the NMFS BO remains valid for the Proposed Action and further consultation with the NMFS under the ESA for protected whales is not necessary. NMFS has concurred with FAA's conclusion. and no further consultation with the NMFS is necessary under the ESA.

Avian Species

Kittlitz's Murrelet

Based on the infrequent nature of proposed rocket launches at the KLC and the very low probability of occurrence of this species, the FAA has determined that the Proposed Action would not adversely affect the Kittlitz's murrelet. Because this species is listed as a candidate species, it is provided no statutory protection under ESA and an official effect determination is not necessary. However, the FAA included the murrelet in its informal consultation with the USFWS for other listed species. Including this species in the informal consultation will simplify initiation of consultation should the species become listed in the future. The USFWS concurred with the FAA's determination on 14 December 2012 (USFWS 2012).

Steller's Eider/Short-tailed Albatross

The potential for effects from KLC small-lift rocket launches on the Steller's eider and short-tailed albatross was addressed in a Biological Opinion in 1998 (USFWS, 1998). USFWS determined that disturbances to wildlife from single launches would be brief and are not expected to have a lasting effect or measurable adverse effect on migratory bird populations. Typically, waterfowl driven from feeding areas by launch activities would return soon after the activity stops, as long as the disturbance is not severe or repeated (FAA, 1996).

The anticipated increase in noise from medium-lift rockets does not represent a severe or repeated disturbance. Although previous studies evaluated potential effects related to small-lift rocket launches, increases in anticipated noise intensities and durations from medium-lift rockets are small when compared to small-lift rockets (Minor, 2012). Based on the above information, the FAA determined the Proposed Action is ***not likely to adversely affect*** the Steller's eider. Similarly, based on the infrequent nature of proposed rocket launches at the KLC and the very low probability of occurrence of the short-tailed albatross within the vicinity of the KLC during a launch, the FAA determined the Proposed Action is ***not likely to adversely affect*** the short-tailed albatross. In its response on 14 December 2012, the USFWS determined the Proposed Action would have **no effect** on the short-tailed albatross. The USFWS concurred with the FAA's determination for the Steller's eider (USFWS 2012).

Yellow-Billed Loon

The Proposed Action would not affect the breeding range of the yellow-billed loon, and the probability of an individual being within close proximity to Narrow Cape at the time of a launch is extremely low. Additionally, noise increases associated with medium-lift rocket launches are anticipated to be small. Based on the above information, the FAA determined the Proposed Action would not adversely affect the Yellow-billed loon. Because this species is listed as a candidate species, it is provided no statutory protection under ESA and an official effect determination is not necessary. However, the FAA included the loon in its informal consultation with the USFWS for other listed species. Including this species in the

informal consultation will simplify initiation of consultation should the species become listed in the future. The USFWS concurred with the FAA's determination on 14 December 2012 (USFWS 2012).

4.1.4.4.2 Cumulative Effects

Population trends of identified special status species appear to be independent of launching activities at the KLC. Anticipated direct and/or indirect effects from the Proposed Action would be minor contributing to an overall minor cumulative effect on the following threatened or endangered species: Steller's eider, short-tailed albatross, sea otter, and humpback whale.

Steller sea lion population trends also appear to be independent of launching activities at the KLC. Traditional use of Ugak Island as a haulout has declined in recent times but this trend is consistent with general declines seen in the species as a whole and is also consistent with counts from all other long-term trend count sites in the Kodiak Archipelago over the same time period (AAC, 2010). Although the launches associated with the Proposed Action may have a temporary minor effect on individual sea lions during launches, it would not contribute to a notable cumulative effect on the species.

4.1.4.4.3 Mitigation

Marine mammal monitoring efforts would continue at the same frequency; quarterly and in support of specific launches. In addition, noise analysis including real-time sound pressure and sound exposure records is required whenever a new class of rocket is flown. This would be conducted the first time a medium-lift rocket is flown from the KLC, and subsequently thereafter whenever a new type of vehicle (e.g. liquid fuels) is flown.

4.1.5 Plants

4.1.5.1 Direct and Indirect Effects

Direct effects to plants by construction activities associated with the Proposed Action are anticipated. Proposed facility and road locations would be cleared and grubbed. Approximately 22 acres would be disturbed, of which 16 acres would be replanted. The remaining six acres would contain the new construction, to include buildings, launch pad, roads, and utilities. The majority of vegetated land to be disturbed includes meadows and some minor areas of wetlands (see Section 4.1.13 for additional information on wetlands). These plant communities are not unique or of high value (i.e., essential to survival) to other species in the area (FAA, 1996 and ENRI, 1995a). The vast majority of the KLC would remain vegetated post-construction. Direct effects to plants would be minor due to the limited area to be disturbed, and would not affect overall plant community composition or structure.

As discussed in Section 4.1.13, the flame trench has been sited to minimize surface water effects to East and West Twin Lakes. The trench directs launch emissions towards a relatively large valley where exhaust would have more time to dissipate prior to reaching the ground surface and vegetation, and the small wetland found there.

A principal product of potential concern from liquid-propellant rockets is carbon monoxide, which does not have an adverse effect on plants in the volumes present during a medium-lift rocket launch. Another principal product of potential concern resulting from launching solid-propellant rockets is hydrogen chloride, which combines with water or water vapor to form hydrochloric acid (HCl). HCl could adversely affect vegetation through periodic contact with plants; however, no such damage was seen following long-term monitoring near LP1. Acid effects are mitigated by frequent precipitation events.

To date, the KLC has conducted 16 launches of solid fuel, small-lift rockets from LP1/2. A study was conducted by ENRI during the first several launches at the complex, where epiphytic macrolichens and Sitka spruce were surveyed (ENRI, 2002a). Epiphytic macrolichens and spruce were chosen because they

were known to be very sensitive to exhaust products. They were first measured and sampled at six sites near the KLC launch facility – including two plots directly adjacent to the LP1/2 installation – in 1998, prior to the first launch. Selected branches were photographed to monitor changes in lichen cover, morphology, or needle loss following launches. Lichen cover was resampled in late June 1999 and again in early June 2002 (ENRI, 2002b). Statistical analyses showed no significant changes had occurred in lichen cover or spruce needle cover from the photo plots or in the measurements of lichen cover on branches. The impact area around LP3 for the medium-lift rockets is expected to be larger due to the greater quantity of fuel used during liftoff, but based on past studies, no long-term effects are anticipated.

The overall effects on plants remain the same under the Proposed Action as assessed in the 1996 EA. Minor permanent effects due to the loss of individual plants from vegetation clearing are anticipated. Temporary heat-related burns might occur to plants located near the launch pad and flame trench (FAA, 1996, and NASA, 1998 and 2009). Heat-related burns and small fires have been documented within 100 feet of the launch pad near the fence line during previous launches; effects on vegetation from scorching are considered minor and the vegetation would re-generate within a season. Similar effects and distances would be anticipated as a result of launching medium-lift rockets. No permanent adverse direct or indirect effects are anticipated in association with launch activities.

4.1.5.2 Cumulative Effects

The Proposed Action would have a minor contribution to cumulative effects on vegetation when considering past, present, and reasonably foreseeable future actions. Proposed construction-related vegetation clearing in addition to past clearing activities during original construction of the KLC decreases the total vegetated cover on Narrow Cape by approximately 0.6% (22 acres of 3,717 acres); however, a cumulative decline in plant diversity or community structure is not anticipated.

4.1.5.3 Mitigation

The construction footprint for LP3 has been aligned to avoid wetlands to mitigate disturbance effects, and construction effects to plants would be limited to the maximum extent practicable. Namely, areas of ground disturbance that are not permanently developed (such as slope embankments and vehicle/equipment staging areas) would be seeded and allowed to revegetate with native, weed-free seed mixtures in accordance with E.O. 13112, *Invasive Species*.

No operational mitigation is required.

4.1.6 Hazardous Materials, Pollution Prevention, and Solid Waste

4.1.6.1 Direct and Indirect Effects

The 1996 EA assessed the effects of hazardous materials and solid waste generation associated with a maximum of nine rocket launches per year utilizing solid fuel sources (FAA, 1996). The Proposed Action would not increase the number of launches per year, but would require additional storage capacity for liquid fuels. The proposed liquid-propellants consist of a combination of RP1 and LOX. An estimated 30,000 gallons of RP1 would need to be stored onsite at the KLC at any given time to facilitate fueling of rockets. Further, large hydraulic rams may need to be installed to erect rockets from the horizontal to vertical positions. This would boost the aggregate petroleum product storage at the KLC to over 48,000 gallons. Based on the current Federal regulations promulgated by the U.S. Environmental Protection Agency (40 CFR 112 – Oil Pollution Prevention), the increase in storage would not by itself create any change in the way petroleum storage at the KLC is currently regulated. Namely, the KLC would need to amend and expand its existing Spill Prevention, Control, and Countermeasure (SPCC) Plan to include the new storage facilities and handling procedures. Other facility plans and/or documentation as set forth in Section 3.6.1 above may need to be updated as well to reflect changes in hazardous materials storage and

hazardous waste management procedures. Specifically, the following plans would need to be updated: KLC Safety Policy, KLC Emergency Response Plan, Community Right to Know Act, AAC's Hazardous Communication Program, the Kodiak Area Emergency Operation Plan, Explosive Site Plan, KLC Industrial Safety Manual, Range User's Manual, and Range Safety Manual.

Direct and indirect effects to the environment would not occur as a direct result of increased petroleum product storage at the KLC. The increased volume of petroleum products stored at the KLC does not directly increase risk of a spill or leak. However, the RP1 storage tanks would be of a larger size than any other current petroleum storage tank at the KLC, therefore the potential volume of a given spill could be greater.

The LFF near LP3 would include holding tanks for LOX, liquid and gaseous nitrogen, gaseous helium, RP1, and piping to fuel the rocket. LOX is a cryogenic liquid, and could present hazards such as extreme cold, overpressure, and fire hazards if not handled properly. Gaseous nitrogen and helium storage could also present high pressure hazards since they are stored between 2400 pounds per square inch (psi) to 6000 psi. However, all substances would be stored and handled in accordance with the SPCC Plan and according to existing procedures to avoid potential releases to the environment and any potential hazardous effects. In accordance with current procedures, hypergolic fuels (hydrazine), if required for satellite propulsion systems, would be stored within DOT-approved containers in a purpose-built vault near the launch facilities, similar to that used at the existing PPF. Previous small-lift payloads (namely satellites) from KLC have used hydrazine for on orbit maneuvering. In the 1996 EA, KLC indicated use for 100 gallons of hypergolic fuels. Medium-lift satellites would use larger quantities, up to 200 gallons, of hypergolic fuels. The current hypergolic fuel storage facility at KLC can store up to 550 gallons, and the KLC is approved by the Department of Defense Explosive Safety Board to store up to 1,190 gallons if required. Therefore, no increase of hypergolic fuel storage would be required at KLC to meet the requirements of medium-lift satellites. Hypergolic fuels are not stored long term at KLC; they are stored on shipment for launch support and residual amounts are back shipped as soon as practical. Because the approved quantities of hydrazine-based fuels would not increase and onsite handling procedures would not change, no additional effects (beyond those evaluated in the 1996 EA) are anticipated with regard to the storage and handling of hydrazine.

The proposed launching of medium lift rockets would not create an increase in the amount of solid waste generated at the KLC when compared to small lift launches. KLC generates an average of 2.6 tons of solid waste a month during non-launch activity, and approximately 50 tons a month during a launch campaign.

Construction of LP3 and the associated facilities would generate a relatively minor amount of construction debris and solid waste that would be disposed of accordingly. Solid Waste management would continue as is currently authorized with updates to relevant plans made as necessary.

Hazardous materials – including but not limited to diesel fuel, anti-freeze, lubricating oils, paints, and adhesives – would be used during construction of the new LP3 facilities and during launch activities. All hazardous material would be handled according to applicable Federal, state, and local laws and regulations. These activities are routine to the KLC upkeep and operation, and would not create any new environmental effects as a result of the Proposed Action.

4.1.6.2 Cumulative Effects

The Proposed Action would require an increase in the storage amounts of petroleum-based products and other fuel constituents, but they would be handled in accordance with the SPCC Plan and according to existing procedures to avoid potential releases to the environment and subsequent effects. No other known projects would require notable petroleum or hazardous materials storage within the vicinity of the

KLC. The increased storage capacity for petroleum-based products and hazardous materials required for rocket launches would not contribute to cumulative effects.

4.1.6.3 Mitigation

All of the Hazardous Materials, Pollution Prevention, and Solid Waste plans associated with the KLC would be updated prior to operational activities at the site. The type and quantity of petroleum products or hazardous materials would be accounted for and incorporated into emergency planning to mitigate environmental effects in the event of a release.

The potential for spills from the new RP1 storage infrastructure would be analyzed using a risk-based approach in the KLC's SPCC Plan update as a result of the LP3 project. The RP1 storage vessel would be placed within a secondary containment unit – or would be constructed to incorporate integral double-walled secondary containment – to mitigate the potential for releases to the environment.

4.1.7 Historical, Architectural, Archaeological, and Cultural Resources

4.1.7.1 Direct and Indirect Effects

The Proposed Action would have no direct or indirect effect on historical, architectural, archaeological, and cultural resources. SHPO provided concurrence with a finding of "No Historic Properties Affected" on July 18, 2012 (SHPO, 2012). See Appendix F for the SHPO consultation letter. The APE for the construction on LP3, associated facilities, and Pasagshak Point Road upgrades would be primarily confined to the actual footprints of the planned roads and structures, as well as those immediately adjacent areas that would be used for equipment access and construction staging (Figure 23). A visual APE was not considered, as there are many existing similar structures present in the viewshed, and no archeological resources are documented near proposed construction activities (ADNR, 1994 and 2005).

4.1.7.2 Cumulative Effects

The Proposed Action would have no cumulative effects on historical, architectural, archaeological, and cultural resources when considering past, present, and reasonably foreseeable future actions. All previous KLC activities have received concurrence with findings of "No Historic Properties Affected" from SHPO.

4.1.7.3 Mitigation

Should cultural, archaeological, or historical resources be encountered during the course of any construction activity, work would cease immediately and the SHPO would be contacted. Existing information and prior research indicates a low potential for encountering unknown cultural resources during construction, therefore, additional survey efforts for this project are not being proposed.

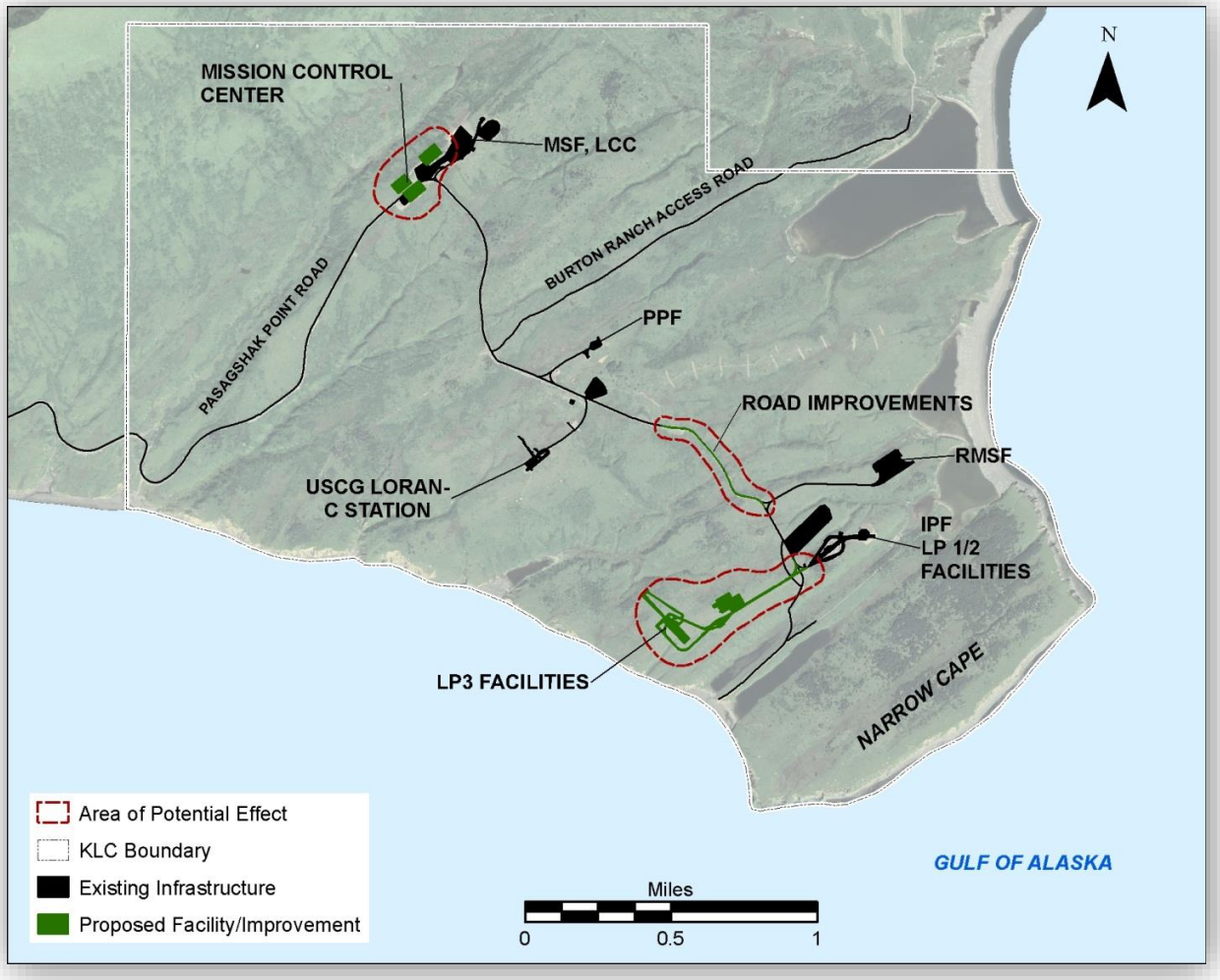

Figure 23: KLC Historic Area of Potential Effect (APE)

4.1.8 Light Emissions and Visual Effects

4.1.8.1 Direct and Indirect Effects

There are no Federal statutory or regulatory requirements for classifying and assessing light emissions and visual effects, and therefore, no established thresholds for significance. Due to the small number of launches that occur per year at KLC, any use of high-powered outdoor lighting associated with launches would be infrequent and short-lived. Previous environmental documentation (FAA, 1996) has assessed light emissions effects based on a maximum of nine launches per year. The Proposed Action would not increase the number of launches and therefore additional light emissions effects are not anticipated.

The existing man-made structures and improvements at the KLC are now part of the existing landscape of Narrow Cape. Expansion of the KLC under the Proposed Action would add an additional four above-ground structures/installations (the MCC, the VPF, the RSF, and the LFF) and one launch pad (LP3) and flame trench to the facility, as well as the LP3 access road. All of the four planned structures and installations

are consistent with the general industrial character of the existing facilities at the KLC. The VPF would be approximately 300 feet high, making it noticeably taller than existing structures.

Visual effects associated with construction of man-made features at Narrow Cape have already been incurred during original construction of the KLC and subsequent improvements. The VPF would be more prominently visible from the sea than existing structures. It would, however, be within the same viewshed and context as the surrounding KLC facilities. Though visual effects to the Narrow Cape area would occur, both from a land and sea perspective, because the proposed improvements would be consistent with the existing visual landscape, the effects would be minor.

4.1.8.2 Cumulative Effects

The Proposed Action would have a minor visual effect on the Narrow Cape area; however, the incremental contribution to cumulative visual effects from the Proposed Action would be minimal. The proposed new infrastructure would be consistent with the existing visual landscape and would not contribute to new effects when considering other past, present, and reasonably foreseeable actions.

The Proposed Action would not contribute to a cumulative effect from light emissions.

4.1.8.3 Mitigation

New structures would be painted to blend with the surrounding environment to the extent possible.

4.1.9 Natural Resources and Energy Supply

4.1.9.1 Direct and Indirect Effects

The Proposed Action is expected to have a negligible effect on the existing Kodiak energy supply during peak launch operations, and no measurable effect when averaged over time. It is anticipated that annual electricity consumption would increase to 4 megawatt-hours, but would not exceed current design load. The majority of KLC facilities are only in full operation during launch-related activities, although some electricity is used at the KLC year-round for support functions. Additional facilities associated with the Proposed Action would increase the overall electrical demand at KLC; but would not surpass the maximum electrical usage/loads for the facility. Increased electrical demands are within the capacity of KEA to accommodate.

Diesel backup generators at existing and proposed KLC installations would not be expected to operate more than the currently estimated maximum of 262 hours per year (FAA, 1996). The LP3 facilities would require three additional generators. The increase in the number of generators operating during the estimated maximum of 262 hours per year would be minor, with no measureable effect over time due to the infrequency of use.

The Proposed Action would not increase the number of launches per year, but would require the additional use of liquid fuels (see Section 4.1.6). The KLC is currently authorized to store and use over 18,000 gallons of petroleum products ranging from gasoline and lubricating fluids to diesel, as detailed in the Affected Environment section of this EA. Up to 570,000 lbs of LOX (approximately 60,000 gallons), and up to 204,000 lbs (approximately 30,000 gallons) of RP1, would be required for the launch of each medium-lift liquid-propellant rocket. This would represent a marked fuel consumption increase at the facility. As no better alternative fuel exists for this purpose, the fuel consumption is unavoidable and has been minimized to the maximum extent practicable to achieve vehicle launch in compliance with E.O. 13123. Fuel requirements are optimized during rocket design to minimize the total weight of the vehicle (including on-board fuel supply).

The short-term effect on water resources at the KLC would be driven by the use of an additional 50,000 gallons of deluge water per liquid-propellant launch at LP3 (Section 4.1.12). Water would be pumped from the KLC groundwater supply well and stored in the four tanks until needed. Storage tanks would be refilled over time between launches. This additional incremental use of water would not put a large demand on the groundwater supply. KLC currently uses approximately 110,000 gallons a year of the authorized 335,627 gallons, therefore LP3 can support four liquid fuel launches a year without exceeding the authorized water quantities. The Proposed Action is expected to have a negligible effect on the Narrow Cape groundwater supply during peak launch operations, and no measurable effect when averaged over time.

4.1.9.2 Cumulative Effects

The Proposed Action would have no cumulative effects on natural resources or energy supply when considering past, present, and reasonably foreseeable future actions.

The demand for power and the infrastructure for delivery existed on Narrow Cape to support the USCG LORAN-C Station prior to KLC's construction in 1998. According to the Department of Homeland Security, the USCG LORAN-C Station was effectively closed in 2010 (USDHS, 2012). This decrease in energy demand on Narrow Cape may help offset the new energy demand for the Proposed Action. The Proposed Action's additional power demands would be an increase to what the KLC already requires of the local power supply. Any future expansion would also increase energy demand. In 2012, KEA added three new wind turbines with a power generating capacity of 1.5 Megawatts each, which brings its total generating capacity to 43.5 MW from renewable sources with a back-up diesel generating capacity of 33 MW (KEA, 2011). KEA is capable of accounting for any demand increase and meeting that demand with 93% or greater renewable energy.

There are no reasonably foreseeable plans to construct other new facilities requiring additional groundwater consumption, therefore no cumulative impacts to the local groundwater supply are anticipated.

4.1.9.3 Mitigation

Mitigation is not required.

4.1.10 Noise

4.1.10.1 Direct and Indirect Effects

This section addresses the noise impacts from a new class of rockets, such as the medium-lift rockets considered under the Proposed Action. The impact to compatible land use in the KLC area is discussed in section 4.1.2. The noise impact analysis in Appendix A was prepared to identify potential differences in the noise levels of medium-lift rockets compared to previously launched small-lift rockets from the KLC. Based on the conclusions of this analysis, the Proposed Action is not anticipated to result in any significant changes in the overall noise environment within the affected area.

The Noise Study presented in Appendix A used noise prediction methods based on the NASA Document NAS8-11217, Sonic and Vibration Environments for Ground Facilities – A Design Manual (NASA 1968) to calculate potential noise levels from medium-lift launches (specifically the Athena III) at noise-sensitive receptors (residences, Ugak Island, and Narrow Cape). The noise analysis (which was conducted without using a computer model) assumed a completely vertical trajectory for the Athena III rocket, which would not be the actual trajectory of this rocket for a launch from KLC. However, it is not expected that this would make a notable difference in the predicted noise levels at the noise-sensitive receptors. The noise analysis did not analyze the potential for a sonic boom to impact a land surface. The original NEPA analysis

(FAA 1996) for construction and operation of the KLC estimated that a sonic boom generated during a launch would impact the ocean's surface approximately 21 to 35 miles down range. Sonic booms were generated from previous small-lift launches at KLC and were not problematic. The current version of the Draft EA concludes the same – a sonic boom would impact the ocean's surface beyond the edge of the Outer Continental Shelf. The FAA Office of Environment and Energy has approved the noise modeling method for the Proposed Action (see Appendix J).

Noise effects from launching medium-lift rockets would be comparable to effects associated with small-lift rockets. There would be a slight increase in the maximum noise levels to the west and southwest of the KLC during launches of medium-lift vehicles from LP3; however, the overall increase in the daily or annual averages would only be measurable at one of the nearby noise-sensitive properties (an increase from 45 to 49 dBA, which is well below the 65 dBA threshold for residences). Launch noise levels would return back to the existing ambient levels within 2 minutes after a launch. Because the KLC is located in a rural area, there are few sensitive receivers near the complex, and all residences are far enough away from the proposed LP3 as not to be affected from launch operations.

The Proposed Action includes up to nine rocket launches per year consisting of a combination of small and medium-lift vehicles. Medium-lift vehicles produce slightly higher maximum noise levels than generated by small lift vehicles. The noise analysis assumed that all nine launches would be medium-lift rockets to maintain a conservative projection. Using this assumption, noise levels at sensitive properties surrounding the KLC would remain below the FAA's 65 dBA DNL criterion.

Based on low ambient noise levels, construction noise may be audible within 1,000 feet from the work area. Construction noise would be temporary and would not affect noise receivers beyond the KLC.

4.1.10.2 Cumulative Effects

The Proposed Action would not increase the total number of launches per year or substantially affect the overall noise environment. Cumulative effects resulting from previous, current, and anticipated launch activities or other reasonably foreseeable projects would be minor.

4.1.10.3 Mitigation

Because there are no currently developed areas outside of the KLC that were identified with noise effects, no mitigation measures are required. However, noise analysis including real-time sound pressure and sound exposure level measurements are required whenever a new class of rocket is flown (50 CFR 217). This would be conducted the first time a medium-lift rocket is flown from the KLC, and subsequently whenever a new type of vehicle (e.g. liquid fuels) is flown.

4.1.11 Socio-Economic, Environmental Justice, and Children's Environmental Health and Safety Risk

4.1.11.1 Direct and Indirect Effects

The Proposed Action is consistent with EO 12898 *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Population*s and EO 13045 *Protection of Children from Environmental Health Risks and Safety Risks.* As documented throughout Section 4.1, the Proposed Action would have no high and adverse impacts to any resource category; therefore no disproportionately high and adverse human health or environmental effect on minority and low-income populations would be expected. Potential effects from the Proposed Action would have the same social effects regardless of race or income level; therefore minority or low-income populations would not be disproportionately affected.

For the reasons outlined in Section 3.11.3, unaccompanied children are not likely to be present during typical operations at the KLC No children would be allowed within the KLC at the time of a launch when

the facilities and surrounding areas are closed to the general public. As such, there would be no additional risk to children's environmental health and safety.

The Proposed Action is expected to have negligible socio-economic effects, as detailed below. Safety zone closures to air and water, similar to those that already occur during small-lift rocket launches, would have minor temporary effects on local populations seeking access to these areas during launch activities. As mentioned in 3.11.5, Narrow Cape is not a primary location for subsistence resource gathering, so these closures would have negligible impact on subsistence activities. Commercial fishing activities could be temporarily disrupted during launch activities as marine vessel restrictions are issued prior to all launches. The Notice to Mariners establishes a closed "safety zone" near the launch complex and Ugak Island, as well as establishes a larger "hazard zone" to the southeast where mariners are discouraged from entering. The Notice to Mariners is issued for a window of time in which a launch may take place (such as from 7:40am to 10:00am daily, September 27 to October 3) and remains in effect until canceled or expired. These closures have the potential to adversely affect local sport, subsistence and commercial fisherman for up to eight hours on the launch day. Any effects would depend on which fishery was open at the time and where those fishing grounds are located (see Table 11). Kodiak Fish and Game is not aware of any significant fishing activity in the down range hazard areas. Closures are dependent on the launch window for the particular mission, without regard to fishing seasons.

A Notice to Airmen is concurrently issued with the Notice to Mariners, imposing flight restrictions in the overhead safety and hazard zones. These closures would temporarily affect private pilots and air taxi companies serving both tourism and air travel needs, who wish to transit the Narrow Cape area. Effects could include longer flight paths (to avoid KLC), scheduled flight delays, and increased use of fuel in aircraft. These effects would be temporary and would not differ from those already permitted at the KLC and documented in the 1996 EA, as the number of launches and corresponding closures would not increase from the maximum of 9 per year. The potential effect would be to adjust trans-oceanic flights from the West Coast to Asia about 50 miles north or south to avoid hazard areas. More specific effects are difficult to quantify, because each rocket and each trajectory have their own specific hazard areas, and trans-oceanic flights adjust their flight path daily based on the jet stream and other weather conditions.

Stage separation during the rocket fly out would result in spent rocket stages falling into the ocean to the south of Kodiak Island. The zones where these stages would impact the water would vary depending on the rocket and the mission, but for each launch, a flight safety analysis would be performed and downrange hazard areas established. The KLC launch azimuth (110° to 220° true) would keep these hazard areas over the ocean. During launch, Notice to Airmen and Notice to Mariners would be issued to keep aircraft and shipping outside of these areas and direct coordination with Air Traffic Control and the U.S. Coast Guard would be maintained to verify that there is no traffic in these areas.

Traffic on Rezanof Drive between the LASH Dock and KLC may experience temporary disruptions lasting up to one hour while rocket motors and payloads are transported to KLC. The transportation schedules would attempt to avoid prime commuting hours to minimize impacts to local travel, but the schedules are also dependent on the tide tables for off loading. Traffic disruptions may increase as more missions are launched from KLC. However, as stated in Section 3.11.2, they would be limited to approximately one per mission for a maximum of 9 times annually as the frequency of launches would not exceed 9 per year and thus have minor impacts on traffic. Further, traffic disruptions would only affect populations south of the dock in Census Track 5 and Womens Bay for a total of 1,650 people.

The Proposed Action would provide a temporary positive effect to the area's economy. Construction of the proposed LP3 and associated infrastructure is estimated to cost more than $125 million dollars and would require a temporary workforce to complete. These expenditures would help to stimulate the

Kodiak Island construction industry as well as support additional indirect jobs in other local business sectors. Benefits associated with these expenditures include wages paid to local residents (since this money would be spent in the local area), goods purchased on the island, and sales taxes paid to the Kodiak Island Borough on items purchased on the Island. An analysis of economic impact showed that Kodiak would have a total output (direct and induced labor income, goods, and services) of approximately $36 million dollars from construction alone (Northern Economics, 2012).

AAC would contract the construction of LP3 and encourage local hires. The 2010 Census indicates that there are 287 construction workers on Kodiak (USCB, 2012). The increase in demand for construction workers would be temporary, approximately two to three years, and existing facilities and resources, including housing resources should be sufficient to satisfy the need. The island's population is somewhat transient due to the seasonal nature of the commercial fishing industry, changes in personnel at the U.S. Coast Guard station, seasonal tourism, and launch activity. As a result, island residents are accustomed to and able to adapt to temporary increases in employment and population. Construction activity would bring about 200 temporary workers to Kodiak in addition to local labor, and launch missions would bring about 100 temporary workers per mission (Northern Economics, 2012). In comparison, Kodiak receives approximately 40,000 tourists a year. The Proposed Action and its related construction are not large enough to create a change in this dynamic, and therefore would have no effect on Kodiak community resources or infrastructure.

As noted in Section 3.11, tourism is a major component of Kodiak Island's economy with over 40,000 visitors per year. Larger rockets may attract more tourists. Due to the remoteness of Kodiak, it is unlikely that many people will make a visit to Kodiak just to see a rocket launch, especially since they can be delayed without notice. However, AAC has designated viewing areas and webcasts public launches. Further, the road closure would only impacts access to Fossil Beach, which is a local attraction more than a tourist attraction. Tourism is unlikely to be affected by the Proposed Action, as the frequency of launches would not change from that analyzed previously in the other NEPA documents.

Customary rural subsistence practices would generally be unaffected. The availability of species commonly harvested for subsistence purposes (Section 3.11.5) would not be affected by the Proposed Action. Safety zone closures may have a temporary effect on subsistence fishing during a launch, but would be relatively minor.

4.1.11.2 Cumulative Effects

The Proposed Action would have no adverse cumulative effects to minority or low-income populations or children when considering past, present, and reasonably foreseeable future actions. The demographic information for Tract 5 and Womens Bay populations indicate that it is a majority White population at 81.7%, with the white non-hispanic population for Census Tract 5 at 75.3% and for Womens Bay CDP at 76.1% (U.S. Census Bureau 2014b; 2014c). Also, the median income is 86% to 327% over the Alaska poverty level. Therefore, the traffic delays associated with transporting rockets and payloads is unlikely to adversely affect minority populations or low income populations.

4.1.11.3 Mitigation

Only temporary and minor adverse effects may occur due to safety zone closures, which are mitigated to the maximum extent possible by issuing advance notices to all potentially affected parties. Initial coordination with Mariners and Airmen begins six months before a proposed launch.

To help offset any lost fishing revenue during the closure, AAC would continue (as they have previously) to hire local fishing vessels to serve as boundary boats during the safety closure periods. These boats keep the areas clear of unintentional vessel entry and are paid for their services.

4.1.12 Water Quality

4.1.12.1 Direct and Indirect Effects

Potential changes in pH to area streams and lakes from acid deposition (HCl) and the potential for accumulation of combustion byproducts (aluminum oxide) in localized surface waters is the primary water quality concern. The accumulation and potential water quality effects from aluminum oxide are only possible under certain environmental conditions and specific pH ranges, and therefore are not anticipated (FAA, 1996). Preliminary assessments prior to construction of the KLC indicated that quantities of HCl that would be released by combustion of solid fuels would not result in measurable degradation of surface water quality, because the exhaust and associated chemical compounds would be dispersed over a large area and immediately diluted and/or neutralized by receiving waters (FAA, 1996). Surface waters at KLC have very high natural buffering capacity which naturally mitigates acid deposition. In addition, local topography – directing the flame duct towards a relatively large valley where the ground cloud exhaust would have more time to dissipate prior to reaching the surface – would also mitigate possible effects of acid deposition from rocket combustion products. This original assessment has been supported by 16 launch-specific water quality monitoring efforts at the KLC (Section 3.12). Water chemistry parameters (temperature, pH, and specific conductivity) indicate that no adverse water quality effects from rocket launches are occurring (R&M, 2007; R&M 2008; R&M, 2009; R&M, 2011). Furthermore, all water samples to date have not detected ammonium perchlorate, which was expected because this oxidizer is completely consumed during the launch process. Aluminum levels are within normal ranges for Kodiak Island (R&M, 2007; R&M 2008; R&M, 2009; R&M, 2011).

The proposed location for LP3 is farther from surface water monitoring sites than LP1/2. Rocket launching from LP1/2 has potential for affecting the Twin Lakes valley whereas LP3 has the potential for affecting the small wetland to the north that drains over the cliff to the sea due to the northerly orientation of the flame trench in the proposed design. Under northerly wind conditions, some of the plume may drift over the Twin Lakes valley. Water quality monitoring in this wetlands is not necessary as it is well demonstrated that waters within KLC are well buffered and there are no fish present due to lack of habitat. The ground cloud produced by a medium lift motor would be somewhat larger than that from a small-lift motor, however the flame trench at LP3 exhausts above the valley with the previously mentioned wetland. The proximity of LP3 to surface waters is not anticipated to have an increase in effects to surface water quality.

Emission quantity and duration may be slightly greater for launching medium-lift rockets, however the amount of acid deposition from proposed medium-lift, solid-propellant rockets is not anticipated to exceed previous amounts (from launching small-lift rockets) to a degree at which the localized water quality might be affected. The chemical composition of the solid fuel and the total number (nine) of authorized launches per year are the same as previously assessed in the 1996 EA. The intermittent and transitory nature of launch operations, the demonstrated capacities of local streams and lakes to buffer acid inputs from natural and man-made sources, and the high levels of local precipitation minimize the potential for changes in pH and water quality effects (FAA, 1996). The flame trench has been sited to minimize surface water effects and is directed towards the north side of the launch pad away from Twin Lakes. This flame duct direction is towards a relatively large valley where the ground cloud exhaust would have more time to dissipate prior to reaching the surface.

The primary chemical exhaust constituent of concern from launching liquid-propellant rockets is carbon monoxide, which does not directly or indirectly affect water quality. Launching liquid-propellant rockets requires a deluge system which consists of multiple large pressure vessels, totaling about 50,000 gallons of water. A suite of water nozzles distribute water directly into the rocket exhaust stream to immediately dampen vibrations after initial ignition and subsequent protection against reflected vibrations as the rocket lifts off from the launch pad. The expected duration of the water deluge system is 3–4 seconds.

Deluge water would be captured in a containment pond at the end of the flame trench providing an area for the water to evaporate or be drained into the surrounding area after testing the water to verify no presence of harmful material. Rockets are designed to optimize their fuel and oxidizer mixture to burn all fuel in order to maximize thrust, however, there is a potential for unburned rocket fuel (RP1) to be present.

No measurable effect to marine waters (Gulf of Alaska/Pacific Ocean) is expected from launches (FAA, 1996). Rocket casings are made of inert materials which represent no threat to the ocean water quality, and therefore, no effect would result from spent rocket cases landing in the ocean after burning all propellants. Spent motor casings are designed to rapidly sink upon contact with the ocean. Early termination of a flight, however, would result in some amount of solid-propellant remaining in the rocket case (or released as free solid-propellant) when it landed in the ocean. Due to the low toxicity of ammonium perchlorate and its rapid dissociation on contact with water, toxic concentrations would be short term and rapidly diluted (FAA, 1996). Liquid propellant vehicles may have several hundred pounds of residual fuel (RP1) and oxidizer (LOX) in their tanks, which would generally rupture upon contact with the ocean and sink. Further, the propellant would quickly be diluted due to the volatile nature of the fuel and the large volume of receiving waters.

Construction activities would not directly affect surface waters, as there are no surface waters within or adjacent to the footprints of the proposed facilities and road improvements. During construction, the potential effects to water quality from sediment transport via stormwater or fugitive dust would be minor and temporary.

Water use would increase during normal operations to accommodate the proposed launch pad infrastructure. As previously mentioned, 50,000 gallons of water is needed for the deluge system associated with launching a liquid-propellant rocket. The current design concept calls for four additional water storage tanks at the LFF. Each tank would contain 12,500 gallons of water and would be pressurized with liquid nitrogen for rapid delivery during launches (approximately 50,000 gallons delivered in 3 to 5 seconds). Storage tanks would be refilled as needed prior to liquid-propellant launches. Total water usage at the KLC is not anticipated to increase above the previously authorized amount of withdrawal (Section 3.12), and therefore no effects to the local groundwater supply are anticipated.

4.1.12.2 Cumulative Effects

There would be no incremental contribution to a cumulative effect on water quality due to high buffering capacity present at KLC.

4.1.12.3 Mitigation

Minimization and mitigation of any potential water quality effects from proposed construction activities would be accomplished by adhering to a site-specific Stormwater Pollution Prevention Plan (SWPPP). The SWPPP would identify ways to minimize erosion of soils, sedimentation of nearby waters, and potential pollutant discharge via stormwater, thus reducing or eliminating surface water quality effects. The SWPPP would incorporate the guidelines from the *Alaska Storm Water Guide,* published by the Alaska Department of Environmental Conservation in December 2011. Best management practices for the Kodiak environment will be used, such as preserving natural vegetation, silt fence, and rolled erosion control products may also be used depending on the final construction design.

4.1.13 Wetlands

4.1.13.1 Direct and Indirect Effects

The Proposed Action is expected to have a negligible effect on Narrow Cape wetlands. Wetland impacts have been avoided and minimized to the maximum extent practicable during project planning. Construction activity for the Proposed Action would disturb meadow-like upland areas. Minor wetland impacts are anticipated at the Pasagshak Point Road improvements and along the LP3 access road near where it intersects Pasagshak Point Road (Figure 21 and Table 12). The proposed road improvement is located to minimize the amount of wetlands to be filled in order to provide safe access to the LP3 area for personnel and aerospace cargo. Impacted wetlands would consist of saturated/seasonally flooded emergent meadows (PEM1B/C). The saturated/seasonally flooded emergent meadows is the dominant form of wetland at KLC, and the area to be filled is small enough to have a minimal impact on the overall ecology. The area to be filled is adjacent to existing road fill, and is expanding this fill to create safer driving conditions for people and aerospace equipment to access the proposed LP3 facilities. The specific saturated/seasonally flooded emergent meadow to be filled does not provide a significant or unique habitat or a significant hydrologic resource, nor does it impact the water quality. See photos of the area in Figure 24: Wetlands along Proposed Road Improvement below.

Pasagshak Point Road Improvements	1.47 acres
LP3 Access Road	0.7 acre

Table 12: Wetland Impacts

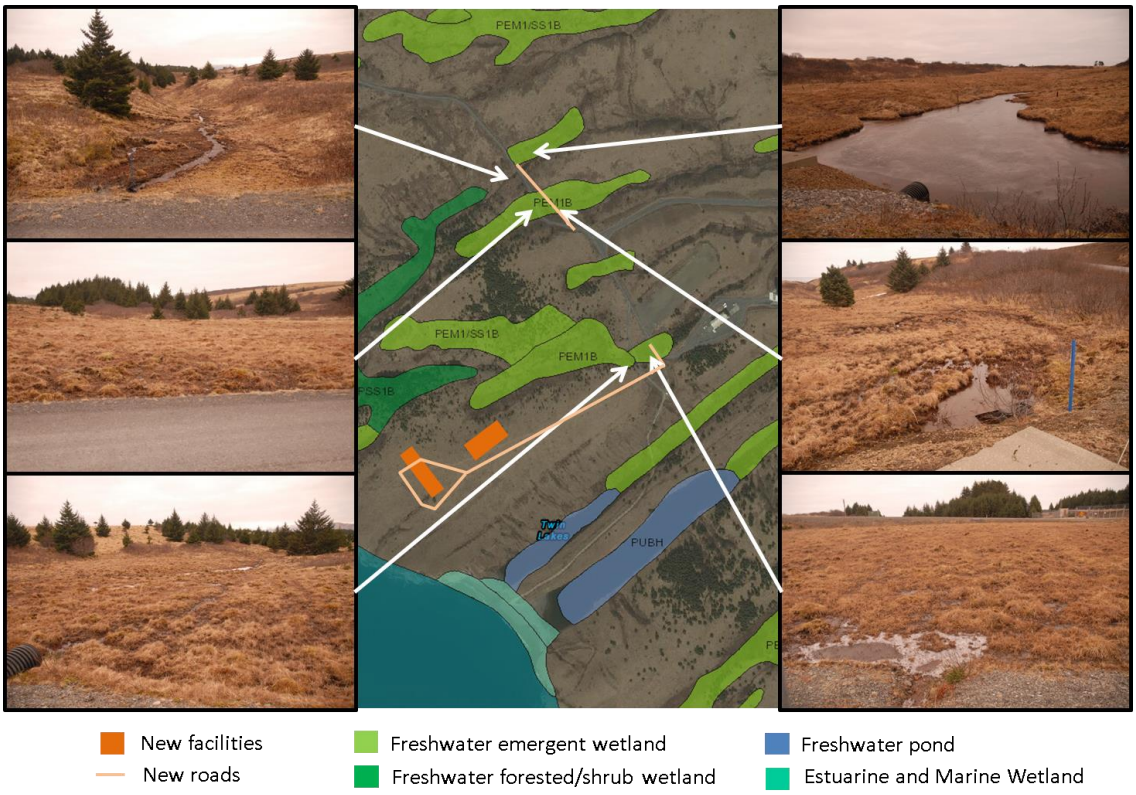

Figure 24: Wetlands along Proposed Road Improvement (USFWS 2014)

Any effect from launch operations would occur only during launches (up to nine per year) as a result of rocket exhaust product deposition. As discussed in Section 4.1.12, the flame trench has been sited to minimize surface water effects and is located on the north side of the launch pad to direct hot exhaust gases away from surface waters (Twin Lakes) and the coast. The trench directs launch emissions toward a relatively large valley where exhaust would have time to dissipate prior to reaching the ground surface. This orientation would minimize effects to vegetation through scorching. The valley does contain areas of wetlands; however, effects to vegetation would be minimal due to the shape and orientation of the flame trench, which would direct exhaust well above the small wetland areas. The exhaust is not anticipated to affect the wetland structure or its inherent functions such as filtration (see Section 4.1.5 for additional information on the effects of rocket exhaust on plants). Overall, the FAA has determined there is no practicable alternative that would avoid wetlands, and that all practicable measures to minimize harm to wetlands would be included in project planning (See Section 4.1.13.3).

4.1.13.2 Cumulative Effects

The Proposed Action would have a minor cumulative effect on wetlands when considering past, present, and reasonably foreseeable future wetland fill actions. Small areas of wetlands were filled during the initial construction of KLC, mainly to provide road access to the buildings. Overall effects to Narrow Cape wetlands have been minimal and represent only a small fraction of wetlands throughout the region.

4.1.13.3 Mitigation

AAC would obtain necessary permits, including Section 404 permits for all proposed construction that would affect wetlands. Mitigation in conjunction with permitting would likely include fee-in-lieu payment to a wetland bank or conservation organization.

The construction footprint would be aligned to reduce effects to wetlands to the maximum extent practicable. Land clearing associated with construction would be carefully planned and conducted according to BMPs to minimize erosion and soil loss, and to prevent effects to nearby wetlands.

4.1.14 Construction Effects

Under the Proposed Action, construction of the LP3 facilities and improvements to Pasagshak Point Road would occur (Section 1.2). The construction-related environmental effects would be minor and temporary in nature. Construction effects have been evaluated under each resource category and proposed mitigation is included following each summary of effect. Refer to the following sections for a summary of direct, indirect, and cumulative effects for each resource area.

- 4.1.1 Air Quality
- 4.1.2 Compatible Land Use
- 4.1.3 Department of Transportation Act Section 4(f) and Recreation
- 4.1.4 Fish and Wildlife
- 4.1.5 Plants
- 4.1.6 Hazardous Materials, Pollution Prevention, and Solid Waste
- 4.1.7 Historical, Architectural, Archaeological, and Cultural Resources
- 4.1.8 Light Emissions and Visual Effects
- 4.1.9 Natural resources and Energy Supply
- 4.1.10 Noise

- 4.1.11 Socio-Economic, Environmental Justice, and Children's Environmental Health and Safety Risk
- 4.1.12 Water Quality
- 4.1.13 Wetlands

4.1.15 Secondary (Induced) Effects

Secondary or induced environmental effects go beyond the extents of cumulative effects, and represent potential effects on surrounding communities from the Proposed Action. Examples of such effects could include: adjustments in established population movement and growth patterns, changes in public service demands, or notable differences to business and economic activity beyond the localized area directly influenced by the Proposed Action.

Expanding the launching capabilities at the KLC would incur minor and temporary socio-economic effects due to construction, and may induce a long-term positive socio-economic effect. Launch activities increase the demand for transportation, hospitality, food services, and tourism as launch customers deploy to Kodiak for several weeks or months to support each mission. No substantial direct, indirect, or cumulative effects to other resource categories have been identified and therefore no associated secondary effects are anticipated from the Proposed Action.

4.2 No Action Alternative

Under the No Action alternative, the existing Kodiak Launch Complex would continue to operate under AAC's Launch Site Operator License as it is currently issued. Existing launch activities – consisting of a maximum of nine small-lift rocket launches per year – would continue. Proposed road modifications to Pasagshak Point Road, and construction of an additional launch pad facility and associated facilities would not proceed. Environmental and socio-economic effects resulting from existing operations at the KLC were evaluated and presented in the 1996 EA and are not discussed in detail below; only new potential effects resulting from the No Action alternative are included in the following analysis.

The purpose and need for the Proposed Action would not be fulfilled under the No Action alternative. The No Action alternative would not follow the direction from Congress under the Commercial Space Launch Act to encourage, facilitate, and promote commercial space launches and reentries by the private sector and facilitate the strengthening and expansion of the U.S. space transportation infrastructure, in accordance with the applicable requirements. Additionally, the No Action alternative would not meet the State of Alaska's mandate to AAC to develop and expand aerospace-related industry, research, educational, and technical opportunities.

4.2.1 Air Quality

Under the No Action alternative, launch activities would continue as currently permitted. There would be no new effects from the No Action alternative.

4.2.2 Compatible Land Use

The No Action alternative would not have an effect on compatible land use, as there would be no land acquisition, use conversion, or changes to the ILMA and no increase in temporary noise effects.

4.2.3 Department of Transportation Act Section 4(f) and Recreation

There would be no new direct or indirect recreational effects under the No Action alternative. The KLC would continue safety closures during launches which would temporarily restrict recreational activities requiring access through the KLC or in marine areas located within established safety zones (FAA, 1996).

4.2.4 Fish and Wildlife

Under the No Action alternative, launch activities would continue as currently authorized and there would be no new effects on fish and wildlife species.

4.2.5 Plants

There would be no new effects on plants and vegetation at the KLC under the No Action alternative as no construction or vegetation clearing would be required.

4.2.6 Hazardous Materials, Pollution Prevention, and Solid Waste

The use, management, and disposal of petroleum products would be handled in accordance with the existing SPCC plan so that potential environmental effects are avoided (FAA, 1996). The quantities and types of materials stored at the KLC would not change and there would be no new effects resulting from the No Action alternative.

4.2.7 Historical, Architectural, Archaeological, and Cultural Resources

There would be no new effects to historical, architectural, or archaeological resources under the No Action alternative, as no construction or ground-disturbing activities would be required.

4.2.8 Light Emissions and Visual Effects

There would be no new effects to the visual landscape or light emissions under the No Action alternative.

4.2.9 Natural Resources and Energy Supply

There would be no increase in the amount of natural resources and electricity required for currently authorized launching activities. Thus, there would be no new effects resulting from the No Action alternative.

4.2.10 Noise

There would be no new noise effects resulting from the No Action alternative.

4.2.11 Socio-Economic, Environmental Justice, and Children's Environmental Health and Safety Risk

The No Action alternative would have no new effects on socioeconomic, environmental justice, or children's environmental health and safety risk issues related to currently authorized launch activities at the KLC.

4.2.12 Water Quality

The existing water quality of Narrow Cape would remain unchanged with the No Action alternative. The No Action alternative would not result in surface or ground water quality effects.

4.2.13 Wetlands

No fill or dredging activities in wetlands would be required under the No Action alternative. The No Action alternative would not result in any new effects on wetlands.

4.2.14 Secondary (Induced) Effects

The No Action alternative could have secondary socio-economic effects. If additional launch contracts are not secured, subsequent changes to the KLC workforce (decrease in employees) may have a secondary socio-economic effect. In August 2012, AAC reduced the KLC workforce by 20% due to lack of launch contracts. The No Action alternative would likely result in a continuation of the historical launch rate of one mission a year.

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Native and Historical Entities (Section 106 Consultation)

Koniag Inc.

Natives of Kodiak, Inc.

Kodiak Tribal Council

Sun'aq Tribe of Kodiak

Afognak Native Corporation

Bells Flats Natives, Inc.

Leisnoi, Inc.

Old Harbor Native Corporation

Kodiak Historical Society

Other

Mayor Pat Branson City of Kodiak

Mayor Jerome Selby Kodiak Island Borough

Bill and Kathleen Burton, Kodiak Game Ranch

Mary Ellen Vojtek, The Aerospace Corporation

C. P. Griffce, The Aerospace Corporation

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APPENDIX A

Noise Impact Analysis

Noise Impact Analysis

Kodiak Launch Complex
Launch Pad 3 Project

October 2012

Prepared for:

Alaska Aerospace Corporation
Anchorage, AK

in association with:

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Addendums

1. Introduction

This technical noise analysis was performed at the request of Alaska Aerospace Corporation in association with R&M Consultants, Inc. The purpose of this study is to provide existing and future noise levels and identify any potential noise impacts near the Kodiak Launch Complex (KLC) outside of Kodiak Alaska. The federal agency responsible for the oversight of noise from space launch facilities is the Federal Aviation Administration (FAA), and therefore, this analysis follows the methods used for a noise analysis of a facility using the FAA regulations.

In addition to providing the noise results to meet the FAA requirements, this analysis also provides information that could be used by other disciplines as part of the Project's overall environmental analysis. This could include other disciplines in the environmental process such as Threatened and Endangered Species, Terrestrial Wildlife and Migratory Birds, and Marine Mammals and Essential Fish Habitat. As part of this analysis, a separate noise memorandum for Ugak Island is included in Addendum 1

1.1. Summary of Findings

The addition of Launch Pad 3 to the KLC is not predicted to result in any notable changes in the overall noise environment. The operation of the launch pad will increase maximum noise levels to the west and southwest of the KLC during launches of medium-lift vehicles by 3 to 5 dBA L_{max}, however, these maximum noise levels occur for 2 to 3 seconds per launch, and launch noise levels are reduced back to the existing ambient by 1 to 2 minutes after the launch (see Sections 5.2 and 6 for detailed results). Furthermore, the overall increase in the daily L_{dn} or the annual DNL is not measureable at most of the nearby residential properties. The only site with an increase DNL is a group of structures near KLC where the DNL increased from 45 to 49 dab DNL, which is still within 65 dBA DNL maximum recommended for residences. Because the KLC is located in a rural area, there are few sensitive receivers near the complex, and all residences are far enough away from the proposed launch Pad 3 as not to be adversely impacted from launch operations.

Noise levels contours at the end of this report provide graphical views of the maximum noise levels from launch operations at the KLC (Figures 7 – 9). Provided are contours with and without the operation of launch pad 3. Based on these contours and acoustical analysis of the facility, the following important findings as related to noise from the proposed launch Pad 3 were identified:

1. Medium-lift launch vehicles will increase the maximum noise levels at some properties near the KLC by 3 to 5 dBA for a few seconds during each launch.
2. The areas with the increased noise from Pad 3 are all located to the south west and west of the KLC.
3. Noise from launches at Pads 1 and 2 will continue to generate noise levels to the east, and north east of the KLC.
4. The increase in the overall average daily L_{dn} is predicted to be 1 dBA or less at any of the non-KLC structures located near the facility (see Section 6 for detailed results).

5. The change in the annual DNL is not measureable at most non-KLC structures with the exception of a group of structures where the DNL increased from 45 to 49 dBA DNL, which is still within 65 dBA DNL maximum recommended for residences.

In addition to the findings provide above, the Ugak Island Addendum 1 also shows a slight increase in the maximum noise levels and the amount of time the launch elevated the noise levels to above the existing ambient. As with the populated areas the change in the overall acoustical energy at Ugak Island from medium lift vehicles is approximately 4 to 5 dB, with the potential time above ambient increasing from 90 seconds to 110 to 120 seconds. See Addendum 1 for more information on Ugak Island noise levels.

2. Project Description

The Alaska Aerospace Corporation (AAC), in cooperation with the Federal Aviation Administration Office of Commercial Space Transportation (FAA), proposes an expansion of the launch capabilities at the Kodiak Launch Complex (KLC), located on Kodiak Island's Narrow Cape (Figure 1). The KLC is currently operated under a Launch Site Operator's License issued by FAA. An FAA-led Environmental Assessment (EA) is therefore being prepared by AAC to facilitate the installation and use of a third launch pad capable of launching medium-lift type space launch vehicles.

2.1. Previous Studies

The facilities and operations at KLC have been included in the following seven NEPA documents since 1996:

- Launch of NASA Routine Payloads EA/FONSI (November 2011)
- Ballistic Missile Defense System Programmatic EIS/ROD (April 2008)
- Flexible Target Family EA/FONSI (November 2007)
- Test Resources Mobile Sensors EA/FONSI (September 2006)
- Orbital / Sub-Orbital Program EA/FONSI (July 2006)
- Ground-Based Midcourse Defense Extended Test Range Final EIS/ROD (August 2003)
- Kodiak Launch Complex EA (May 1996)

All of the previous studies concluded in Findings of No Significant Impact or Records of Decision. The NASA EA can be downloaded here: http://www.nasa.gov/agency/nepa/routinepayloadea.html. The other documents are available for download from the following MDA website: http://www.mda.mil/news/environmental_archive.html.

2.2. Proposed Action

Under the new launch site license, AAC would make improvements to the KLC to add both solid and liquid fuel, medium-lift launch capability, and would operate the KLC in the future as a small and medium-lift launch complex. Proposed construction includes six primary modifications to the KLC, as described below and depicted in Figure 1.

- Launch Pad 3 (LP3): The launch stool, flame trench, a new access road, and all related surface and subsurface construction.
- Vehicle Processing Facility (VPF): A rectangular tower where assembly of the solid rockets will take place on top of the pad.
- Rocket Staging Facility (RSF): A rectangular building for the short term storage of solid rocket motors and the processing of liquid fueled vehicles.
- Air Plant/Liquid Fueling Facility (LFF): On-site producing plant for liquid oxygen and liquid nitrogen. The liquid fueling facility will include holding tanks for liquid oxygen, liquid and gaseous nitrogen, gaseous helium, highly refined kerosene, and piping to fuel the rocket.
- Mission Control Center (MCC): A new control center in the vicinity of the current Launch Control Center.
- Modifications to Pasagshak Point Road: Straightening the curves and flattening the dips of Pasagshak Point Road within the KLC.

2.3. Purpose and Need

The purpose of the Proposed Action is to:

1. Expand the KLC's launch capabilities to create a competitive medium-lift launch facility on the west coast, and

2. Enable the KLC to accommodate a wider variety of new launch vehicles and spacecraft.

3. Further AAC's vision for KLC as a national resource for enabling low-cost and schedule conscious access to space.

The expansion would be consistent with the National Space Policy, published in June 2010, which defines the guideline to "enhance capabilities for assured access to space" (United States, 2010). To that end, KLC is the only alternative west coast launch complex to Vandenberg Air Force Base (VAFB), California. VAFB is situated on the Central California coast, and is the only federal west coast launch facility. This decreases the United States' "assured access to space" from the west coast, a condition which would be mitigated by expanding KLC's capabilities to include medium-lift access to space.

Medium-lift accounts for nearly half of the U.S. launch market. Until recently, the only medium-lift rocket in use was the Delta II, based out of Vandenberg Air Force Base, California. The Delta II is being phased out of service, and there are several competitors for the medium-lift market that require new launch facilities to be built in the next three years. These include the Athena III (Lockheed Martin Corporation), Antares (Orbital Sciences Corporation), and other aerospace companies. AAC has already secured an agreement with Lockheed Martin to launch the Athena III from KLC as early as December 2014. AAC is also engaged with Orbital Sciences and other companies to pursue potential medium-lift rocket contracts.

The need for the Proposed Action is two-fold, driven both by AAC's immediate contractual obligation with Lockheed Martin, and by the State of Alaska mandate to AAC to develop and expand aerospace-related industry, research, and technical opportunities.

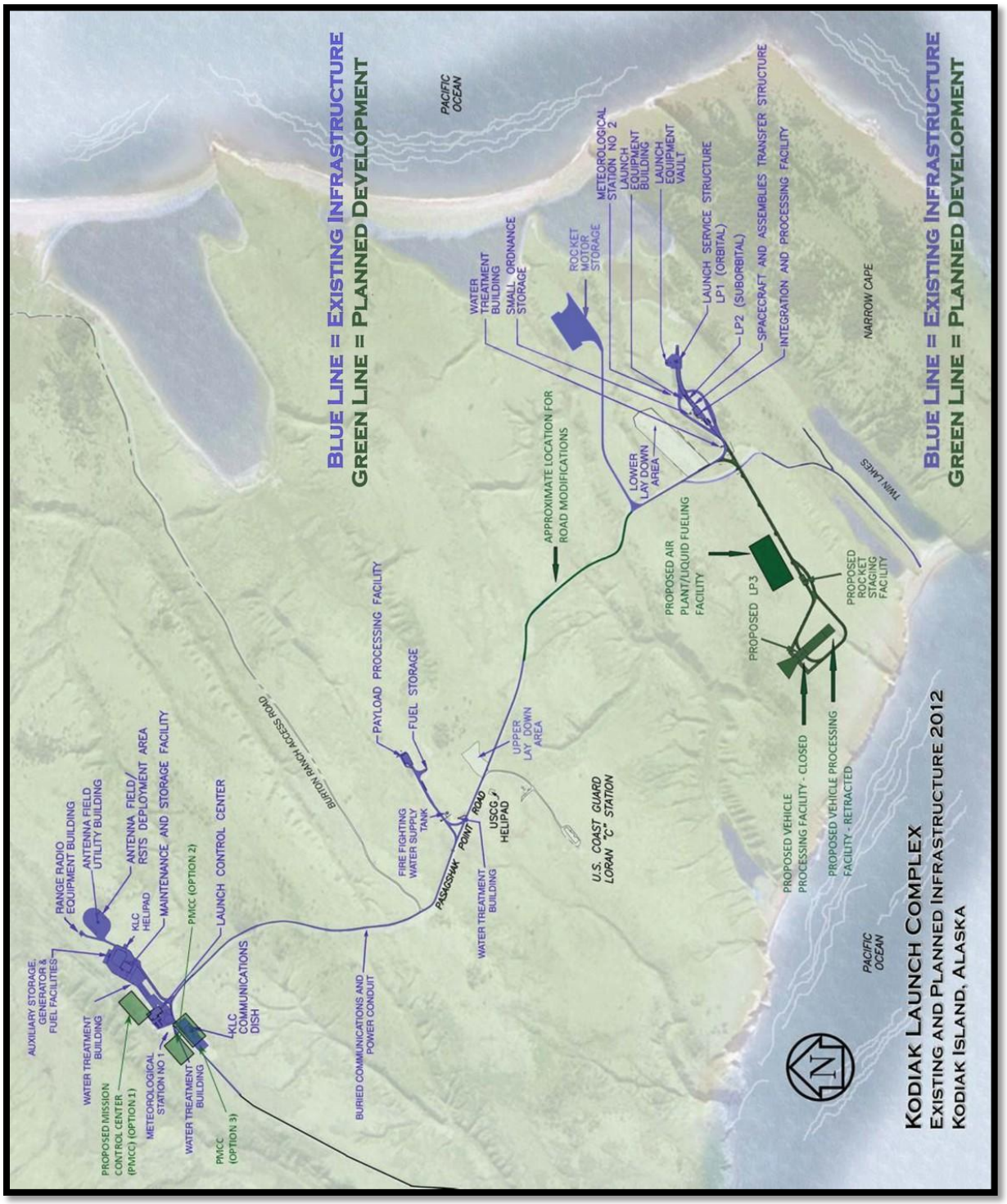


Figure 1. KLC Overview with Proposed Expansions

3. Acoustical Terminology

Noise is generally defined as unwanted sound. Noise is measured in terms of sound pressure level. It is expressed in decibels (dB), which are defined as 10 log P^2/P^2ref, where P is the root-mean-square (rms) sound pressure and P_{ref} is the reference rms sound pressure of 2 x 10^{-5} Newtons per square meter.

The number of fluctuation cycles or pressure waves per second of a particular sound is the frequency of the sound. The human ear is less sensitive to higher and lower frequencies than to mid-range frequencies. Therefore, sound level meters used to measure environmental noise generally incorporate a weighting system that filters out higher and lower frequencies in a manner similar to the human ear. This system produces noise measurements that approximate the normal human perception of noise. Measurements made with this weighting system are termed "A-weighted" and are specified as "dBA" readings.

3.1. Sound Measurement Descriptors

The minimum noise level during a measurement period is denoted L_{min}. The maximum noise levels (L_{max}) that occur during an event, such as the passing of a heavy truck or the flyover of an airplane, can be useful indicators of interference with speech or sleep and are sometimes used to assess the effect of noise on animals.

Several noise descriptors are used that take into account the variability of noise over time. The equivalent sound level (L_{eq}) is the level of a constant sound for a specified period of time that has the same sound energy as an actual fluctuating noise over the same period of time. It is an energy average sound level.

Another important noise level descriptor that is useful in comparing noise levels for space launch vehicles is the Sound Exposure Level, or SEL. The SEL is defined as constant level in decibels that, lasting for 1 second, has the same amount of acoustic energy as a given noise event lasting for a period of time T. The SEL is similar to the L_{eq} in that the total sound energy is integrated over the measurement period, but instead of averaging it over the entire measurement duration, it is averaged over a reference period of 1 second. For the purpose of space launch vehicles, the SEL provides a single number that can be used to compare the acoustical energy between different launch vehicle types. The SEL can be reported with weighting factors, for example, SEL(A)or SEL (dBA) are the SEL noise level with the A-weighting filter applied.

To aid in the understanding of the different noise descriptors, Figure 2 provides a graphical view of 1-second instantaneous sound pressure levels (including the L_{max} and L_{min}) over the course of a one-minute period. The graphic also shows the overall A-weighted L_{eq} and the SEL for this one-minute measurement for comparison. The figure shows that with noise levels varying constantly, and ranging from 30 dBA to 69 dBA, the L_{eq} is 56 dBA, while the SEL is 88 dBA. This means that a constant noise source, like a steady running fan, that produced a constant level of 56 dBA for one minute would have the same acoustical energy as the varying noise levels shown with the blue line. Further, a one-second constant noise source, producing 88 dBA, would also have same acoustical energy as the varying noise

levels shown with the blue line. The L_{eq} is therefore a measure of the acoustical energy that is dependent on the length of the measurement period. The SEL, however, is always normalized to one-second, and therefore provides a measure of the acoustical energy without the time dependence.

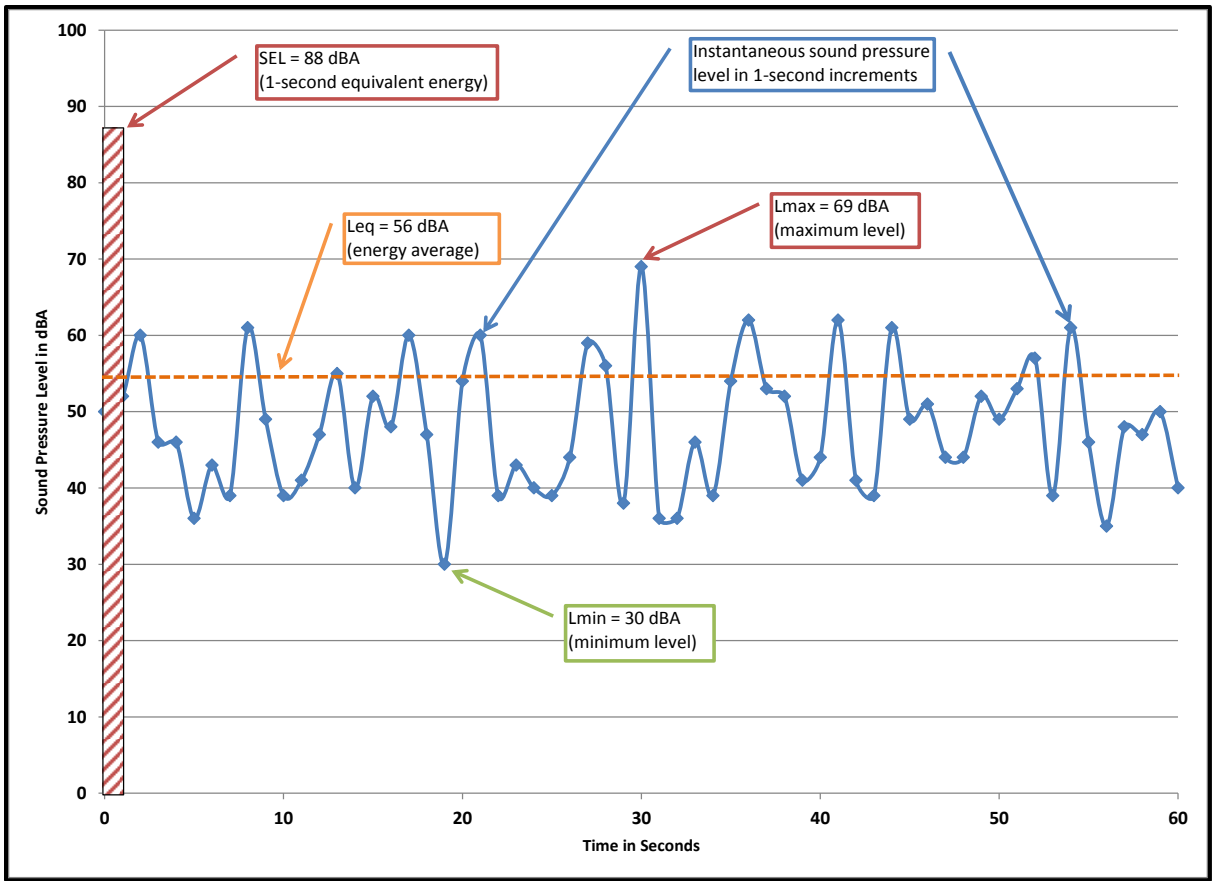


Figure 2. Comparison of Sound Level Descriptors

3.1.1. Day-Night Sound Pressure Level

The noise level metric used to assess the noise levels for FAA projects is the annual day-night average sound level (DNL). The DNL provides a single noise level that represents a 24-hour/day – 365-day period taking into consideration a greater sensitivity to noises that occur at nighttime. Nighttime sensitivity is weighted by the addition of a 10 dBA penalty factor included with nighttime sound levels occurring between 10 p.m. and 7 a.m. The DNL metric is recognized by the Federal Aviation Administration (FAA) for use in all FAA Part 150 (noise abatement) studies as the appropriate measure of cumulative noise exposure.

3.2. Human Perception of Noise

Noise levels decrease with distance from a noise source. For noise from a point source (such as a rocket), sound levels decrease by 6 dBA for each doubling of the distance due to geometric divergence of the sound waves. Additional noise reduction (attenuation) can be provided by vegetation, terrain, and atmospheric effects that block or absorb noise. However, for the purpose of this study, no additional attenuation will be considered due to the directional forces involved with rocket launches.

Subjectively, a 10-dBA change in noise level is judged by most people to be approximately a twofold change in loudness (e.g., an increase from 50 dBA to 60 dBA causes the loudness to double). A 3-dBA increase is a barely perceptible increase, while a 5 dBA change is clearly noticeable to virtually everyone.

Normal conversation ranges between 44 and 65 dBA when speakers are 3 to 6 feet apart. Noise levels in a quiet rural area at night are typically between 32 and 35 dBA. Quiet urban nighttime noise levels range from 40 to 50 dBA. Noise levels during the day in a noisy urban area are frequently as high as 70 to 80 dBA. Noise levels above 110 dBA become intolerable and then painful, while levels higher than 80 dBA over continuous periods can result in hearing loss. Table 2 provides an overview of the DNL considered compatible based on land use type, with a detailed FAA table on land use provided in Addendum 2.

Table 1. Land Use Compatibility by Sound Level in DNL

Land Use Category	Community Noise Exposer in DNL (dBA)		
	55 to 65	65 to 75	Above 75
Residential: Single Family, Duplex, Mobile Homes, Multifamily, Hotels	Fully Compatible	May be Compatible with Noise Abatement	Not Compatible
Institutional: Schools, Libraries, Churches Hospitals, Nursing Homes, Arts/Instructional	Fully Compatible	May be Compatible with Noise Abatement	Not Compatible
Recreational: Playgrounds, Neighborhood Parks, Sports Arenas, Outdoor Spectator Sports, Camping, Golf Courses	Fully Compatible	Fully Compatible	Not Compatible
Commercial: Office Buildings, Business and Professional	Fully Compatible	Fully Compatible	Fully Compatible
Industrial and Agricultural	Fully Compatible	Fully Compatible	Fully Compatible

Source: Federal Aviation Administration

4. Affected Environment

This section describes the study area, land use in the study area, background noise levels and launch vehicle noise monitoring performed near the KLC.

4.1. Land Use

Overall, land use near the KLC is mostly undeveloped. There appear to be some residential units to the southwest and north of the complex. The vast majority of residences are located greater than 50,000 feet from the complex. However, there are several residential uses located inside the 50,000 foot contour.

Land use near KLC was divided into segments based on the geographic area and distance from the existing and proposed launch pads. This method allowed properties to be grouped by distance from the launch facility. Figures 3 and 4 are aerial views of the area with distances contours from the LP1/2 and LP3 at intervals of 10,000, and 20,000 feet on Figure 3, and 20,000 and 50,000 feet on Figure 4. Note also that because the distance between LP1 and LP2 is so small when compared to the distance to noise sensitive properties, there would be no difference in noise levels from rocket launches at these launch pads. Therefore, LP1 and LP2 are grouped together for this analysis. Figures 3 and 4 also show the two locations used for background and launch vehicle noise monitoring.

Land use within each of these areas is described below. Although every attempt was made to identify all noise sensitive land uses within 50,000 feet of the complex, in addition to major population areas outside the 50,000 foot range, it is possible that there could be some additional properties not identifiable with available aerial mapping or using information from the City of Kodiak.

4.1.1. Land Use within 10,000 Feet

Land use within 10,000 feet of launch pads 1 and 2 includes only buildings associated with the KLC, with the exception of the U.S. Coast Guard Loran "C" Station. There are no other noise sensitive properties identified in this area. There are, however, several areas near the launch complex that are used for cattle grazing and also have wild buffalo and other animals.

With the addition of Pad 3, however, there will be 5 structures along Pasagshak Point Road that will be just within the 10,000 foot contour. All five buildings are located near each other and share a single driveway from Pasagshak Point Road. The buildings are approximately 9600 feet from the LP3 and 12,500 from LP1/2.

4.1.2. Land Use between 10,000 and 20,000 Feet

The only structures located between 10,000 and 20,000 feet from the three launch pads is the Kodiak Ranch and 4 other building located near the ranch. The ranch and 4 other buildings are all located approximately 11,500 to 11,600 feet from LP1 and LP2, and 14,200 from LP3. No other structures were identified between 10,000 and 20,000 feet of the three launch pads.

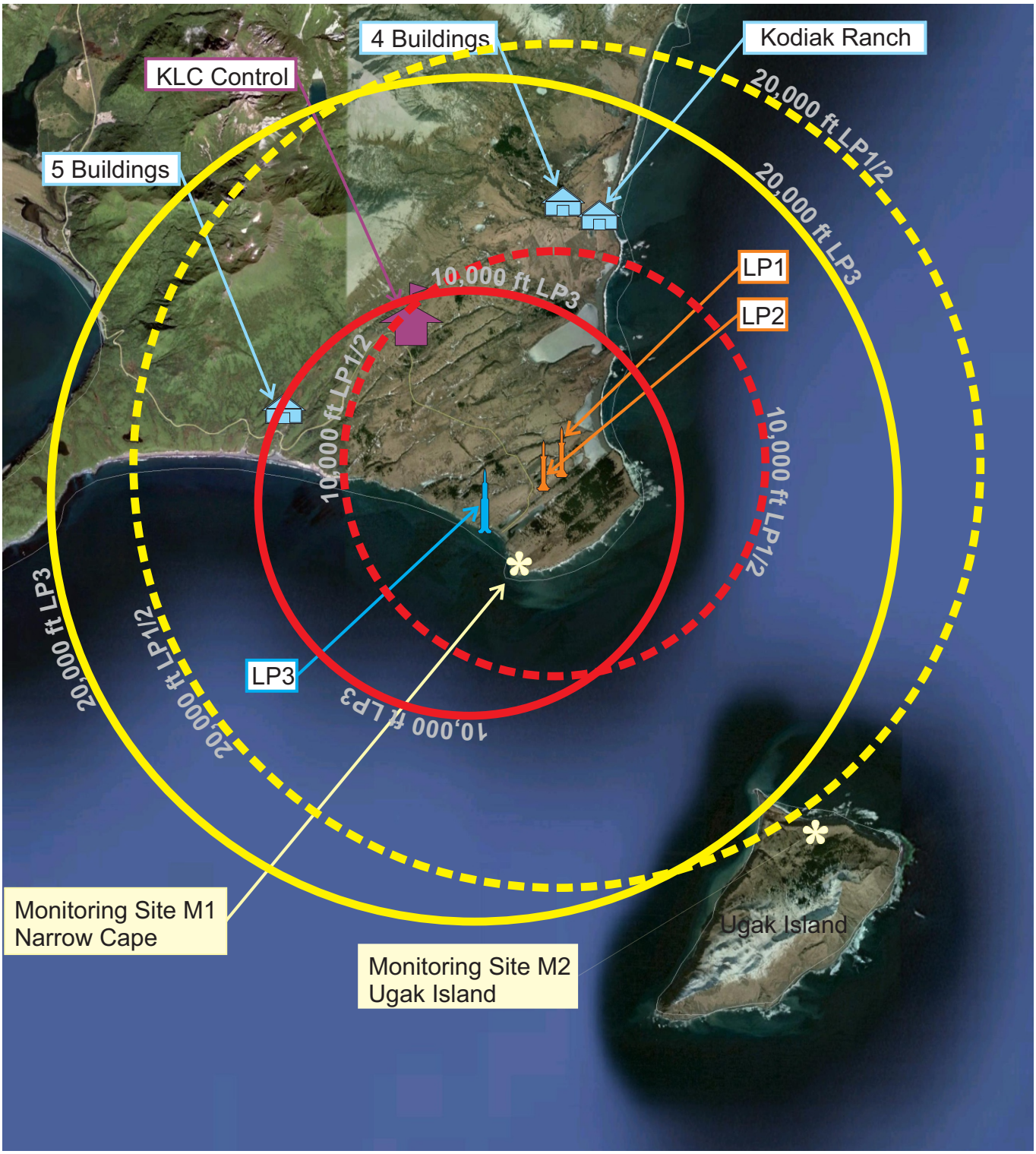
Animals are commonly found grazing between 10,000 and 20,000 feet from the three launch pads.

4.1.3. Land Use between 20,000 and 50,000 Feet

Between 20,000 and 50,000 feet from the three launch pads approximately 22 additional residential structures were identified off Pasagshak Point Road in Pasagshak Bay, northwest of the launch pads. The 22 residential structures are approximately 23,300 feet from LP3 and 25,600 from LP1 and LP2. One other potential residence was identified to the north of Pasagshak Bay along Pasagshak Road, approximately 27,000 from LP3 and 28,300 from LP1 and LP2. Wild animals are commonly found in this area also.

4.1.4. Land Use Outside of 50,000 Feet

Outside of 50,000 feet from the launch pads there are several residential structures, the Olds River Inn, and the Lagoonside Bed and Breakfast. The Olds River Inn is located at the "T" intersection on Pasagshak Road and Chiniak Highway, with the remaining residences and the Lagoonside Bed and Breakfast all located north of the launch pads in the Chiniak area. The distance from the launch pads to these residences ranges from 56,000 and 75,000 feet. In addition, there are several other residences, commercial and industrial uses located along the highway from Kodiak to the intersection of Pasagshak Road and Chiniak Highway.



Distance Contours:

10,000 from LP1 and LP2
10,000 from Proposed LP3
20,000 from LP1 and LP2
20,000 from Proposed LP3

0 1750 3500 7000

1.00 in

Approximate Scale 1 inch to 3500 feet

N

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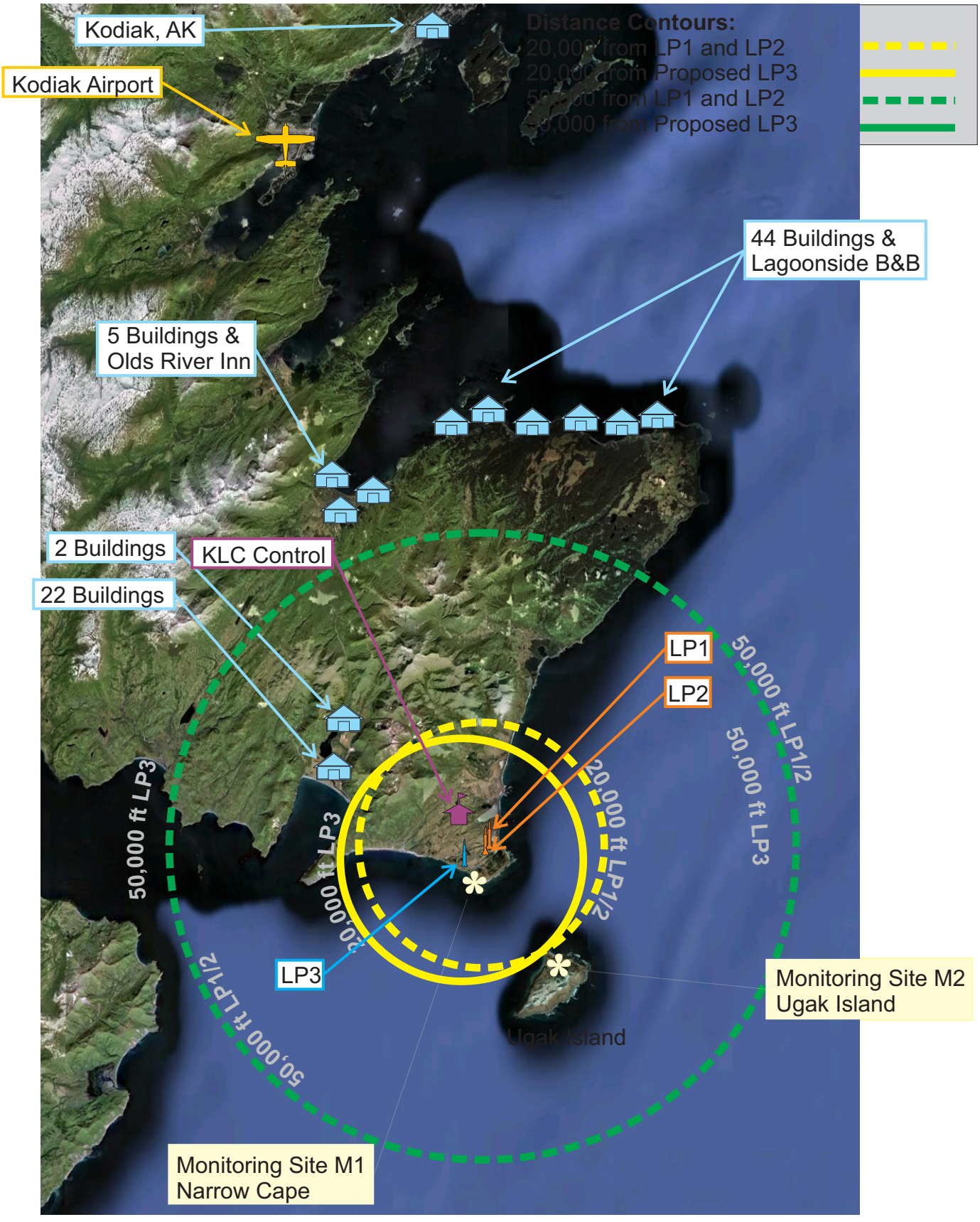
Portland, Oregon

Figure 3
Land Use Within 20,000 Feet of LP1-3
Noise Monitoring Locations
KLC Noise Analysis



0 5000 10,000 20,000

1.00 in

Approximate Scale 1 inch to 10,000 feet

N

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Portland, Oregon

Figure 4
Land Use Outside 20,000 Feet of LP1-3
Noise Monitoring Locations
KLC Noise Analysis

4.2. Noise Monitoring

This section provides the noise monitoring methods and a summary of the measured noise levels near the KLC. Noise levels used in this analysis include measured and calculated noise levels. Background ambient levels were measured before and directly after several launches over the last six years. The measured background noise levels are used to establish an existing ambient noise level for Ugak Island and the rural areas near the KLC. Over this same period, actual measurements of seven launches were performed. The measured data is used to provide a baseline of the existing noise levels associated with the KLC operations.

4.2.1. Measurement Methods

Noise measurements were taken in accordance with the American National Standards Institute (ANSI) procedures for community noise measurements. The equipment used for noise monitoring were 2 Bruel & Kjaer (B&K) Type 2260 acoustical analyzers (shown to the right). The analyzers were calibrated prior to, and after the measurement period using a Bruel & Kjaer Type 4231 Sound Level Calibrator. Calibration varied by less than 0.1 dB during the measurement period. Complete system calibration is performed on an annual basis by Bruel & Kjaer Instruments. System calibration is traceable to the National Institute of Standards and Testing (NIST). The system meets or exceeds the requirements for an ANSI Type 1 noise measurement system.

Bruel & Kjaer Type 2260 Acoustical Analyzer

The acoustical analyzers were placed in weather proof Pelican cases that included batteries for long term unattended operation and descant packs to control moisture. The B&K 2260 acoustical analyzers were set to record sound levels in 1-sec intervals and store the data on a compact flash card. The acoustical analyzers stored 1-sec, A-weighted L_{eq}, L_{max}, L_{min}, L_{peak} and SEL, along with the C-weighted L_{peak}, over the entire measurement period. In addition, the acoustical analyzers also recorded and stored the un-weighted L_{eq} and L_{max} in 1/3 octave bandwidths. This octave data allows for an analysis of the frequency content of the different space launch vehicles.

The acoustical analyzers were set to trigger (identify) 1-sec L_{eq} noise levels above 60 dBA with duration of more than 3 sec as an event. The acoustical analyzers were setup to take an audio recording of the event and store the recoding as a Windows compatible WAV file. The audio information was very useful when analyzing the noise levels and length of time it takes for the rocket noise levels to diminish to pre-launch ambient noise level.

Noise level data was downloaded into the B&K Type 7820 software package for post processing. This package allows for easy viewing and analysis of the measured noise level and also allows the user to listen to the noise event. The data was also exported to a spreadsheet for additional post processing and development of tables and graphs of the noise levels.

4.3. Measurement Locations

Two acoustical analyzers were installed and used to monitor the rocket launches. One system was placed approximately 5350 feet (1-mile) from the launch site, along Narrow Cape (M1), and the second meter (M2) and a video system were placed on Ugak Island, approximately 21,300 feet (4.1 miles) from the launch site. Figures 3 and 4 provide an overview of the area and identify the 2 noise monitoring sites.

4.4. Measured Rocket Launch Noise Levels

This section presents actual measured noise levels for small-lift launches of submarine ballistic missiles (SLBM) and a Minotaur Rocket from the KLC. Measured noise levels for the SLBM launches FT-04-1 (23 February 2006), FTG-02 (1 September 2006), FTG-03 (25 May 2007), FTG-03a (28 September 2008) FTG-04 (18 July 2008), and FTG-05 (19 November 2008) were summarized using the Lmax, Lpeak, and SEL measurements (MM&A, 2006-2008). The launch on November 19, 2010 of the Minotaur – IV rocket motors was noticeably louder under all metrics and, therefore, was not included in the comparison of the SLBM launches (MM&A, 2010). Although it would be possible to also compare the previous launches to the Minotaur launch, given the vast difference between the rocket types, metrics such as the standard deviation would not be helpful. Instead, the overall averages of the previous launches of the SLBM's are compared to the overall level from the Minotaur launch to provide a summary of the difference between the two small-lift rocket types.

Overall, the noise levels among the first six launches were very similar when compared within monitoring sites, and any differences were likely due to atmospheric conditions. For the previous launches, the Narrow Cape site the SEL has a range of 110.5 dBA to 112.6 dBA with an average of 112.0 dBA and a standard deviation of only 0.8 dBA. The L_{max} noise levels for the first six launches varied by 4.0 dBA, ranging from 106.0 dBA to 110.0 dBA. The average L_{max} was 107.8 dBA and the standard deviation for the L_{max} is 1.7 dBA. The peak levels were also similar, varying from 125.5 dBC to 128.0 dBC, with an average of 126.5 dBC and a standard deviation of 1.2 dBC.

The launch on November 19, 2010 with the Minotaur – IV rocket motors was louder under all metrics. Also notable was the amount of time the rocket produced noise levels above the background ambient levels, which increased from under 2 minutes for the launches of SLBM to well over 3 minutes for the Minotaur rocket at the Narrow Cape site. Also notable was the change in frequency content of the rocket noise, which on SLBM launches ranged between 125 and 250 Hz, but for the Minotaur launch the vast majority of acoustical energy was below 60 Hz. Table 2 provides a summary comparison of the measured data for the Narrow Cape site.

The Ugak Island site only had data for four of the six launches due to weather restricting access during the FTG-03 launch. The SEL from previous launches at Ugak Island ranged from 90.3 dBA to 92.3 dBA, with an average of 90.9 dBA and a deviation of 1.2 dBA. L_{max} noise levels at Ugak Island ranged from 83.1 dBA to 86.0 dBA. The L_{max} from previous launches has a standard deviation of 1.4 dBA and the average level of 84.1 dBA. The peak

noise levels ranged from 105.6 dBC to 109.0 dBC, with an average of 107.6 dBC and a standard deviation of 1.5 dBC.

Table 2. Launch Vehicle Measurements at Narrow Cape

Noise Metric	Submarine Ballistic Missile Launches by Date							Minotaur IV	
	2/23/06	9/1/06	5/25/07	9/2//07	7/18/08	12/12/08	Average (previous launches)	11/19/10	Difference (average to 11/19/10)
Lmax	106.7	110.0	110.0	107.0	106.9	106.0	**107.8**	109.6	+1.8
LPeak-C	128.0	128.0	125.5	125.8	125.6	126.1	**126.5**	132.5	+6.0
SEL(A)	112.6	112.5	111.6	110.5	112.6	112.4	**112.0**	116.0	+4.0

Noise levels from this launch site were 6.3 dB higher for the L_{max}, 5.8 dB higher for the Lpeak C-weighted, and also have an SEL that is 2.6 dB higher than previous launches. The other notable differences in launch noise over ambient and frequency content also hold true for this site. Table 6 has a summary of the measured launches at the Ugak Island site.

Table 3. Launch Vehicle Measurements at Ugak Island

Noise Metric	Submarine Ballistic Missile Launches by Date							Minotaur IV	
	2/23/06	9/1/06	5/25/07	9/2//07	7/18/08	12/12/08	Average (previous launches)	11/19/10	Difference (average to 11/19/10)
Lmax	86.0	83.1	N/A[a]	84.2	83.0	N/A[a]	**84.1**	90.4	+6.3
LPeak-C	109.0	105.6	N/A[a]	107.3	108.3	N/A[a]	**107.6**	113.4	+5.8
SEL(A)	92.3	90.3	N/A[a]	91.4	89.6	N/A[a]	**90.9**	93.5	+2.6
a) There were no measurements on Ugak Island for the 5/25/07 and 12/12/08 launches due to weather									

4.5. Establishing Existing Noise Levels

Existing noise levels for Ugak Island and near the launch complex at Narrow Cape were taken from measurements performed before and after several rocket launches, in addition to using actual launch noise levels. The data was reviewed and launch related noise sources, such as helicopter fly-overs, were omitted from the data, to provide background noise levels without any rocket launches. A separate analysis of the launch data was also performed and used to calculate the existing conditions ambient noise level including rocket launches. Ambient noise levels for areas near the launch complex were predicted from measurements at Narrow Cape. Noise levels near Kodiak and surrounding communities were estimated from measured data at other locations in Alaska. The following sections provide a summary of the existing noise conditions.

4.5.1. Existing Noise within 10 Miles of the KLC

Noise levels near the KLC during most of the year are governed by noise from traffic along the Chiniak Highway and Pasagshak Road. Other local noise sources include local residences, ongoing activities at the KLC, helicopters, animals, wind and rain. Non-local noise sources include boating activities and aircraft over-flights.

Noise generated during pre-launch preparations would include noise from trucks, cranes, and other load handling equipment needed to prepare the rocket for launch. Maximum noise levels from these operations are expected to range between 72 and 92 dBA L_{max} at 50 feet from the activity, or approximately 45 to 46 dBA L_{max} at the Kodiak Ranch, the nearest residential use. These are typical noise levels for this type of equipment. Based on the large distance from the KLC to nearby residential areas and short time frame of pre-launch preparation, noise associated with pre-launch preparations and rocket motor transport are not predicted to result in notable increases in noise levels at any of the nearby populated areas.

KLC and Vicinity Noise Levels

Noise levels at the KLC will vary greatly depending on the level of work happening at the facility. Typical daytime hourly L_{eq} noise levels that are taken from measured noise levels ranged from 52 to 58 dBA with nighttime noise levels ranging from 40 to 42 dBA. The typical daily L_{dn} was calculated at 45 dBA. During the period before a launch, when activities at the facility are increased, the average daily L_{dn} is predicted to increase to 61 dBA, due to increased traffic and general pre-launch activity. Finally, on the day of the launch, the daily L_{dn} increases to 67 dBA. The launch day L_{dn} was calculated using actual measured noise levels at the narrow cape monitoring site, and includes the launch of a small-lift rocket producing a maximum level of 110 dBA at 5300 feet from the launch site. Assuming nine small-lift launches per year, the DNL for the KLC was calculated at 45 dBA DNL, which is fully compatible with the land use based on Table 1.

Ugak Island Noise Levels

There are no residences or other uses on Ugak Island. Using measured noise levels measured on the island, the typical hourly L_{eq} noise level ranges from 35 to 44 dBA, depending on the wind and aircraft fly-overs. Based on these measurements the typical daily L_{dn} was calculated at 45 to 46 dBA. During a launch day, the L_{dn} increased to 49 dBA, and assuming nine small-lift launches per year, the annual DNL was calculated at 45 dBA DNL. The maximum noise level from a small-lift launch was measured on Ugak at 90 dBA L_{max}. See Addendum 1 for more information on Ugak Island Noise levels.

Chiniak Residential Area Noise Levels

Daytime noise levels in the Chiniak residential area would be dominated by local area traffic and residential activities along with noise from aircraft, boats, animals and wind. Based on noise measurements at Narrow Cape and the number of residences in the area, daytime L_{eq} noise levels are predicted to range from 48 to 56 dBA, with nighttime noise levels of 42 to 48 dBA L_{eq} due to noise from waves and wind. The existing annual DNL was calculated assuming nine small-lift capacity launches, with up to 2 weeks of increased activity associated with the launch. The predicted DNL of 55 dBA is well within the allowable DNL for residential land use from Table 1.

4.5.2. Existing Noise Levels near Kodiak

Existing noise levels near Kodiak would be governed by noise from passenger vehicles, Kodiak Airport, operations of seafood facilities, boating and the power generation plant along Marine Way E. Background noise levels would be the highest near major arterial

roadways, such as Rezanof Drive W, Lower Mill Bay Road and E Rezanof Drive. Increased noise levels can also be expected for locations near the airport and along flight paths. There are also several seafood processing facilities and docks for the seafood industry where elevated noise levels can be expected during normal operations.

Hourly average noise levels near the commercial areas in Kodiak are predicted to have daytime noise levels ranging from 60 to 67 dBA L_{eq}, with nighttime levels reducing to between 50 and 57 dBA L_{eq}. This results in an estimated DNL of 62 to 66 dBA for locations near the major arterial roadways. For sites that are shielded from traffic noise, the daytime noise levels are predicted to range from 52 to 62 dBA, with nighttime noise levels ranging from 45 and 52 dBA, for an annual DNL of 58 to 62 dBA.

More rural areas surrounding Kodiak would have slightly lower noise levels, with daytime levels of 50 to 57 dBA L_{eq} and nighttime noise levels of 40 dBA L_{eq}, for an overall DNL of 52 to 54 dBA.

Because of the distance between the launch facility and Kodiak, the noise from a rocket launch is not predicted to cause an overall increase in the annual DNL in Kodiak and nearby surrounding areas. However, associated with the launch are the added trips to and from the KLC by contractors and stakeholders, which could have a short-term effect on noise levels in the city of Kodiak. The increased traffic, helicopter flights and other launch associated noise is temporary, typically lasting less than 1 to 2 weeks per launch. Even with the added traffic and activities, the overall effect on the DNL for nine small lift launches per year is marginal, increasing the annual DNL in Kodiak and nearby surrounding areas by less than 1 dBA. In all cases, the calculated DNL is within the recommended DNL for residential land use.

5. Future Noise Level Analysis Methods

Noise level projections were performed using several different methods in order to provide an analysis comparable to the FAA regulations and to provide information to other disciplines, such as Threatened and Endangered Species, so those studies could be performed (see Addendum 1 for noise levels on Ugak Island). The following list summarizes the analysis performed and a summary of noise descriptors and analysis conditions are provided in Table 4:

1. **Launch Noise Levels:** Predict and provide rocket launch noise levels for the different proposed launch vehicles that would use the new launch Pad 3. Compare and contrast the difference between the different launch vehiclesand select the loudest vehicle for graphical presentation. Noise levels were projected and reviewed using information from NASA on space launch vehicles, measured noise levels from launches at KLC, Vandenberg AFB, Cape Canaveral Air Station and Wallops Flight Facility along with reference data and information from rocket motor manufacturers. Calculation for the new Athena III space launch vehicle with the revised RSRM were calculated using NASA Document NAS8-11217, *Sonic and Vibration Environments for Ground Facilities – A Design Manual*, Wyle Laboratories Research Staff Repot WR 68-2, March 1968 (NAS8-11217).

2. **Future Combined Noise Levels:** Predict future noise levels for noise sensitive properties located near the facility. Noise projections will also be made for Ugak Island and undeveloped lands with significant wildlife population for input into other discipline reports and analysis. All projections assume the worst case noise levels and use the loudest of the potential light and medium lift launch vehicles.

3. **Project Impacts:** Determine the potential for project impacts at properties and areas identified above using the annual DNL assuming the worst case launch vehicle.

4. **Additional Data:** Provide the L_{max} dBA, launch hour L_{eq} dBA, Peak noise level in dBC and the SEL in dBA for typical launch vehicles from the new launch pad 3. This task was performed for all potential medium lift launch vehicles and used to determine the loudest launch vehicle.

Table 4. Noise Descriptors and Analysis Conditions

Noise Descriptor	Existing Conditions	Future Conditions
Launch hour L_{eq} (dBA)	Data from existing measurements	Projected from medium-lift launch
Daily L_{dn} (dBA)	Same as above	Projected from medium-lift launch
Annual DNL (dBA)	Same as above	Projected from medium-lift launch
Launch SEL (dBA)	SEL from previous launches	SEL from medium-lift launch
Launch Lmax (dBA)	L_{max} from previous launches	L_{max} from medium-lift launch
Peak Level in (dBC)	Peak-C from previous launches	Peak-C from medium-lift launch[1]

1. The NASA noise projections do not include the C-Weighted Peak noise levels. However the C-Weighted Lmax was calculated and used to predict the peak C-Weighted noise level for an Athena III.

Because of the limited number of rocket launches, the change in the energy average noise level descriptors (L_{eq}, L_{dn} and annual DNL) are not expected to show a notable increase in the overall noise levels with the project at populated areas outside the KLC. The SEL, L_{max} and launch hour L_{eq} will provide the documentation of any short-term increase in area noise levels. Calculation for the hourly L_{eq} and DNL noise levels are detailed in Addendum 3, *Energy Averaged Noise Calculations*.

This report also discusses the time from the launch until noise levels have reduced back to the typical ambient noise level, which for undeveloped areas near the site and on Ugak Island range from 40 to 50 dBA (MM&A, 2006, 2006, 2007, 2008, 2008, 2010). The major noise source in most undeveloped areas is wind and wildlife. Noise levels of typical launch vehicles versus time were graphed for comparison. Tables of the launch data is also included for comparison of noise levels from the different launch vehicles.

5.1. Proposed Operations

The current and proposed operations at the KLC include up to nine (9) launches per year. The nine launches are expected to be a combination of small and medium lift vehicles. Therefore, to maintain a conservative analysis, it was assumed that all nine launches would be the worst cast (loudest) medium lift launch vehicles. The worst case launch scenario for noise was performed by comparing the Lmax and SEL of the different launch vehicles. The Lmax provides the loudest instantaneous 1-second noise levels and the SEL is a measure of

the amount of time is takes for the rocket to clear the area and noise levels return to pre-launch ambient. Rockets that take longer to clear the area will elevate noise levels longer than a rocket that clears the area quickly, and therefore produce a higher SEL. Medium lift launch vehicles that are currently proposed for use at the KLC could include the Antares liquid fueled launch vehicle, a Notional Liquid Fueled Launch Vehicle, and the new Athena III launch vehicle. Reference noise levels and comparisons for each of these launch vehicles are provided in the following sections.

5.1.1. Liquid Fueled Medium Lift Vehicles

The Antares liquid fueled rocket is manufactured by Orbital Sciences Corporation with a payload of up to 12,000 pounds and a thrust of 734 pounds, which is almost twice the thrust of the current small-lift rockets used at the KLC. The Notional Liquid Fueled Launch Vehicle is larger than the Antares and uses liquid oxygen (LOX), rocket propellant 1 (RP-1), and will have a payload of up to 13,000 pounds. The manufacturer for the Notional vehicle has not yet been determined; however for this analysis a conservative noise emission of 125 dB (peak un-weighted noise level), or 115 dBA at 5,280 feet (1-mile) was used. The reference noise levels are based on measured noise levels from launches of Delta II and Taurus II SLV's. Both of these SLV's have liquid fuel first stages and are typical medium lift SLV's. Noise levels for Delta II launches are taken from the Navstar EA for Cape Canaveral Air Station (Navstar, 1994). The Taurus II launch noise levels are taken from the EA for the Expansion of the Wallops Flight Facility (Wallops, 2009). For comparison, the Minotaur IV produced 123 dB (peak un-weighted noise level), or 110 dBA at 5280 feet (1-mile) during the launch in November 2010. The Minotaur IV can be considered one of the louder small lift rockets.

5.1.2. Athena III Medium Lift Launch Vehicle

The Athena III launch vehicle is currently under development in a joint venture with Lockheed Martin and Alliant Techsystems (ATK). The Athena III will use a modified version of the Reusable Solid Rocket Booster (RSRB) that was the basis for the Space Shuttle launch system. The new Athena III is planned to have a Castor 30 second stage, and a Castor 120 third stage, both manufactured by ATK. Because the burn time for the RSRB is approximately 125 to 140 seconds, the RSRM will be the major noise source for this space launch vehicle, while noise from second stage are predicted to be at, or below typical ambient noise levels in the vicinity of the launch complex. The third stage will not produce measurable noise levels due to the high altitude of the launch vehicle at the time of ignition.

There is no existing launch data for the Athena III launch vehicle with a single RSRM, except for limited ground testing. The space shuttle launch system uses two RSRM rocket motors, and this fact, in addition to modifications the RSRM for the use on the Athena III and smaller payloads, make noise levels from space shuttle launch notable higher than the predicted levels for the Athena III. Therefore, noise emissions for a launch of the new Athena III launch vehicle was projected using acoustical calculations methods developed by NASA. The noise predictions methods are based on the NASA Document NAS8-11217, *Sonic and Vibration Environments for Ground Facilities – A Design Manual*, Wyle Laboratories Research Staff Repot WR 68-2, March 1968 (NAS8-11217).

Chapter 6 of NAS8-11217 provides a validated modeling method for predicting noise levels from space launch vehicles. Input to the model and source for the model input includes:

- Rocket thrust, 2,600,000 Lbs: Obtained from Alaska Aerospace, ATK published data and Haynes and Kenny, *Modifications to the NASA SP-8072 Distributed Source Method II* and modeled launch data (no date).
- Exit gas velocity, 5080 ft/sec: Obtained from Alaska Aerospace, ATK published data and Haynes and Kenny, *Modifications to the NASA SP-8072 Distributed Source Method II* and modeled launch data (no date).
- Number of nozzles and nozzle exit diameter 1 nozzle at 12.4 ft: Obtained from Alaska Aerospace and Sutton, George Paul, *Rocket Propulsion Elements; An introduction to Engineering of Rockets*, 2001.
- Trajectory height (varies with time): Typical trajectory height versus time obtained from Alaska Aerospace in the form of a time record.
- Vehicle velocity (varies with time): Vehicle velocity calculated from trajectory height versus time.
- Distance from launch pad to receiver, model at Ugak Island (approximately 4-mile from all there launch pads) and Narrow Cape (approximately 1-mile from launch pads 1 and 2, and 0.70 miles from the proposed pad 3; note that launches from pad 3 were calculated at a distance of 1-mile for comparison with measured data from pads 1 and 2 at Narrow Cape)

The noise model accounts for other variables including atmospheric absorption, Doppler Effect on rocket frequency along with the speed and elevation of the vehicle at different times throughout the launch cycle. The noise projections are performed in 1/3 octave bandwidth, which allows for a detailed analysis of the acoustical energy based on frequency at any time from liftoff to burnout of the RSRM. Using the methods described, the overall sound level was predicted, including 1/3 octave noise levels, at blast-off and at increments of 2, 4, 6, 8, 12, 16, 20, 30, 40,50, 60, 80, 100, and 125 seconds after launch. The data projections were used to provide the maximum (Lmax) noise level in dB, dBA and dBC along with the SEL in dB and dBA. The Peak C-Weighted noise level was predicted based on the measured Peak C-Weighted level of the Minotaur IV rocket. Tables 5 and 6 provide a summary of the launch vehicle noise levels versus time along with the overall maximum and SEL at one-mile (for comparison with measured data at Narrow Cape) and Ugak Island respectively. Figures 5 and 6 provide time records for launch vehicle noise in a graphical view.

It's important to note that as the rockets increase in altitude, the distance from the rocket to Ugak Island or Narrow Cape get closer and closer, and therefore noise levels at the two sites become nearly identical. This typically occurs after 40 to 60 seconds of flight, and after that time, the noise levels at virtually all sites within 5 miles of the launch site will have similar noise levels (+/- 1 to 2 dB). This is illustrated by the noise levels in Table 5 and 6. Note that the 1-mile noise levels are notable higher until 50 seconds after launch, where the noise levels are all within 1 to 2 dB. Nay slight differences after 60 seconds are due to rounding to whole numbers.

Table 5. Athena III Noise Level at One Mile (5280 ft.)		
Time from Launch	**Calculated Sound Level dB[1]**	**Calculated Sound Level dBA[2]**
Lift-off	121 dB	115 dBA
2 seconds	121 dB	115 dBA
4 seconds	121 dB	115 dBA
6 seconds	121 dB	114 dBA
8 seconds	121 dB	114 dBA
12 seconds	122 dB	112 dBA
16 seconds	122 dB	109 dBA
20 seconds	121 dB	104 dBA
30 seconds	115 dB	92 dBA
40 seconds	110 dB	83 dBA
50 seconds	106 dB	75 dBA
60 seconds	103 dB	69 dBA
80 seconds	97 dB	59 dBA
100 seconds	92 dB	49 dBA[3]
125 seconds	87 dB	37 dBA[3]
Overall Maximum	**122 dB**	**115 dBA**
SEL	**131 dB**	**122 dBA**

1. Predicted un-Weighted sound pressure level using NASA NAS8-11217 methods
2. Predicted sound pressure level with A-Weighting filter applied using NASA NAS8-11217 methods.
3. Noise levels in green cells are near, or below ambient noise levels in dBA

Table 6. Athena III Noise Level at Ugak Island (21,322 ft.)		
Time from Launch	**Calculated Sound Level dB[1]**	**Calculated Sound Level dBA[2]**
Lift-off	104 dB	83 dBA
2 seconds	104 dB	83 dBA
4 seconds	104 dB	83 dBA
6 seconds	104 dB	83 dBA
8 seconds	104 dB	83 dBA
12 seconds	104 dB	83 dBA
16 seconds	105 dB	84 dBA
20 seconds	105 dB	84 dBA
30 seconds	106 dB	84 dBA
40 seconds	103 dB	79 dBA
50 seconds	103 dB	75 dBA
60 seconds	101 dB	69 dBA
80 seconds	96 dB	58 dBA
100 seconds	90 dB	48 dBA[3]
125 seconds	86 dB	36 dBA[3]
Overall Maximum	**106 dB**	**84 dBA**
SEL	**115 dB**	**93 dBA**

1. Predicted un-Weighted sound pressure level using NASA NAS8-11217 methods
2. Predicted sound pressure level with A-Weighting filter applied using NASA NAS8-11217 methods.
3. Noise levels in green cells are near, or below ambient noise levels in dBA

When the Athena III noise levels are compared to launch noise levels from previous launches at KLC, the predicted overall Lmax of 115 dBA at Narrow Cape is 7 dB higher than the average of previous SLBM's and 5 to 6 dB higher than the Lmax of the Minotaur IV. The SEL of 122 dBA is also higher than previous launches at Narrow Cape, exceeding the SLBM's by 10 dB and the Minotaur IV by 6 dB (see Table 2 for Narrow Cape data).

On Ugak Island, however, the 84 dBA Lmax and 93 dBA SEL are very similar to the noise levels from the SLBM's and the Minotaur IV launches (see Table 3 for Ugak data). The reason that the Athena III noise levels at Ugak are similar to other launches at the KLC is primarily the result of the high energy, low frequency content of the RSRM rocket when compared to the previous launch vehicles. The low frequency content of the RSRM is partly due to the larger diameter exit nozzle. The lower frequency content of the RSRM reduces the overall A-Weighted noise levels because of the A-Weighted filter's substantial reduction at low frequencies.

The two graphs of the noise levels versus distance (see Figures 5 and 6) also include a best-fit line using exponential extrapolation to provide worst case noise levels past 125 seconds. Because the second stage motor is far less powerful, with less thrust and exit gas velocity, the actual noise levels associated with the launch of the Athena III would be expected to be less than the best-fit extrapolation for the second and third stages.

Finally, both of the graphs of sound pressure versus time show that noise levels will be below 40 dBA at Ugak Island and Narrow Cape prior to the second stage firing, and therefore noise related to the second stage is not predicted to be noticeable and would be substantially less than the noise emitted from the Athena III's first stage RSRM (see Figures 4 and 5).

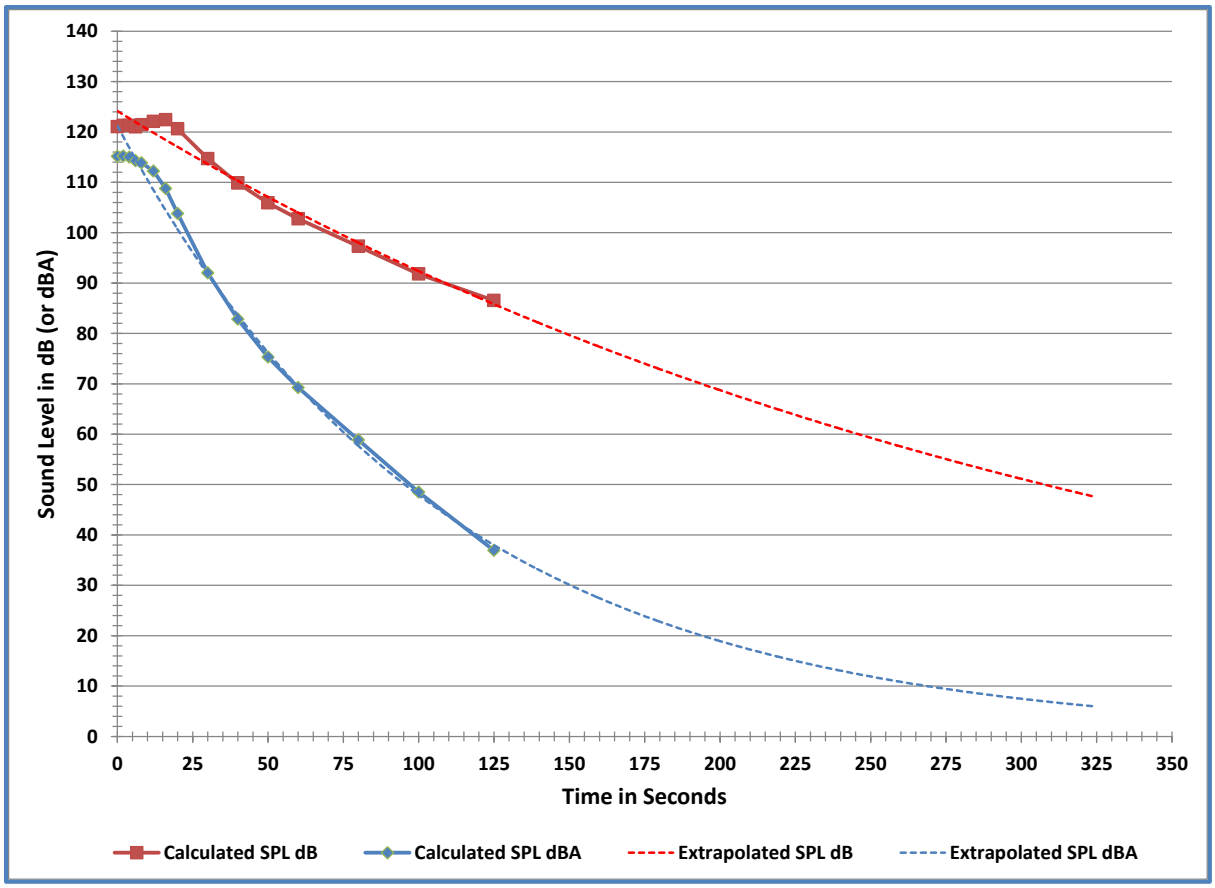


Figure 5. Noise versus Time for Athena III at Narrow Cape (5280 ft.)

Predicted Athena III (RSRM) noise levels using NAS8-11217 with exponential extrapolation past 125 seconds.

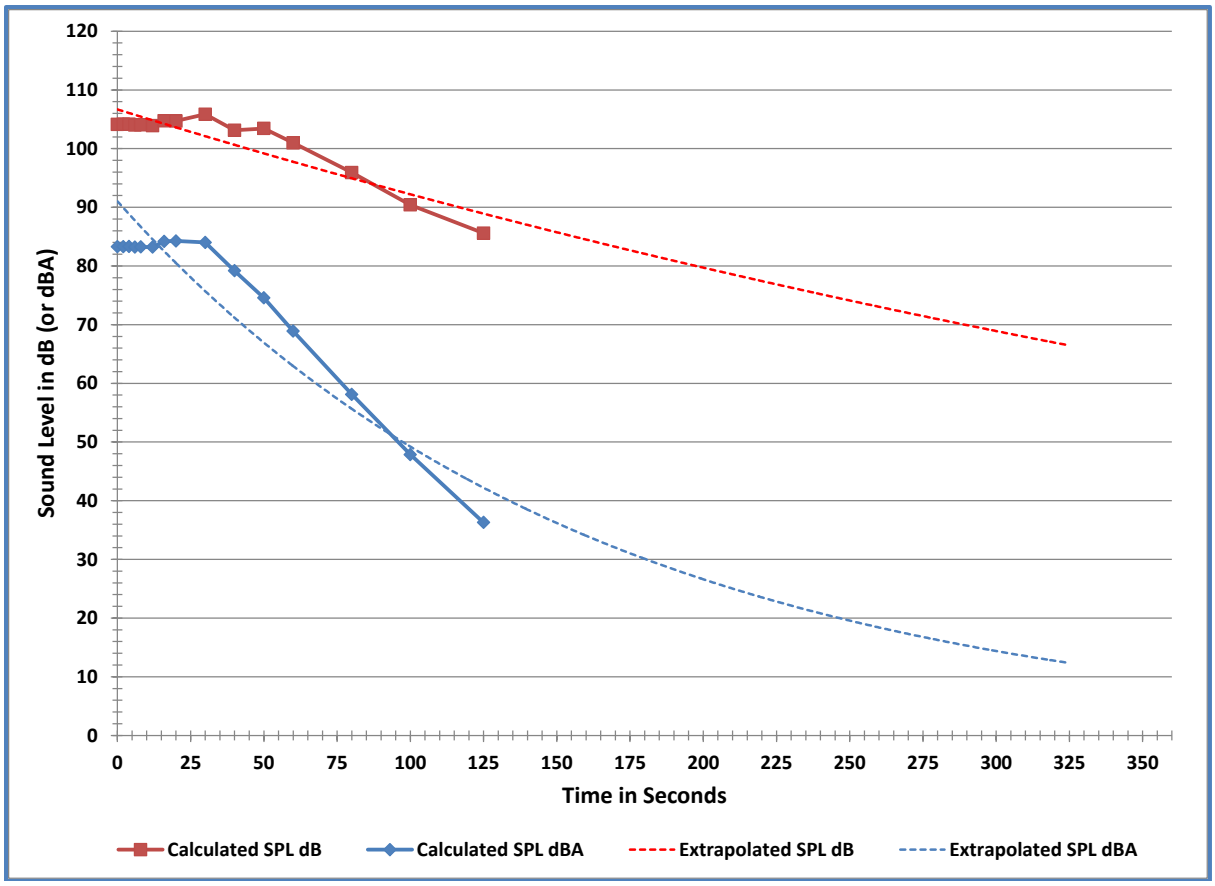


Figure 6. Noise versus Time for Athena III at Ugak Island (21,322 ft.)

Predicted Athena III (RSRM) noise levels using NAS8-11217 with exponential extrapolation past 125 seconds.

6. KLC Noise Modeling Results and Exposure Maps

Future noise exposure predictions were performed using the assumptions provided in Section 5.1. The assumptions assume that there will be up to nine (9) launches per year and include a combination of small and medium lift launch vehicles. For this analysis, the worst case assumption of nine Athena III launch vehicles was used to provide the annual DNL along with launch day L_{dn}, launch hour L_{eq} and the worst case L_{max}, SEL and Peak-C launch vehicle noise levels.

6.1. Existing Noise Levels

Currently, under the assumed launch of up to nine small-lift launch vehicles, there are no populated areas with annual noise levels above the 65 dBA DNL recommended level for populated areas. In fact, the annual DNL at the KLC was projected at 58 dBA DNL. Currently, there are no populated areas within the 65 dBA DNL contour.

Maximum noise levels within 5300 feet of the KLC range from 107 to 110 dBA, with Peak-C levels of 126 to 133 dBC. The SEL from current launches ranged from 111 to 113 dBA.

The typical time for launch noise levels to return to back to ambient range between 90 seconds for SLBM to over 3 minutes for a Minotaur IV. Figure 7 provides a time record of measured noise levels for three previous launches at the KLC, two SLBM's and one launch of a Minotaur IV.

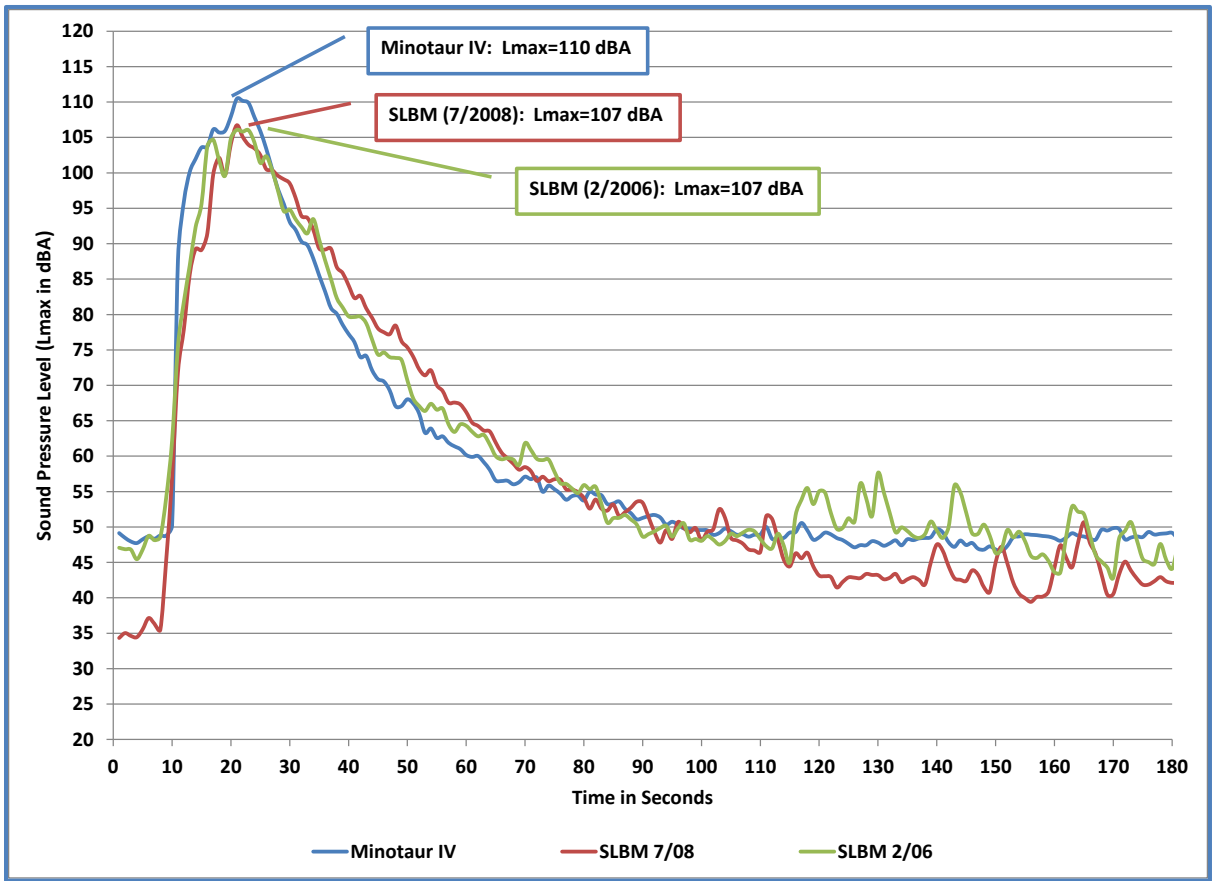


Figure 7. Typical Previous Launch Noise Levels (L_{max} in dBA)

In addition to the L_{max}, the SEL, Peak-C and DNL noise levels were also recorded or calculated from measurements. This data was used to plot noise contours on an aerial map to demonstrate the existing noise levels associated with the KLC operations

6.2. Future Modeled Noise Levels

This section provides information on the future noise levels with the proposed project. Included in this analysis are the noise levels related to launches, including launch preparation, construction of Launch Pad 3, and the associated support required for the operations of a space launch facility.

For this analysis the Athena III launch vehicle was selected as it is the loudest rocket (Lmax) and also produces the highest SEL. Figure 8 is the same as Figure 7, with the predicted Lmax for the new Athena III rocket with the RSRM overlaid for comparison. Note that the noise levels for the Athena III do not account for shielding and deflection of rocket noise

when the rocket is close to the launch pad. During the first few seconds of the launch, much of the acoustical energy is directed through blast tunnels or shielded from the measurement devices by launch related facilities. The effects of this shielding can be seen in the measured data of the other three rockets during the first few seconds after launch. Once the rocket clears the pad, the effects of the launch related facilities are quickly reduced and have no effect on noise levels.

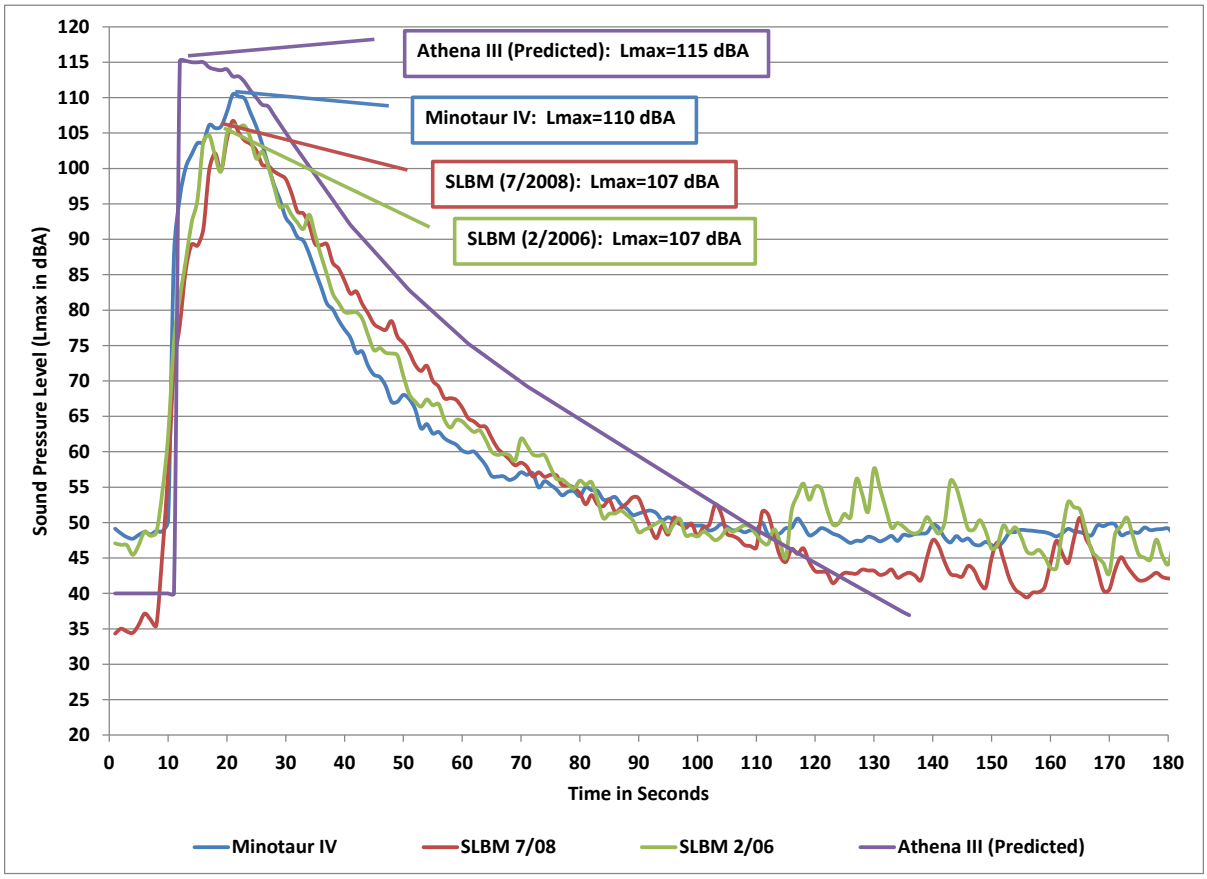


Figure 8. Previous Launch Noise Levels with Athena III (L_{max} in dBA)

Predicted Athena III (RSRM) noise levels using NAS8-11217

The graph shows that the Athena III produces the highest over Lmax, and also takes longer to move downrange sufficiently for noise levels to reduce back to the pre-launch ambient. Therefore the Athena III was selected as the worst case launch vehicle. It was assumed for this analysis that nine (9) launches of Athena III launches would occur over a 12 month period.

6.2.1. Future Launch Scenarios

With the construction of launch pad 3, the number of launches would remain the same as under the existing conditions. However, launches of medium-lift vehicles, including the Athena III, could also occur from the KLC. The maximum noise from the launch of the Athena III medium-lift launch vehicles is 5 to 6 dB higher than the measured data from the

small-lift Minotaur IV rocket. Furthermore, because Athena III medium-lift launch typically take more time than small-lift rockets to gain altitude and move downrange, the time for the noise from the launch vehicle to be equal to or less than the prelaunch ambient usually takes longer, resulting in an increase in the SEL and L_{eq} noise readings.

The analysis for nine Athena III launches per year from Pad 3 would represent the worst case noise levels for the residential areas near KLC and the Kodiak Ranch. The analysis includes the L_{max}, SEL, Peak-C and the one-hour L_{eq} and annual DNL. The combination provides for a comprehensive review of noise levels from the KLC.

For this analysis the nearby residential areas were divided into 6 groups that will experience similar launch noise levels. A complete set of noise levels was calculated for each of the residential groups and Ugak Island. The groups are shown on Figure 6. Table 7 provides a summary of the noise modeling results at the nearby residential groups along with Ugak Island. The table provides launch related L_{max}, SEL, Peak-C along with a typical one-hour L_{eq} during a launch and the annual DNL. Noise contours for the different launch scenarios are provided in the following sections.

The analysis was performed using the following assumptions:

- Nine launches of the Athena III rocket would occur per year.
- The receiver group's distance is the distance from the launch pad to the nearest structure in the receiver group.
- Launches from Pad 3 will use the noise emissions for Athena III vehicles taken from noise predictions performed using the NASA Document NAS8-11217, as provided in Section 5.1.2, Athena III Medium Lift Launch Vehicle.
- The Kodiak average temperature of 40.8 degrees Fahrenheit with a relative humidity 76.0% was used for sound propagation.
- The L_{max}, and SEL (dBA), were all predicted using standard geometric acoustical dispersion, reducing at 6 dB per doubling of distance with a correction for temperature and humidity using the averages for Kodiak provided above.
- Calculations for the hourly L_{eq} and DNL noise levels are detailed in Addendum 3, Energy Averaged Noise Calculations. The projections assume 239 days/year of normal ambient noise levels, 117 days/year of pre and post launch support, and nine launch days/year.

Table 7. Summary of Noise Levels at Nearby Residential Areas						
Noise Metrics	**Receiver Noise Levels from Athena III Launch at Pad 3 (see Figure 6)[1]**					
	A	**B**	**C**	**D**	**E**	**Ugak[2]**
L_{max} (dBA)	107	102	96	77	73	96
Peak (dBC)	126	121	115	96	92	115
SEL (dBA)	112	106	99	74	70	98
L_{eq} (dBA)[3]	78	72	65	40	40	64
DNL (dBA)	49	45	45	45	45	45

Notes:

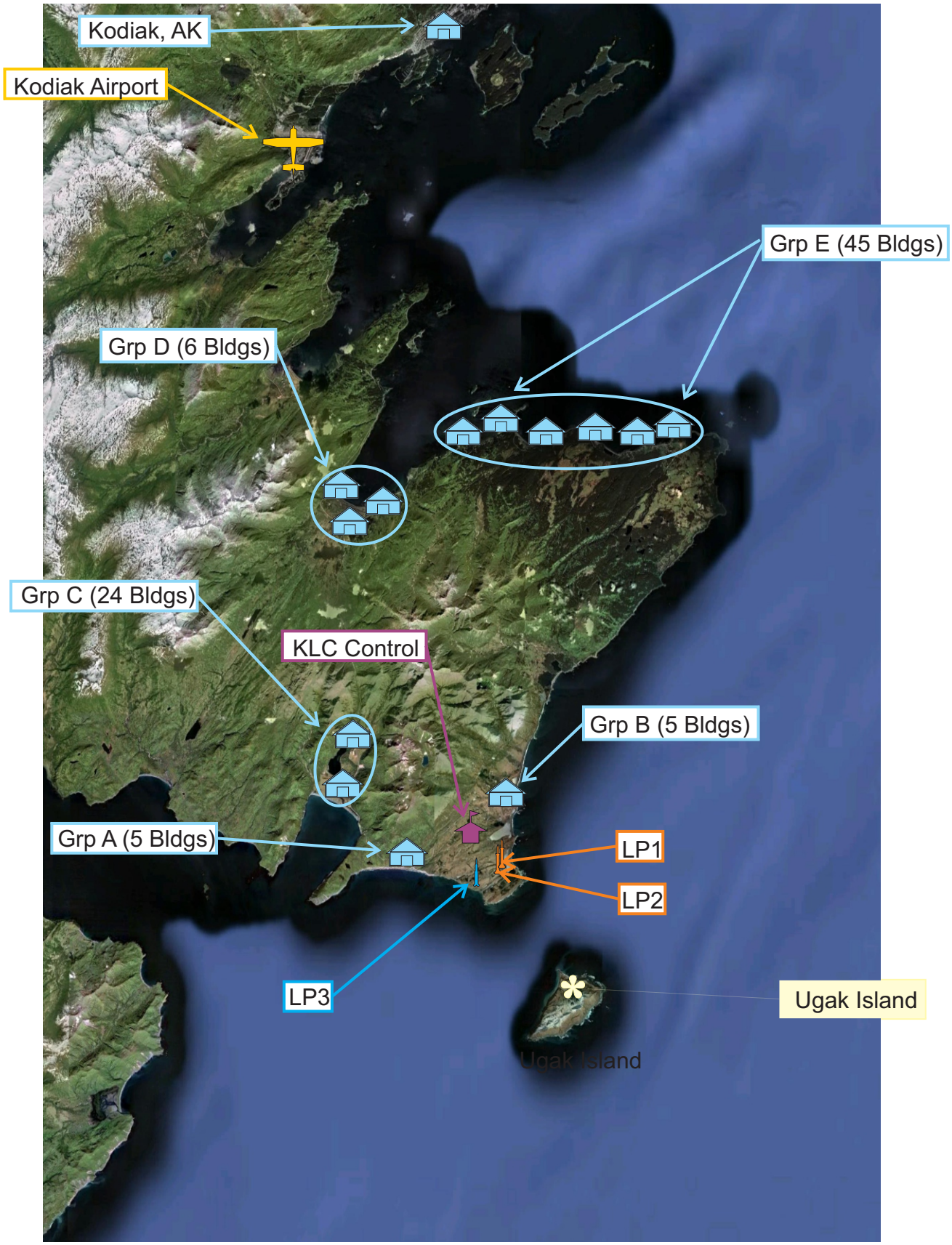
1. Calculated for the closest residence/building in the receiver group
2. Calculated at the noise monitoring site on Ugak Island
3. L_{eq} for the one hour with a rocket launch
4. Annual DNL assuming nine launches per year of Athena III Rockets and an average background daily L_{dn} of 45 dBA

Receiver Groups (shown on Figure 6)

A. 5 structures along Pasagshak Point Road
B. Kodiak Ranch and nearby structures
C. 22 plus structures along Pasagshak Point Rd and near Lake Rose Tead
D. 6 structures near the intersection of Pasagshak Rd and Chiniak Hwy
E. Multiple structures in the Chiniak area

Ugak Island noise monitoring site

The modeled noise levels in Table 7 shows that the proposed action has a minimal effect on the overall DNL noise levels at nearby noise sensitive properties. An increase of 4 dB in the DNL is predicted at receiver group A, with all other groups remaining at 45 dBA DNL. The data also shows that KLC operations will not have a no effect on the DNL in Kodiak due to the large distance from the KLC to the city.



0 5000 10,000 20,000

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Approximate Scale 1 inch to 10,000 feet

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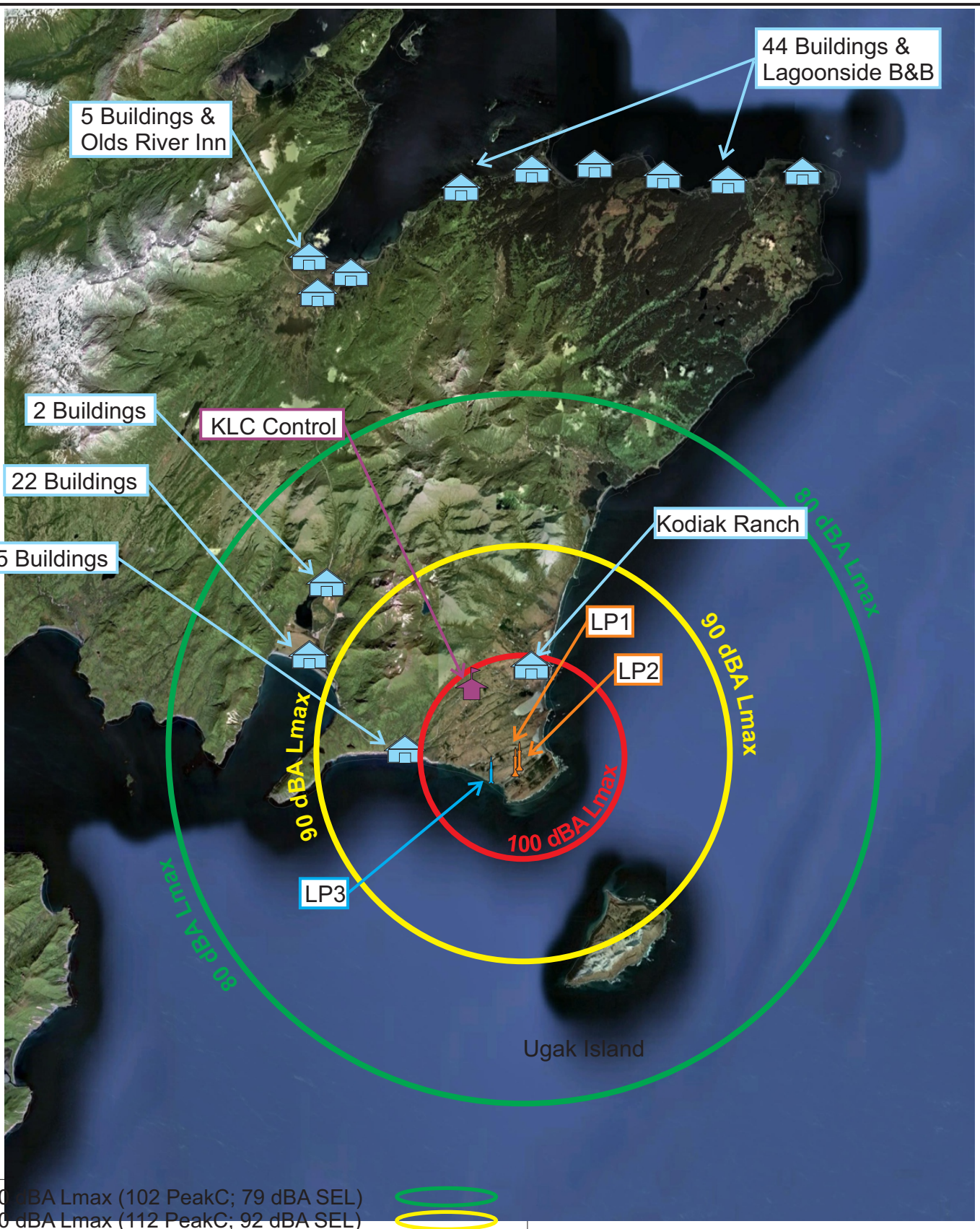
Figure 9
Noise Modeling Groups
KLC Noise Analysis

6.3. Noise Level Contours

This section provides noise level contours for the existing and future conditions. Contours are provided for the L_{max}, Peak-C and the SEL, as these are the metrics that show the differences between the existing and future conditions. The annual DNL was not plotted because the nine launches per year have no effect on the annual DNL at any of the noise sensitive properties near the KLC except for Group A, where the DNL increased by 4 dB, from 45 DNL to 49 DNL. The 49 DNL at group B is well below the recommended level of 65 DNL for residential properties (see Addendum 2, FFA Land Use Compatibility). In addition, the 65 DNL contour, even with the addition of Launch Pad 3, is entirely contained within the boundaries of the KLC.

The distance from launch pad for the projected 100 dBA, 90 dBA and 80 dBA L_{max} from an Athena III launch were calculated and plotted on vicinity maps. The distance from the launch sites to the three L_{max} noise levels were predicted using standard geometric acoustical dispersion. Athena III launch noise levels were predicted assuming 6 dB per doubling of distance, with a correction for the average temperature and humidity in Kodiak. This method produces circular noise contours surrounding each of the launch pads. This is considered an accurate prediction of maximum noise levels as the highest noise levels occur within the first few seconds of the launch. Because the maximum noise levels occur within the first few seconds of the launch, the trajectory of the launch vehicle is not represented in the maximum noise data plotted on the figures. The following plots were generated:

- Figure 7: Existing conditions assuming launches from Pads 1 and 2 only
- Figure 8: Future conditions with Athena III launches from Pad 3. Note that the noise from Athena III launches at Pad 3 is louder than small-lift launches at Pads 1 and 2. Therefore, this plot is the worst case L_{max}, Peak-C and SEL for any launch at any of the three pads
- Figure 9: A comparison of the existing conditions to the proposed project with launch Pad 3 for comparison



0 8,000 16,000 32,000

1.00 in

Approximate Scale 1 inch to 16,000 feet

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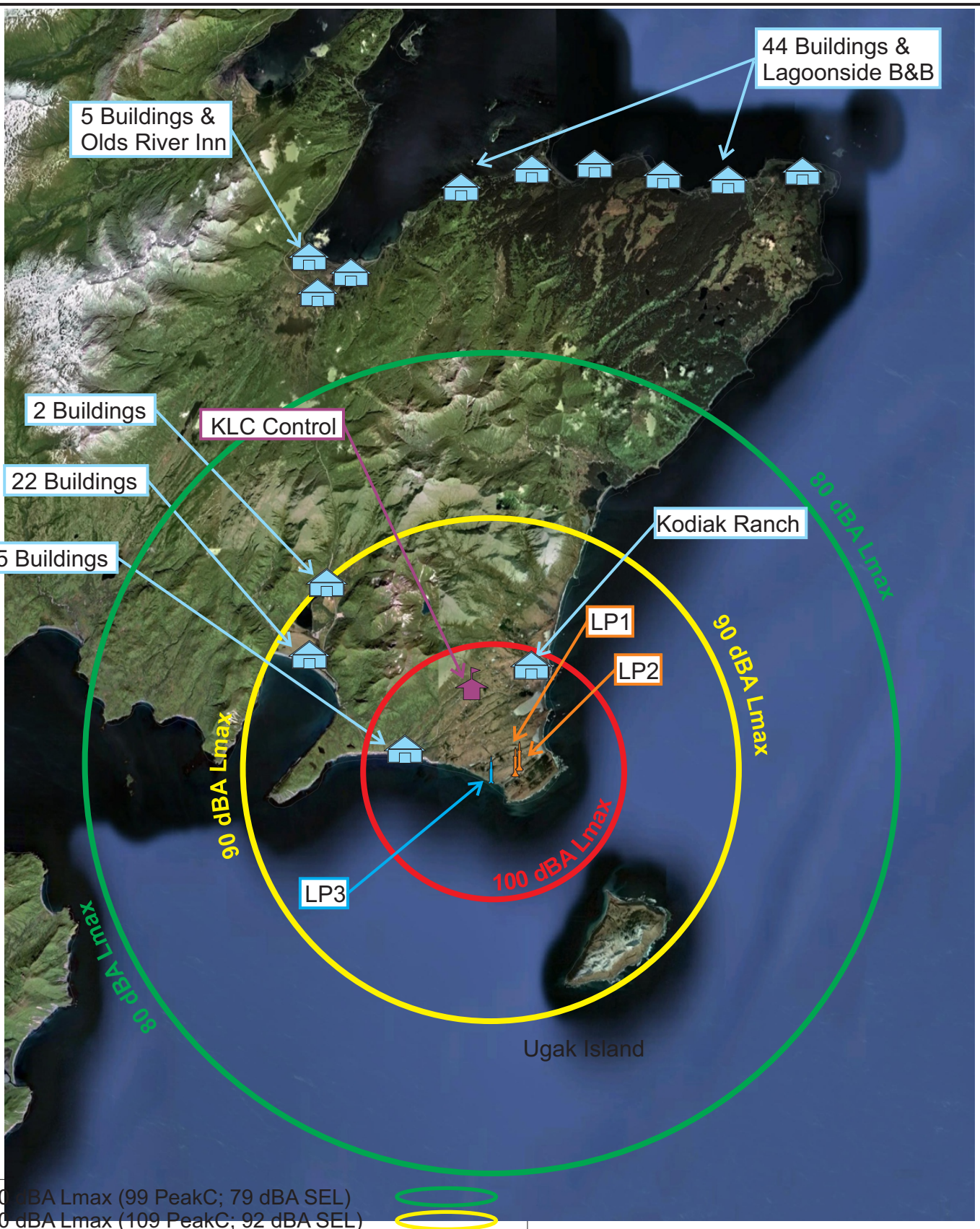
Figure 10
Existing Conditions Noise Contours
Launch Pads 1 and 2 Only
KLC Noise Analysis



0 8,000 16,000 32,000

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Approximate Scale 1 inch to 16,000 feet

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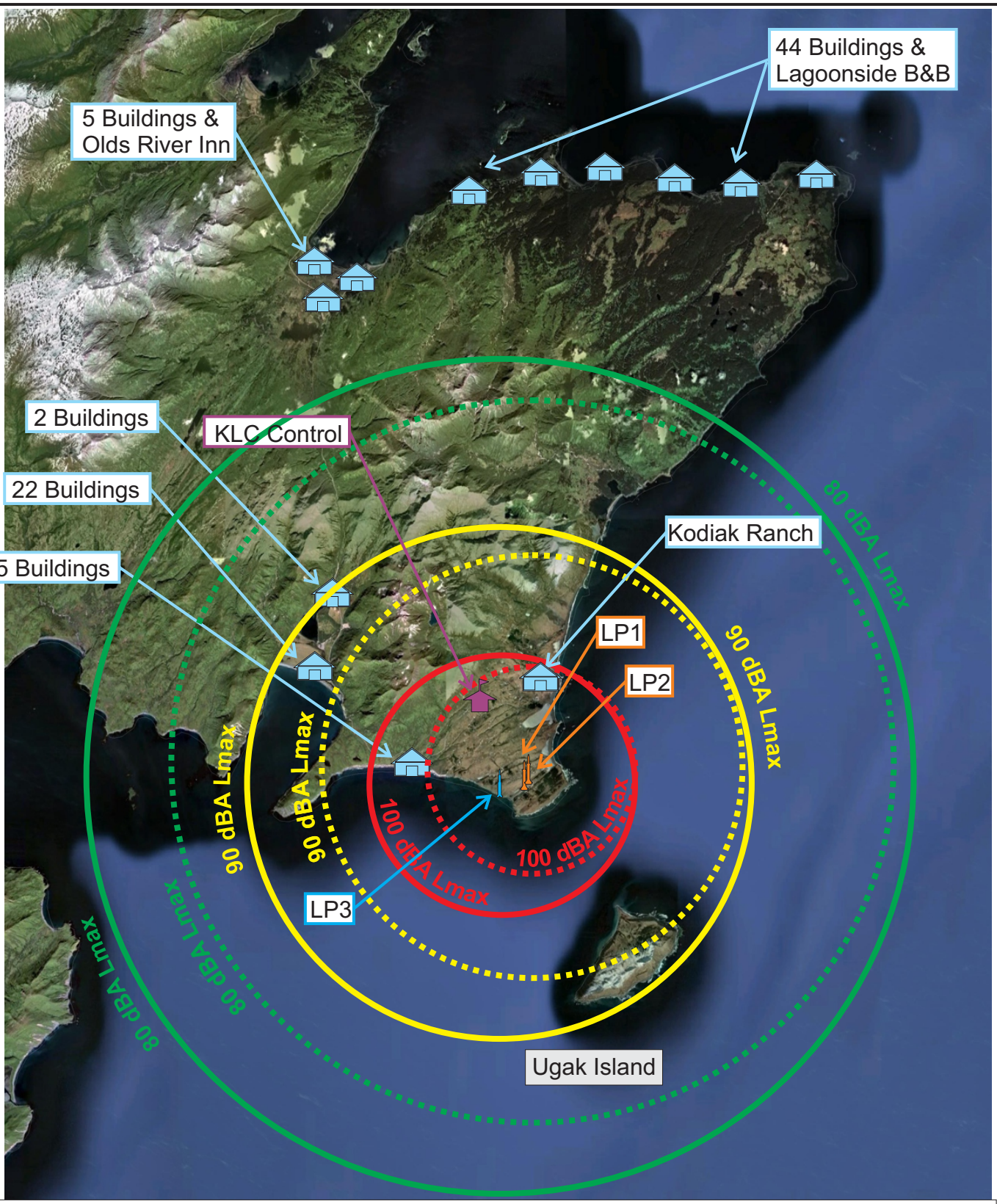
Figure 11
Future Conditions Noise Contours
Athena III from Launch Pad 3 Only
KLC Noise Analysis



80 dBA Lmax (99 PeakC; 79 dBA SEL)
90 dBA Lmax (109 PeakC; 92 dBA SEL)
100 dBA Lmax (119 PeakC; 104 dBA SEL)

Dashed Line are Existing Conditions for Launches at Pad 1 and 2 Only (see Figure 6)

0 8,000 16,000 32,000

1.00 in

Approximate Scale 1 inch to 16,000 feet

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Figure 12
Existing and Future Conditions Noise Level Contours
KLC Noise Analysis

As is shown on the previous figures, the main difference between the existing conditions and the proposed project with Pad 3 is the extension of the noise contours to the west/south west of the KLC. Launches at Pad 3 would increase the 100 dBA L_{max} short-term noise exposure to include the five structures located west of the complex. Although there is an increase in the L_{max} and other metrics of the maximum noise levels (Peak-C and SEL), the increase in the daily L_{dn} or the annual DNL is predicted at only 1 to 3 dBA. This is due to the fact that the noise from a launch is of a very short duration, as was shown previously in Figures 7 and 8. Figures 7 and 8 shows that the amount of time that the noise levels are above 75 dBA is less than 50 seconds per launch for small lift and most medium lift, and approximately 60 seconds for the Athena III. Furthermore, the maximum noise levels that exceed 100 dBA at a distance of 1 mile (5280 feet) is approximately 25 seconds for the medium-lift Athena III launch vehicle and only 12 to 15 seconds for a small-lift Minotaur IV launch vehicle.

To further illustrate the short duration of noise effect from a launch vehicle, Figure 13 provides a measured one-hour period with the launch of the Minotaur IV launch vehicle. This figure provides a view of the rocket launch as it is compared to the background noise levels and also shows how quickly the noise levels return back to ambient. Figure 13 shows that the rocket launch only affected the overall noise levels for less than 60 seconds. This would be increase to approximately 90 to 120 seconds with the launch of an Athena III, depending on the ambient at the time of launch.

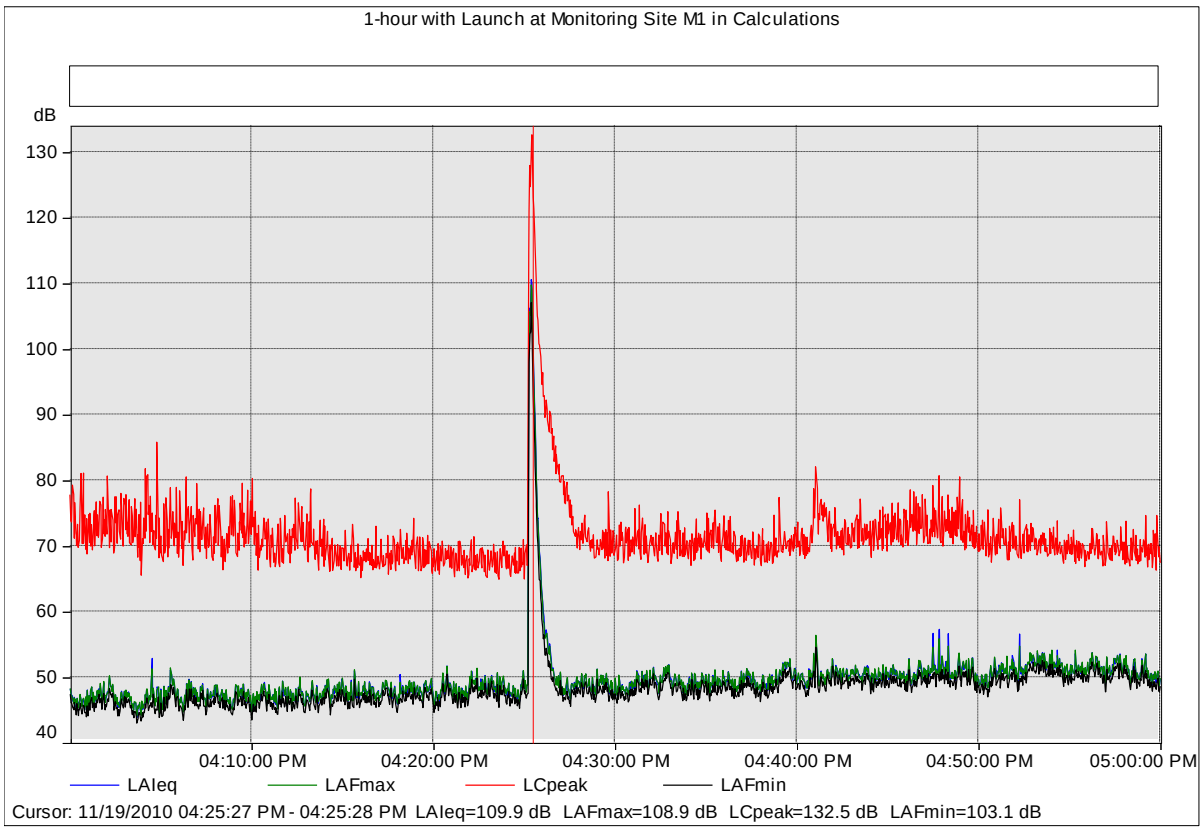

Figure 13. Time Record of Minotaur IV Launch at KLC

7. Project Noise Mitigation and Land Use Recommendations

The goal of the project noise mitigation and preventative measures would be to provide some form of noise mitigation for areas with noise impact and to prevent any future incompatible developments near the KLC. Because there are no currently developed areas outside the KLC that were identified with noise impacts, no mitigation measures are recommended.

Any new developments within the 65 dBA DNL would be located within KLC property. Therefore, it is assumed that any development on the KLC would be compatible with the land use of the KLC.

8. Project Construction

Although there are no residences close enough to the facility to be affected by construction noise, a brief analysis of potential construction noise and typical construction noise mitigation is provided for reference.

8.1. Construction noise Levels

Noise levels for construction activities can be expected to range from 70 to 95 dBA at sites 50 feet from the activities. Table 8 lists equipment typically used for constructing this type of project, the activities for which the equipment would be used, and the corresponding maximum noise levels under normal use measured at 50 feet.

Table 8. Typical Noise Levels from Construction Equipment

Equipment	Typical Expected Project Use	L_{max} [a, b] (dBA)
Air Compressor	Used for pneumatic tools and general maintenance—all phases	70–76
Backhoe	General construction and yard work	78–82
Concrete Pump	Pumping concrete	78–82
Concrete Saw	Concrete removal, utilities access	75–80
Crane	Materials handling, removal, and replacement	78–84
Excavator	General construction and materials handling	82–88
Haul Truck	Materials handling, general hauling	86
Jackhammer	Pavement removal	74–82
Loader	General construction and materials handling	86
Paver	Roadway paving	88
Power Plant	General construction use, nighttime work	72
Pump	General construction use, water removal	62
Pneumatic Tools	Miscellaneous construction work	78–86
Service Truck	Repair and maintenance of equipment	72
Tractor Trailer	Material removal and delivery	86
Utility Truck	General project work	72
Vibratory Equipment	Soil compacting for roadways	82–88
Welder	General project work	76

[a] Maximum noise level measured at a distance of 50 feet under normal operation.

[b] Sources of noise levels presented include the USDOT and other construction noise source.

8.2. Construction Noise mitigation

The following is a list of potential construction noise mitigation measures that could be used to maintain lower overall noise levels:

- Require all engine-powered equipment to have mufflers that were installed according to the manufacturer's specifications.
- Require all equipment to comply with pertinent EPA equipment noise standards.
- Locate stationary construction equipment as far from nearby noise-sensitive properties as possible.
- Shut off idling equipment.
- Notify nearby residents whenever extremely noisy work would be occurring.

9. Conclusion

The addition of Launch Pad 3 to the KLC is not predicted to result in any notable changes in the overall noise environment. The operation of the launch pad will increase the maximum noise levels to the west and southwest of the KLC during launches of medium-lift vehicles by 3 to 5 dBA L_{max}, however, the overall increase in the daily L_{dn} or the annual DNL is not measureable at most of the nearby residential properties. There is a slight increase of 4 dB to the DNL at the nearest properties to the facility, resulting in a future DNL of 49 dBA, well below the recommended 65 DNL for residences. Because the KLC is located in a rural area, there are few sensitive receivers near the complex, and all residences are far enough away from the proposed launch Pad 3 as not to be impacted from launch operations.

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Addendum 1
Ugak Island Noise Levels

This Addendum was prepared to assist the environmental team performing an analysis of the potential effects of launch noise on wildlife. Included is a summary of measured noise level from previous launches and projections of noise levels with the addition of launch pad 3.

Existing Launch Noise Levels

As described in Section 4 of the Noise Impact Analysis, detailed noise measurements were taken on Ugak Island for four SLBM launches and one launch of a Minotaur IV. The measurement site is shown on Figures 3 and 4 in the Noise Impact Analysis and a summary of the data is in Table A1. The SEL from previous SLBM launches at Ugak Island ranged from 90.3 dBA to 92.3 dBA, with an average of 90.9 dBA and a deviation of 1.19 dBA. L_{max} noise levels for SLBM's at Ugak Island ranged from 83.1 dBA to 86.0 dBA. The L_{max} from previous SLBM launches has a standard deviation of 1.39 dBA and the average level of 84.1 dBA. The peak noise levels for SLBM's ranged from 105.6 dBC to 109.0 dBC, with an average of 107.6 dBC and a standard deviation of 1.48 dBC. Noise levels from the Minotaur IV launch were measured at 90.4 L_{max}, 113.4 Peak-C and the SEL was 93.5. These levels exceed the average SLBM launches by 6.3 dB for the L_{max}, 5.8 dB for the Lpeak C-weighted, and 2.6 dB for the SEL.

Table A1. Launch Vehicle Measurements at Ugak Island

Noise Metric	Submarine Ballistic Missile Launches by Date					Minotaur IV	
	2/23/06	9/1/06	9/2//07	7/18/08	Average (previous launches)	11/19/10	Difference (average to 11/19/10)
L_{max}	86.0	83.1	84.2	83.0	**84.1**	90.4	+6.3
LPeak-C	109.0	105.6	107.3	108.3	**107.6**	113.4	+5.8
SEL	92.3	90.3	91.4	89.6	**90.9**	93.5	+2.6

To provide a better understanding of launch noise levels at Ugak Island, the measured data for the Minotaur IV launch is attached to this addendum. In order of presentation, the following plots were prepared:

1. **Ugak Island Launch Details in Calculations**
    a. The top of the first page is a graph of the launch showing the details over a 3 minute 30 second period. The graph shows the how the launch levels are reduced as the launch vehicle moves down range, and the noise levels at the measurement site are back to ambient within 1minuts 30 seconds to 1minute 40 seconds. The data at the bottom displays the noise levels at the cursor, which is set to the L_{max}
    b. The bottom of the first page is a display of the measured noise levels, and includes the L_{eq} over the 3 minute 30 second period, the L_{max}, SEL (LAE) and

the Peak-C (LCPeak) along with some statistical distributions of the noise levels over the measurement period. The statistical data (LA1, LA10, LA50 and LA90) are useful, as these levels are a good measurement of how long noise levels were elevated. For example, the LA1 noise level of 83.9 means that the noise levels were equal to, or above 83.9 dBA for 1 percent of the 3 minute 30 second period (210 seconds) or the A-weighted noise levels were above 90.4 dBA for 2.1 seconds. The LA10 (10 percent or 21 seconds) was 68.9 and the LA50 (105 seconds) was 48.9. Therefore, the noise levels were only above the typical ambient of approximately 45 to 50 dBA for approximately 105 seconds.

c. Page 2 is a detailed summary of the statistical data described above.

2. Ugak 1-hour with Launch in Calculations

a. The first page is a graph of the launch showing the details over a 1-hour period. This graph allows the reader to visually see how the launch affected the overall noise levels during a one hour period.

b. The bottom of the first page is a display of the measured noise levels, and includes the L_{eq}, L_{max}, SEL (LAE) and the Peak-C (LCPeak) along with some statistical distributions of the noise levels over the 1-hour period.

c. Page 2 is a detailed summary of the statistical data over the 1-hour period. As is shown, over a one hour period, noise levels only exceeded 64.3 dBA for 1% of the hour, or 36 seconds

3. Ugak 1-hour without Launch in Calculations

a. This data set provides a summary of the hour without the rocket launch. It is excluded from the measurement using Bruel & Kjaer software, and can be seen in the data, but is grayed out.

b. The bottom of the first page in this data set provides the hourly L_{eq}, L_{max}, SEL (LAE) and the Peak-C (LCPeak) along with some statistical distributions of the noise levels without the launch (Total or Unmarked row) and the excluded launch levels (Excluded row)

c. Page 2 is a detailed summary of the statistical data over the 1-hour period. As is shown, over a one hour period, for 90% of the time, noise levels are at or above 44.1 dBA, and for 50% of the time noise levels are at or above 45.7 dBA, however they only exceeded 50.5 dBA 1% of the hour.

The major noise source on Ugak Island is wind noise, with added noise from birds and waves. It is important to note that the measurement site was elevated on land, at approximately 200 feet above the water line. Therefore the meter did not capture noise from waves on the shoreline, which would be expected to elevate ambient noise levels to between 50 and 60 dBA, depending on the wave action.

The time it takes for A-weighted noise levels to return to ambient at the measurement site for a Minotaur IV launch was approximately 1 minute 30 seconds, and for the C-weighted levels,

it took slightly longer, at close to 5 minutes. However that after approximately 2 minutes, noise levels from the launch are so close to ambient that it would have a minimal overall effect on area noise levels.

Future Launch Noise Levels

Future noise levels with the launches from Pad 3 are not predicted to be substantially different then current launches. The maximum noise produced by the medium-lift rocket motors is slightly louder than the Minotaur IV rocket (5 to 6 dB), in addition, due to the larger payload, it would take slightly longer for the launch vehicles to leave the area, and therefore the noise levels are predicted be elevated for a longer period than the 1 minute 30 seconds for the Minotaur IV.

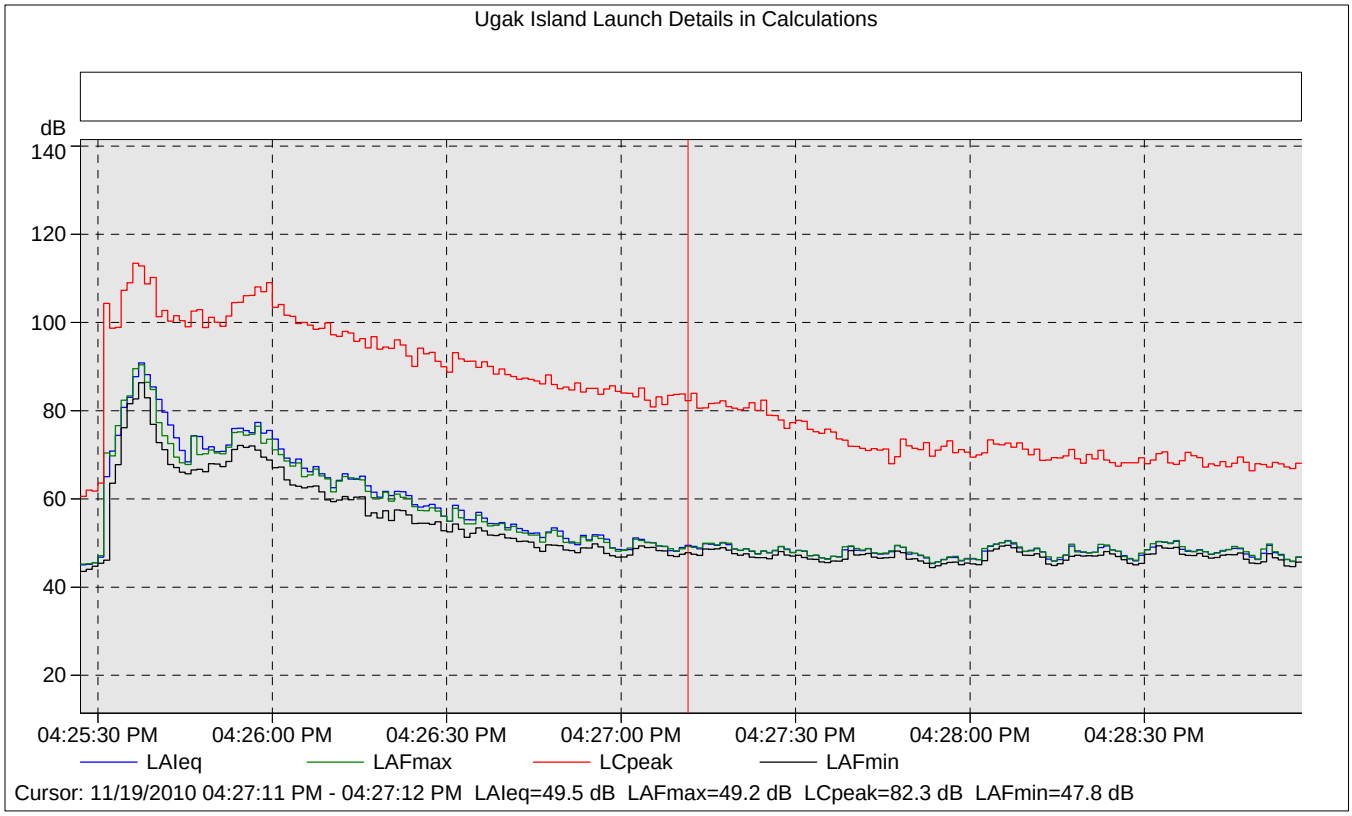
To provide a comparison that can be used by other disciplines, the overall hourly L_{eq}, L_{max}, SEL along with the calculated LA1, LA10, LA50 and LA90 and the time above ambient were projected for the Athena III using NAS8-11217. Table A2 has the results of the calculations and also compares the medium lift Athena III launch vehicle to the measured noise levels for a Minotaur IV rocket and an SLBM.

Table A2. Typical Launch Vehicle Noise Levels and Time above Ambient

Launch Vehicle Type	L_{eq}	L_{max}	LA1	LA10	LA50	LA90	SEL (LAE)	Time above ambient
Athena III	64.9[1]	96.1[1]	71.0[2]	54.6[2]	52.5[2]	50.8[2]	98.8[1]	1:54[1]
Minotaur IV	58.2	90.4	64.3	47.9	45.8	44.1	93.7	1:30
SLBM	54.5	83.0	65.5	46.3	43.6	41.3	90.0	1:30

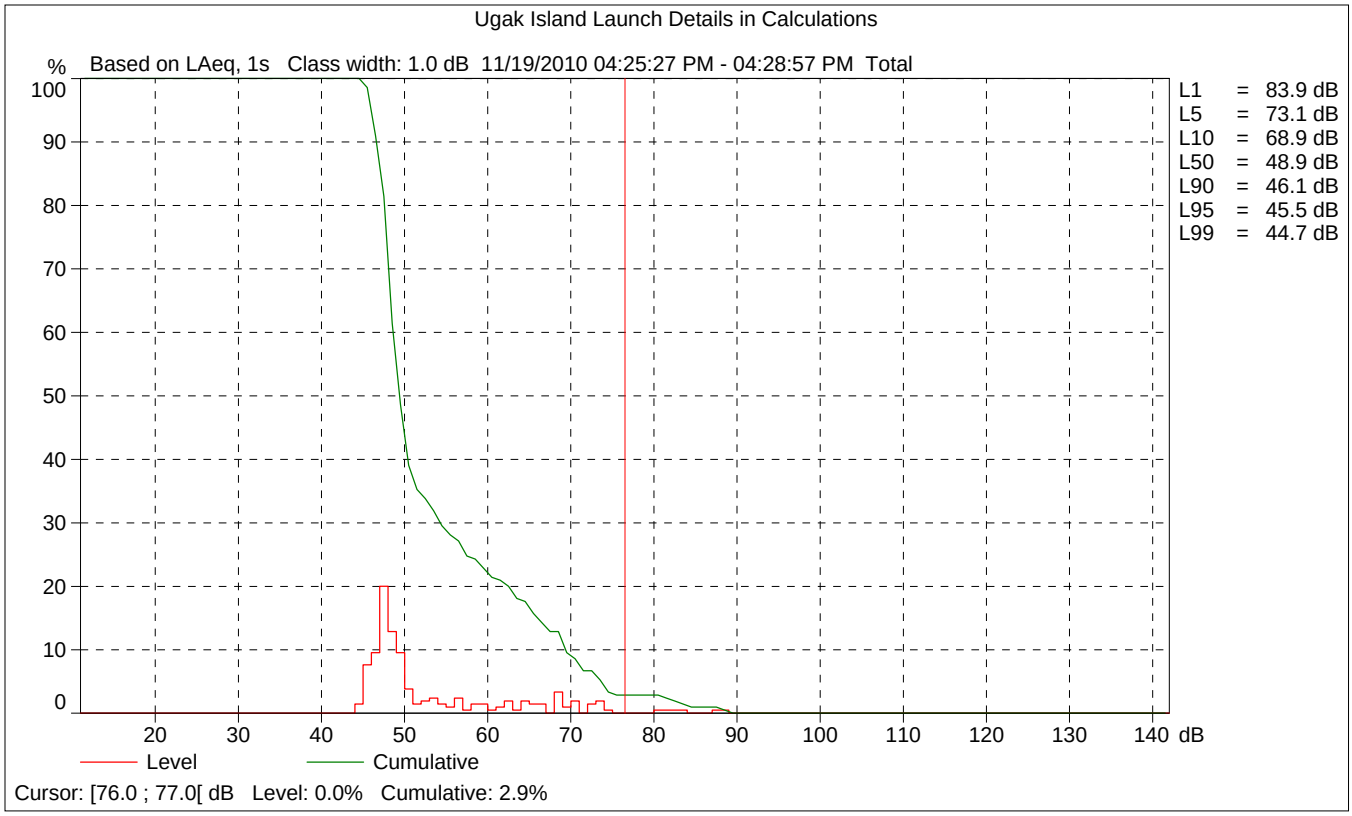
1. Predicted Athena III (RSRM) noise levels using NAS8-11217. See Figure 8 and Tables 4 and 5.
2. Estimated based on projections from NAS8-11217.

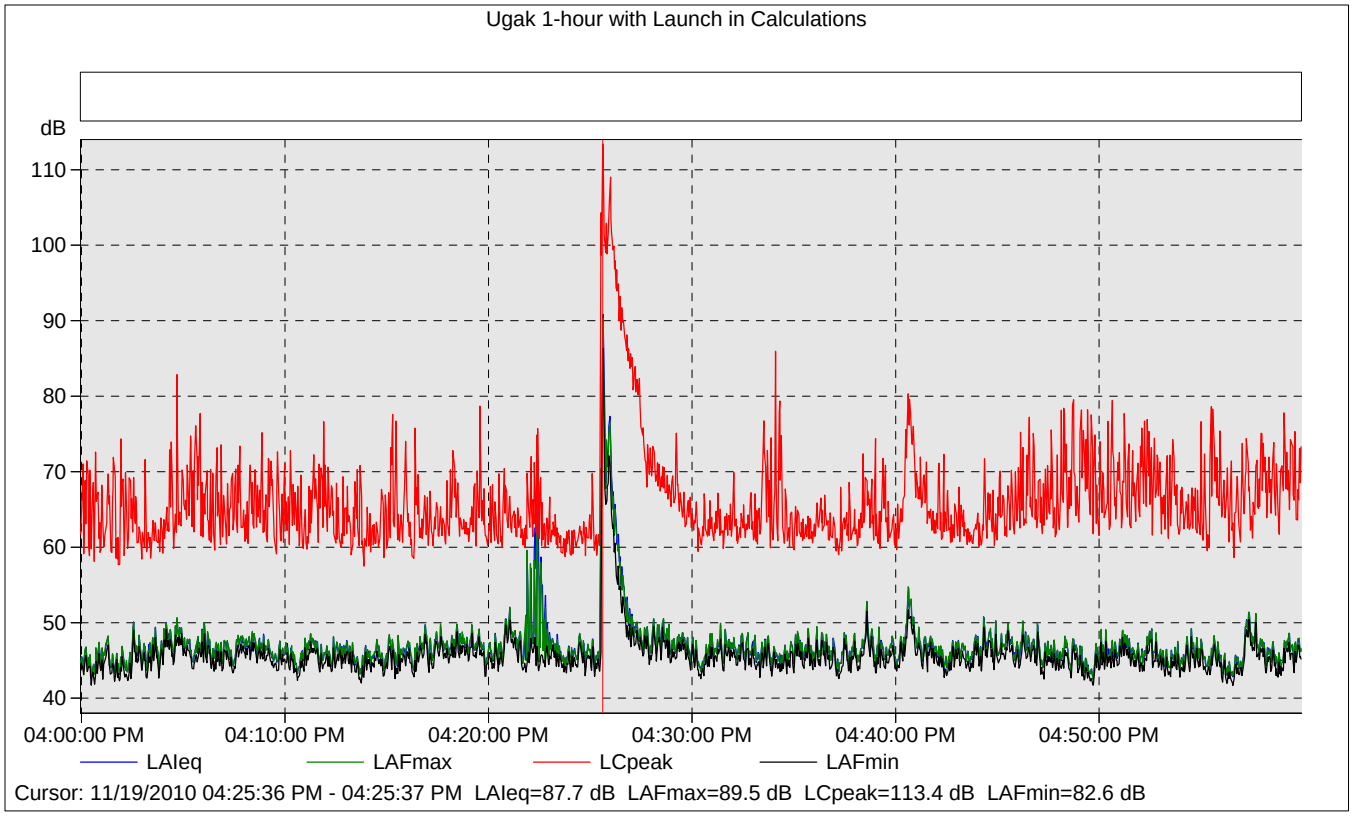
It is important to note that the time above ambient will vary with each launch and is dependent on the background level at the time of the launch. For example, during the launch of the SLBM in July 2008, winds were much calmer than during the 2010 launch of the Minotaur IV, resulting in a time above ambient that is approximately the same for both vehicles. However, the lower background, illustrated by the LA90, shows that the background levels were lower, increasing the time above ambient for the SLBM launch. The time above ambient is also expected to be lower near the shoreline, where waves splashing against the shoreline are predicted to increase the background ambient by 5 to 10 dBA or more, depending on the severity of the waves. In general, however, the actual difference between an Athena III medium-lift launch vehicle and small-lift vehicles in the Minotaur IV class is small, and would include a slightly louder initial launch (+5 to 6 dB), followed by a slightly longer time before noise levels return to ambient (approximately 25 seconds longer).



Ugak Island Launch Details in Calculations

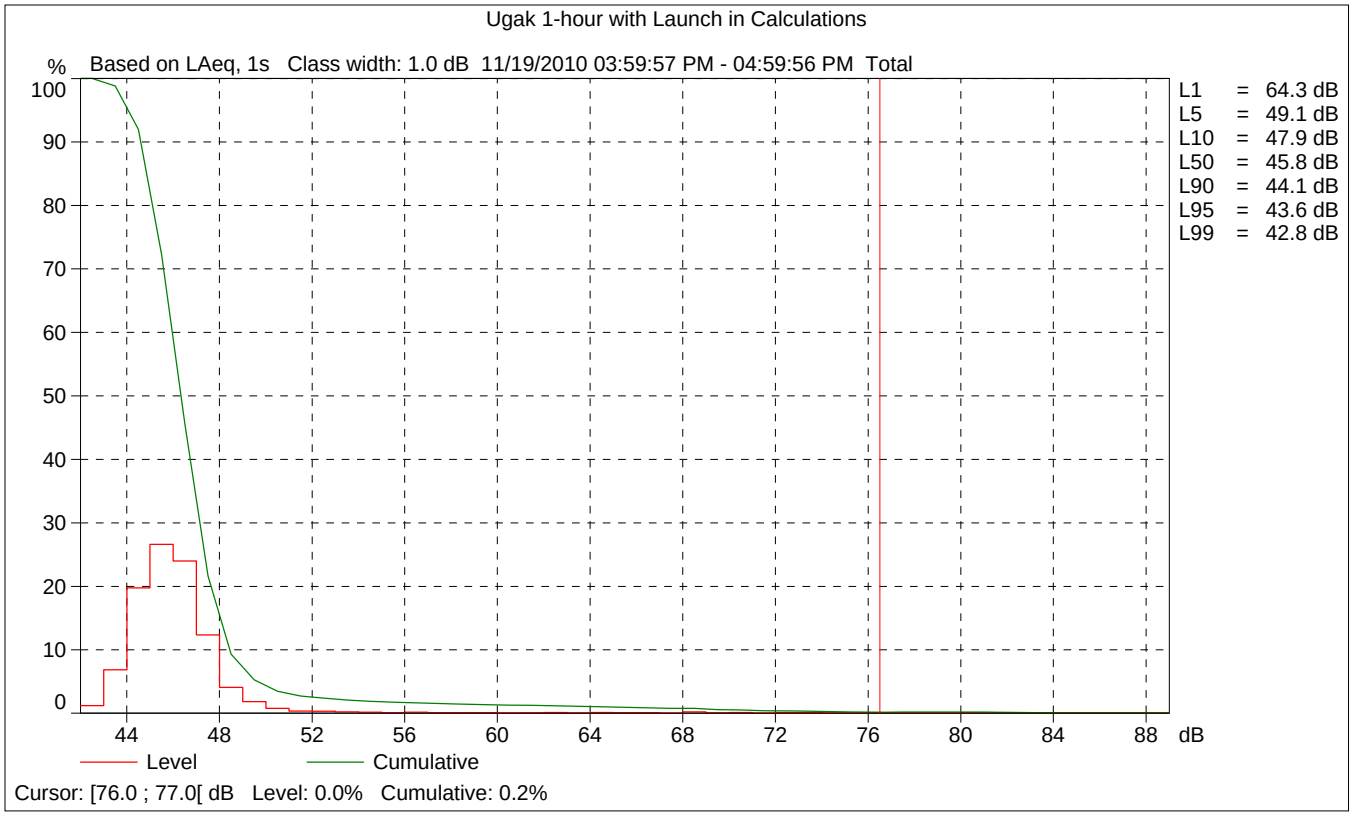
Name	Start time	LAeq [dB]	LAFmax [dB]	LA1 [dB]	LA10 [dB]	LA50 [dB]	LA90 [dB]	LAFmin [dB]	LAE [dB]	LCpeak [dB]
Total	11/19/2010 04:25:27 PM	70.2	90.4	83.9	68.9	48.9	46.1	43.6	93.5	113.4
Unmarked	11/19/2010 04:25:27 PM	70.2	90.4	83.9	68.9	48.9	46.1	43.6	93.5	113.4

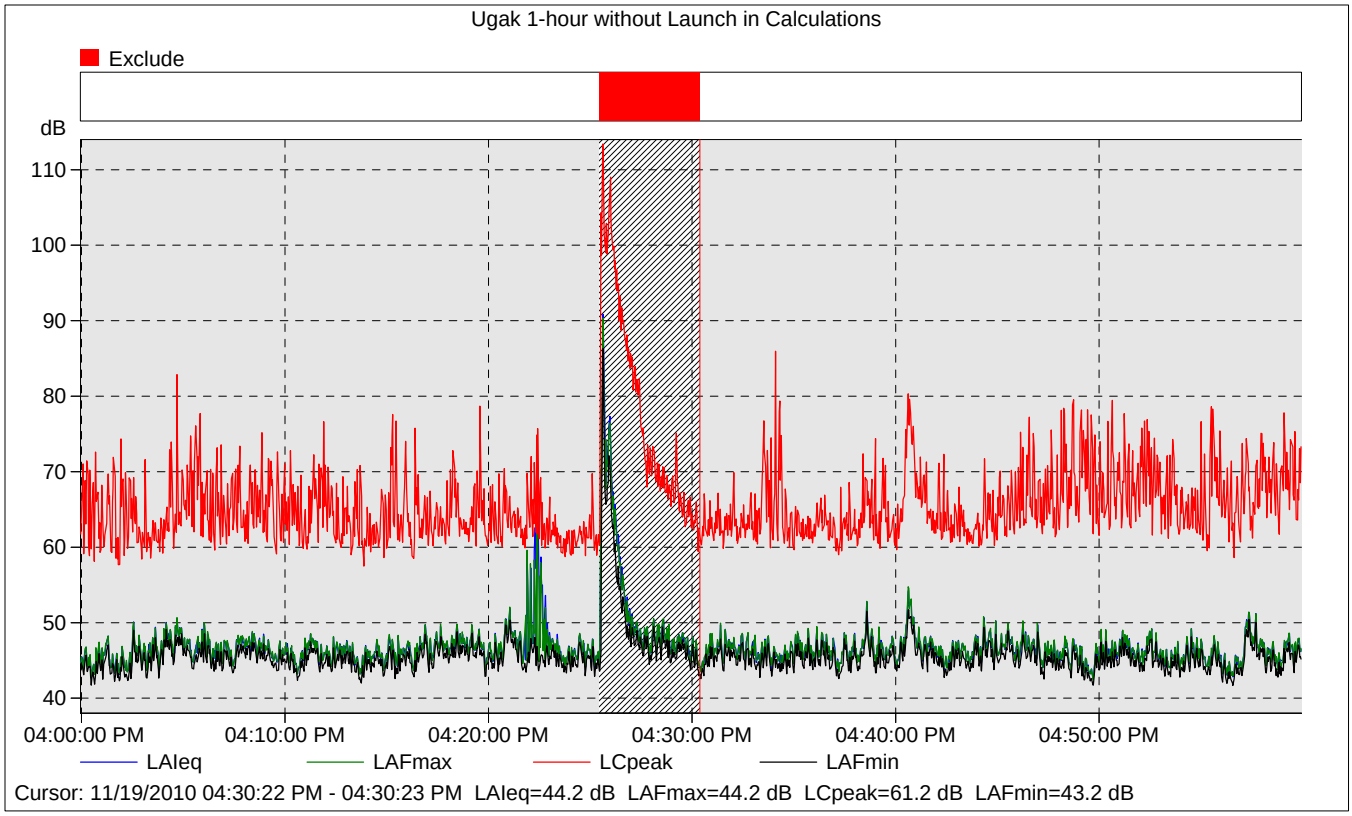

Ugak Island Launch Details in Calculations
% Based on LAeq, 1s Class width: 1.0 dB 11/19/2010 04:25:27 PM - 04:28:57 PM Total
100
90
80
70
60
50
40
30
20
10
0
20 30 40 50 60 70 80 90 100 110 120 130 140 dB
Level
Cumulative
L1 = 83.9 dB
L5 = 73.1 dB
L10 = 68.9 dB
L50 = 48.9 dB
L90 = 46.1 dB
L95 = 45.5 dB
L99 = 44.7 dB
Cursor: [76.0 ; 77.0[dB Level: 0.0% Cumulative: 2.9%



Ugak 1-hour with Launch in Calculations

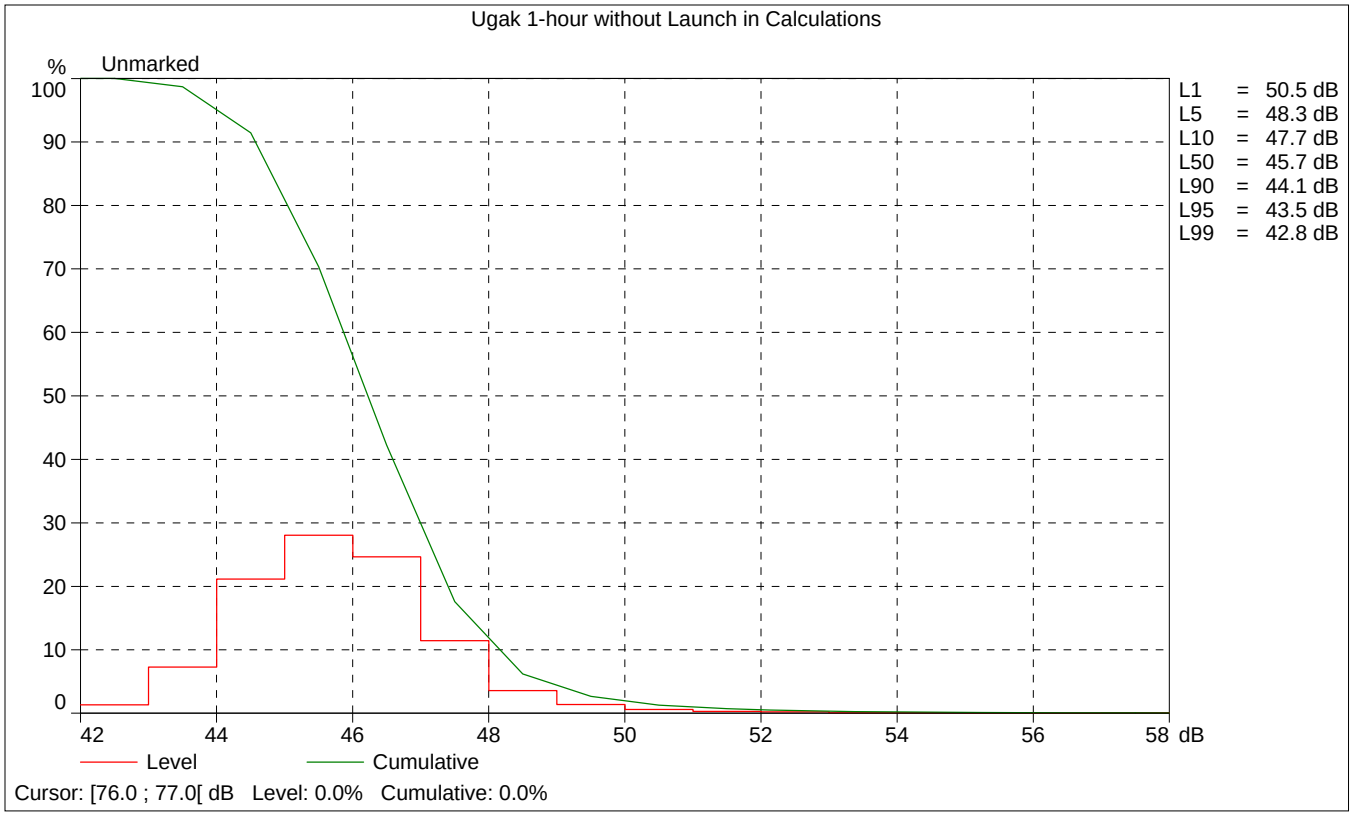
Name	Start time	LAeq [dB]	LAFmax [dB]	LA1 [dB]	LA10 [dB]	LA50 [dB]	LA90 [dB]	LAFmin [dB]	LAE [dB]	LCpeak [dB]
Total	11/19/2010 03:59:57 PM	58.2	90.4	64.3	47.9	45.8	44.1	41.7	93.7	113.4
Unmarked	11/19/2010 03:59:57 PM	58.2	90.4	64.3	47.9	45.8	44.1	41.7	93.7	113.4


Ugak 1-hour with Launch in Calculations
% Based on LAeq, 1s Class width: 1.0 dB 11/19/2010 03:59:57 PM - 04:59:56 PM Total
100
90
80
70
60
50
40
30
20
10
0
44
48
52
56
60
64
68
72
76
80
84
88
dB
L1 = 64.3 dB
L5 = 49.1 dB
L10 = 47.9 dB
L50 = 45.8 dB
L90 = 44.1 dB
L95 = 43.6 dB
L99 = 42.8 dB
Level
Cumulative
Cursor: [76.0 ; 77.0[dB Level: 0.0% Cumulative: 0.2%



Ugak 1-hour without Launch in Calculations

Name	Start time	LAeq [dB]	LAFmax [dB]	LA1 [dB]	LA10 [dB]	LA50 [dB]	LA90 [dB]	LAFmin [dB]	LAE [dB]	LCpeak [dB]
Total	11/19/2010 03:59:57 PM	46.1	65.0	50.5	47.7	45.7	44.1	41.7	81.3	86.0
Exclude	11/19/2010 04:25:26 PM	68.7	90.4	83.0	66.1	47.7	45.3	42.9	93.5	113.4
Unmarked	11/19/2010 03:59:57 PM	46.1	65.0	50.5	47.7	45.7	44.1	41.7	81.3	86.0
(All) Exclude	11/19/2010 04:25:26 PM	68.7	90.4	83.0	66.1	47.7	45.3	42.9	93.5	113.4
Exclude	11/19/2010 04:25:26 PM	68.7	90.4	83.0	66.1	47.7	45.3	42.9	93.5	113.4


Ugak 1-hour without Launch in Calculations
%
Unmarked
100
90
80
70
60
50
40
30
20
10
0
42
44
46
48
50
52
54
56
58
dB
L1 = 50.5 dB
L5 = 48.3 dB
L10 = 47.7 dB
L50 = 45.7 dB
L90 = 44.1 dB
L95 = 43.5 dB
L99 = 42.8 dB
Level
Cumulative
Cursor: [76.0 ; 77.0[dB Level: 0.0% Cumulative: 0.0%

Addendum 2

FAA Land Use Compatibility with Yearly Day-Night Average Sound Levels

Land use	Yearly Day-Night Average Sound Level (DNL) in A-Weighted Decibels (dBA)					
	Below 65	65–70	70–75	75–80	80–85	Over 85
Residential						
Residential, other than mobile homes and transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoriums, and concert halls	Y	25	30	N	N	N
Governmental services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail—building materials, hardware and farm equipment	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail trade—general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts and camps	Y	Y	Y	N	N	N
Golf courses, riding stables and water recreation	Y	Y	25	30	N	N

Numbers in parentheses refer to notes.

*The designations contained in this table do not constitute a Federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise compatible land uses.

Key to Table 1

SLUCM=Standard Land Use Coding Manual.

Y (Yes)=Land Use and related structures compatible without restrictions.

N (No)=Land Use and related structures are not compatible and should be prohibited.

NLR=Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

25, 30, or 35=Land use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structure.

Notes for Table 1

(1) Where the community determines that residential or school uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide a NLR of 20 dB, thus, the reduction requirements are often stated as 5, 10 or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year round. However, the use of NLR criteria will not eliminate outdoor noise problems.

(2) Measures to achieve NLR 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

(3) Measures to achieve NLR of 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.

(4) Measures to achieve NLR 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal level is low.

(5) Land use compatible provided special sound reinforcement systems are installed.

(6) Residential buildings require an NLR of 25.

(7) Residential buildings require an NLR of 30.

(8) Residential buildings not permitted.

Sec. A150.103 Use of computer prediction model.

(a) The airport operator shall acquire the aviation operations data necessary to develop noise exposure contours using an FAA approved methodology or computer program, such as the Integrated Noise Model (INM) for airports or the Heliport Noise Model (HNM) for heliports. In considering approval of a methodology or computer program, key factors include the demonstrated capability to produce the required output and the public availability of the program or methodology to provide interested parties the opportunity to substantiate the results.

(b) Except as provided in paragraph (c) of this section, the following information must be obtained for input to the calculation of noise exposure contours:

(1) A map of the airport and its environs at an adequately detailed scale (not less than 1 inch to 2,000 feet) indicating runway length, alignments, landing thresholds, takeoff start-of-roll points, airport boundary, and flight tracks out to at least 30,000 feet from the end of each runway.

(2) Airport activity levels and operational data which will indicate, on an annual average-daily-basis, the number of aircraft, by type of aircraft, which utilize each flight track, in both the standard daytime (0700–2200 hours local) and nighttime (2200–0700 hours local) periods for both landings and takeoffs.

(3) For landings—glide slopes, glide slope intercept altitudes, and other pertinent information needed to establish approach profiles along with the engine power levels needed to fly that approach profile.

(4) For takeoffs—the flight profile which is the relationship of altitude to distance from start-of-roll along with the engine power levels needed to fly that takeoff profile; these data must reflect the use of noise abatement departure procedures and, if applicable, the takeoff weight of the aircraft or some proxy for weight such as stage length.

(5) Existing topographical or airspace restrictions which preclude the utilization of alternative flight tracks.

(6) The government furnished data depicting aircraft noise characteristics (if not already a part of the computer program's stored data bank).

(7) Airport elevation and average temperature.

(c) For heliports, the map scale required by paragraph (b)(1) of this section shall not be less than 1 inch to 2,000 feet and shall indicate heliport boundaries, takeoff and landing pads, and typical flight tracks out to at least 4,000 feet horizontally from the landing pad. Where these flight tracks cannot be determined, obstructions or other limitations on flight tracks in and out of the heliport shall be identified within the map areas out to at least 4,000 feet horizontally from the landing pad. For static operation (hover), the helicopter type, the number of daily operations based on an annual average, and the duration in minutes of the hover operation shall be identified. The other information required in paragraph (b) shall be furnished in a form suitable for input to the HNM or other FAA approved methodology or computer program.

Sec. A150.105 Identification of public agencies and planning agencies.

(a) The airport proprietor shall identify each public agency and planning agency whose jurisdiction or responsibility is either wholly or partially within the L_{dn}65 dB boundary.

(b) For those agencies identified in (a) that have land use planning and control authority, the supporting documentation shall identify their geographic areas of jurisdiction.

Addendum 3

Energy Average Noise Level Calculations

Energy average noise projections were performed in using two basic steps. Step1 was to establish the typical hour L_{eq} for different times of the day, evening and nighttime. The hourly L_{eq}'s were derived from measured noise levels taken near the KLC before and after launches. Hourly L_{eq}'s were developed for periods between launches, when activities in and around the KLC were at a minimum, and for the 2 weeks leading up to a launch, when there would be significantly more traffic and general activity near the KLC. Finally, hourly L_{eq}'s were also developed for launch day, with the assumption that all launches would occur between the hours of 7:00 am and 10:00 pm. Table AD3-1 provides the KLC typical hourly L_{eq} noise levels based on activity levels, as described above. The DNL is projected assuming nine launches per year, with 239 days of low activity, 117 days of pre-launch activity (13 days per launch) and one launch day.

Table AD3-1. Hourly L_{eq} and Daily Ldn at the KLC

	Low Activity	Pre-Launch	Launch Day
Morning (7 – 9 am)	42 dBA L_{eq}	47 dBA L_{eq}	47 dBA L_{eq}
Daytime (10 am – 4 pm)	56 dBA L_{eq}	66 dBA L_{eq}	66 dBA L_{eq}
Evening (5 – 7 pm)	52 dBA L_{eq}	57 dBA L_{eq}	57 dBA L_{eq}
Late Evening (8 – 9 pm	50 dBA L_{eq}	55 dBA L_{eq}	55 dBA L_{eq}
Early Night (10 – 11 pm)	48 dBA L_{eq}	53 dBA L_{eq}	53 dBA L_{eq}
Nighttime (midnight – 4 am)	40 dBA L_{eq}	45 dBA L_{eq}	45 dBA L_{eq}
Early Morning (5 – 6 am	42 dBA L_{eq}	47 dBA L_{eq}	47 dBA L_{eq}
Launch Hour	N/A	N/A	83 dBA L_{eq}
Daily L_{dn}	54 dBA L_{dn}	62 dBA L_{dn}	69 dBA L_{dn}
Projected DNL at KLC	**59 dBA with Nine Athena III Launches per Year**		
DNL assumes 239 days @ 54 dBA L_{dn}, 117 days at 62 dBA L_{dn}, and one day @ 69 dBA L_{dn}.			

For sites located near the KLC, the DNL was predicted at 45 to 49 dBA. For all the building sites analyzed, except building group A (building groups B, C, D and E and Ugak Island), the DNL remained at 45 dBA regardless of the extra activity from rocket launches due to the large distance from the buildings to the KLC. At group A the DNL was projected at 49 dBA, or 4 dBA higher than the existing DNL and well below the 65 DNL recommended maximum. If nine launches of a Minotaur IV were to occur at pad 2 or 3, the DNL at site B (Kodiak Ranch) would be predicted to increase by 1 dBA to 46 dBA DNL.

APPENDIX B

National Marine Fisheries Service Letter of Authorization, 2013-2014

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

JUL 16 2013

Craig E. Campbell
President and CEO
Alaska Aerospace Corporation
4300 B Street, Suite 101
Anchorage, AK 99503

Dear Mr. Campbell:

On July 1, 2013, the National Marine Fisheries Service (NMFS) received a letter from the Alaska Aerospace Corporation (AAC) requesting renewal of a Letter of Authorization (LOA), under regulations issued on March 23, 2011 (76 FR 16300). Enclosed is an LOA issued to the AAC for the take of marine mammals incidental to rocket launches at the Kodiak Launch Complex. This LOA is valid from August 1, 2013 through July 31, 2014.

This authorization is effective for 1 year, and covers the taking of Steller sea lions (*Eumetopias jubatus*) and Pacific harbor seals (*Phoca vitulina richardii*) incidental to a maximum of twelve rocket launches, provided the mitigation, monitoring, and reporting requirements are undertaken as required by the regulations and the LOA. Please note that according to 50 CFR 217.74(a), the AAC must avoid launches during the harbor seal pupping season (May 15-June 30). In addition, the AAC must cooperate with any federal, state, or local agency monitoring the impacts of your activities, and submit a draft report to the NMFS Office of Protected Resources and the NMFS Alaska Regional Office no later than 90 days prior to expiration of this authorization.

If you have any questions concerning the LOA or its requirements, please contact Michelle Magliocca, Office of Protected Resources, National Marine Fisheries Service at (301) 427-8426.

Sincerely,

for Donna S. Wieting, Director
Office of Protected Resources

Enclosures

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, MD 20910

DEPARTMENT OF COMMERCE

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

NATIONAL MARINE FISHERIES SERVICE

Letter of Authorization

The Alaska Aerospace Corporation (AAC), 4300 B Street, Suite 101, Anchorage, Alaska, 99503, is hereby authorized under section 101(a)(5)(A) of the Marine Mammal Protection Act (16 U.S.C. 1361 et seq.; MMPA) to take small numbers of marine mammals incidental to space vehicle and missile launch operations from the Kodiak Launch Complex (KLC) on Kodiak Island, Alaska subject to the provisions of the MMPA, the Regulations Governing Small Takes of Marine Mammals Incidental to Specified Activities (50 CFR Part 217, Subpart H) (the Regulations), and the following conditions:

1. This Authorization is valid from August 1, 2013 through July 31, 2014.

2. This Authorization is valid only for the unintentional taking of the species of marine mammals identified in 50 CFR 217.70(b) and Condition 3 of this Authorization incidental to activities associated with a maximum of twelve rocket launches from the KLC on the eastern side of Kodiak Island, Alaska.

3. This Authorization is valid for the taking, by harassment only, of Steller sea lions (*Eumetopias jubatus*), and for the taking, by harassment (adults or pups) or mortality (pups only) of Pacific harbor seals (*Phoca vitulina richardsi*). The taking by serious injury or death of Steller sea lions or adult harbor seals, or the taking by harassment, injury or death of any other species of marine mammal is prohibited and may result in the modification, suspension, or revocation of this Authorization.

4. The taking of any marine mammal in a manner prohibited under this Authorization must be reported within 48 hours of the taking to the National Marine Fisheries Service (NMFS) Alaska Assistant Regional Administrator for Protected Resources and to the NMFS Division of Permits and Conservation, Office of Protected Resources. If injurious or lethal take is discovered during monitoring, launch procedure, mitigation measures, and monitoring methods must be reviewed in coordination with NMFS, and appropriate changes made prior to the next launch.

5. Notification:

The holder must notify the NMFS Alaska Assistant Regional Administrator for Protected Resources and the NMFS Division of Permits and Conservation, Office of Protected Resources, at least 2 weeks prior to launches (unless constrained by the date of issuance of this Authorization).

6. Mitigation Requirements:

The Holder of this Authorization, and any individuals operating under his authority, must conduct the activity identified in 50 CFR 217.70 and Condition 2 of this Authorization in a manner that minimizes, to the greatest extent practicable, adverse impacts on marine mammals and their habitats. When conducting operations identified in 50 CFR 217.70, the following mitigation measures must be implemented:

(a) Security overflights associated with a launch will not approach occupied pinniped haulouts on Ugak Island by closer than 0.25 mile (0.4 km), and will maintain a vertical distance of 1,000 feet (305 m) from the haul outs when within 0.5 miles (0.8 km), unless indications of human presence or activity warrant closer inspection of the area to assure that national security interests are protected in accordance with law.

(b) Missile and rocket launches must be avoided during the harbor seal pupping season of May 15 through June 30, except when launches are necessary for the following purposes: human safety, national security, space vehicle launch trajectory necessary to meet mission objectives, or other purposes related to missile or rocket launches.

(c) All flights by fixed-wing aircraft associated with the marine mammal abundance quarterly surveys must maintain a minimum altitude of 500 feet (152 m) and remain 0.25 miles from recognized seal haul outs.

(d) If launch monitoring or quarterly aerial surveys indicate that the distribution, size, or productivity of the potentially affected pinniped populations has been affected due to the specified activity, the launch procedures and the monitoring methods will be reviewed, in cooperation with NMFS, and, if necessary, appropriate changes may be made through modifications to this Authorization, prior to conducting the next launch of the same vehicle.

7. Monitoring

When conducting operations identified in 50 CFR 217.70, the Holder of this Authorization, and any individuals operating under his authority, must implement the following monitoring measures:

(a) Designate qualified protected species observers to:

(1) Deploy for the Holder a remote camera system designed to detect pinniped responses to rocket launches for at least the first five launches conducted under these regulations. The AAC will conduct visual monitoring for at least 2 hours before, during, and 2 hours after launch;

(2) Ensure a remote camera system is in place and operating in a location which allows visual monitoring of a harbor seal rookery during the launch, if a launch during the harbor seal pupping season cannot be avoided;

(3) Relocate the camera system to, or re-aim the camera system on, another haulout to be chosen in cooperation with NMFS after the first five launches with harbor seals present;

(4) Review and log pinniped presence, behavior, and re-occupation time data from the visual footage obtained from the remote camera system;

(5) Obtain, whenever a new class of rocket is flown from the Kodiak Launch Complex, a real-time sound pressure and sound exposure record for documentation purposes and to correlate with the behavioral response record. Two monitors shall be used: one shall be placed at the established recording location known as Narrow Cape, and the other as close as practical to the remote video system; and

(6) Conduct quarterly aerial surveys, ideally during midday coinciding with low tide, to obtain data on pinniped presence, abundance, and behavior within the action area to determine long-term trends in pinniped haul-out use.

(b) The holder of the Letter of Authorization must comply with any other applicable state or federal permits, regulations, and environmental monitoring agreements set up with other agencies and cooperate with NMFS and any other federal, state, or local agency with authority to monitor the impacts of the activity on marine mammals.

(c) AAC must inform NMFS immediately of any proposed changes or deletions to any portions of the monitoring requirements.

8. Reporting:

The Holder of the Letter of Authorization must implement the following reporting requirements:

(a) Notify the Administrator, Alaska Region, NMFS, by letter, email, or telephone, prior to each launch.

(b) Report results from the remote camera system footage and any other data from monitoring activities to NMFS within 90 days following cessation of field activities for each launch. A summary of the effectiveness of the videotaping will be included in the associated launch report.

(c) Holder must submit a report to the Alaska Region Administrator, NMFS, and to the NMFS Division of Permits and Conservation, Office of Protected Resources within 90 days after each launch. This report must contain the following information:

(1) Date(s) and time(s) of the launch;

(2) Location of camera system and acoustic recorders (if used);

(3) Design of the monitoring program and a description of how data is stored and analyzed; and

(4) Results of the monitoring program, including, by not necessarily limited to:

(i) Numbers of pinnipeds, by species and age class (if possible) present on the haul out prior to commencement of the launch;

(ii) Numbers of pinnipeds, by species and age class (if possible) that may have been harassed, including the number that entered the water as a result of launch noise;

(iii) The length of time pinnipeds remained off the haul out during post-launch monitoring;

(iv) Number of harbor seal pups that may have been injured or killed as a result of the launch; and

(v) Other behavioral modifications by pinnipeds that were likely the result of launch noise.

(5) Results of sound pressure and sound exposure level monitoring will be reported in flat weighted, A-weighted, and peak measurements.

(d) An annual report must be submitted at the time of request for a renewal of this Authorization; it will include results of the aerial quarterly trend counts of pinnipeds at Ugak Island.

(e) A final report must be submitted at least 90 days prior to expiration of the governing regulations if new regulations are sought or 180 days after expiration of the governing regulations otherwise. This report will:

(1) Summarize the activities undertaken and the results reported in all previous reports;

(2) Assess the impacts of launch activities on pinnipeds within the action area, including potential for pup injury and mortality; and

(3) Assess the cumulative impacts on pinnipeds and other marine mammals from multiple rocket launches.

(f) Reports required in Conditions 8(b), (c), (d), (e) above will be subject to review and comment by NMFS. Any recommendations made as a result of such review must be addressed prior to acceptance by NMFS.

(g) In the unanticipated event that launch activities clearly cause the take of a marine mammal in a manner prohibited by this Authorization, such as an injury (Level A harassment), serious injury, or mortality to a Steller sea lion, the AAC shall immediately cease launch activities and report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, at 301-427-8401 and/or by email to Michael.Payne@noaa.gov and Michelle.Magliocca@noaa.gov and the Alaska Regional Stranding Coordinator (Aleria.Jensen@noaa.gov). The report must include the following information:

(1) time, date, and location (latitude/longitude) of the incident;

(2) the type of rocket involved;

(3) description of the incident;

(4) description of marine mammal observations in the 24 hours preceding the incident;

(5) species identification or description of the animal(s) involved;

(6) the fate of the animal(s); and

(7) and photographs or video footage of the animal (if equipment is available).

Activities shall not resume until NFMS is able to review the circumstances of the prohibited take. NMFS shall work with the AAC to determine what is necessary to

minimize the likelihood of further prohibited take and ensure MMPA compliance. The AAC may not resume their activities until notified by NMFS via letter, email, or telephone.

(h) In the event that the AAC discovers an unauthorized injured or dead marine mammal, and the lead PSO determines that the cause of the injury or death is unknown and the death is relatively recent (i.e., in less than a moderate state of decomposition as described in the next paragraph), the AAC will immediately report the incident to the Acting Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, at 301-427-8401, and/or by email to Michael.Payne@noaa.gov and Michelle.Magliocca@noaa.gov and the Alaska Regional Stranding Coordinator (Aleria.Jensen@noaa.gov). The report must include the same information identified in Condition 8(g) above. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with the AAC to determine whether modifications in the activities are appropriate.

(i) In the event that the AAC discovers an injured or dead marine mammal, and the lead PSO determines that the injury or death is not associated with or related to the activities authorized in Condition 3 of this Authorization (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), the AAC shall report the incident to the Acting Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, at 301-427-8401, and/or by email to Michael.Payne@noaa.gov and Michelle.Magliocca@noaa.gov and the Alaska Regional Stranding Coordinator (Aleria.Jensen@noaa.gov), within 24 hours of the discovery. The AAC shall provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network. Activities may continue while NMFS reviews the circumstances of the incident.

9. Activities related to the monitoring described in this Authorization and as described in the holders application, do not require a separate scientific research permit issued under section 104 of the MMPA.

10. Failure to comply with the terms and conditions contained in Subpart H – Taking of Marine Mammals Incidental to Space Vehicle and Missile Launch Operations at Kodiak Launch Complex, Alaska (50 CFR 217.70-217.78) may result in the modification, suspension or revocation of this Authorization.

11. A copy of this Authorization and the attached Subpart H of the regulations must be in the possession of each observer or group operating under the authority of this Letter of Authorization.

12. The Holder of this Authorization is required to comply with the Terms and Conditions of the Incidental Take Statement corresponding to NMFS' Biological Opinion as they pertain to listed marine mammals.

for Donna S. Wieting
Director
Office of Protected Resources
National Marine Fisheries Service

July 16, 2013
Date

APPENDIX C

U.S. Fish and Wildlife Service Consultation, 14 December 2012

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Anchorage Fish & Wildlife Field Office
605 West 4th Avenue, Room G-61
Anchorage, Alaska 99501-2249

In reply refer to: AFWFO

December 14, 2012

Emailed to:
Michael McElligott
Office of the Associate Administrator for Commercial Space Transportation
Federal Aviation Administration
800 Independence Ave. SW
Washington, DC 20591

Re: Kodiak Launch Complex Expansion (*Consultation Number 2012-0127*)

Dear Mr. McElligott,

Thank you for your letter of October 31, 2012, regarding threatened and endangered species that may be affected by the proposal to expand launch capabilities at the Kodiak Launch Complex (KLC). Because KLC is a commercial launch facility, the FAA has regulatory authority in licensing its operation. The U.S. Fish and Wildlife Service (the Service) is responding to your request for concurrence with the determination that construction and operation of expanded facilities is not likely to adversely affect species listed under the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq*., as amended, ESA). The Service has previously reviewed the existing operations of the KLC and found these not likely to adversely affect listed species in the area (e.g., consultation numbers 2002-132, 2004-093, 2006-065). This consultation addresses the proposed changes to the facility and does not negate or alter prior consultations.

Project Description
Alaska Aerospace Corporation (AAC) is proposing to expand the launch capabilities of the KLC. The existing license currently authorizes only small-lift operations. The FAA will modify the current license to expand launch capabilities to include medium-lift launch capability and to add new infrastructure to support these launches, including: a new launch pad; a vehicle processing facility; rocket staging facility; liquid fuel facility; and the mission control center. Additionally, modifications would be made to Pasagshak Point Road to access these facilities. The combination of small-lift and medium-lift vehicles launched from KLC will not exceed a combined total of 9 launches per year.

ESA-Listed Species
Our records indicate the following species listed under the ESA may be found within the action area of the proposed project: Alaska breeding population of Steller's eider (*Polysticta stelleri*,

listed as threatened in 1997) and the southwest distinct population segment of northern sea otter (*Enhydra lutris kenyoni,* listed as threatened in 2005). Critical habitat for the sea otter is found in all marine waters of Kodiak that are within 100 meters of the shore and up to 20 meters deep. The short-tailed albatross (*Phoebastria albatrus*, listed as endangered in 2000) is occasionally seen in the vicinity, but is not expected to occur in the construction area, and is highly unlikely to be present during any single rocket launch. Therefore no effects to this species are anticipated. The Kittlitz's murrelet (*Brachyramphus brevirostris*), and yellow-billed loon (*Gavia adamsii*) may also be found in the project area. The Kittlitz's murrelet and yellow-billed loon are candidates for listing under the ESA. Candidate species receive no formal protection; however, FAA has determined that the project is not likely to adversely affect these species. Assessment of impacts to these species at this time will simplify reinitiation of consultation should these species become listed in the future.

Analysis of Impacts

Contaminants

High energy fuels used and stored at KLC are possible sources of contamination. Fuels could spill or leak due to improper storage or handling; rocket emissions could contaminate local water and soil. Listed species could be directly affected by these contaminant sources through exposure or indirectly affected through habitat degradation. Water quality sampling near KLC was performed by R&M Consultants Inc. (2011). Surface water pH, temperature, and conductivity values, along with aluminum and alkalinity were generally within normal ranges or consistent with recorded values prior to the KLC's use as a launch site. Based on water quality data, there is no indication that the KLC has had any measurable impact on local water quality.

Noise

Extremely loud noise may cause hearing loss or harm to Steller's eiders or sea otters if they are present near the KLC during a launch. Whether a specific noise source will cause harm depends on several factors, including the distance between the animal and the sound source, the sound intensity, background noise levels, the noise frequency, duration, and whether the noise is pulsed or continuous, and the animal's response to the sound. Based on audiogram analyses, sea otters, eiders, murrelets, and loons are expected to be susceptible to rocket launch noise because the frequencies produced during a launch overlap the frequencies audible to sea otters and birds. Because the hearing abilities and sensitivities of these species have not been fully evaluated, we rely on the closest related proxies to inform our analysis of impacts.

To evaluate the potential for harm, marbled murrelets provide the closest related proxy for eiders, Kittlitz's murrelets, and yellow-billed loons. Pinnipeds are the best proxy for otters. The Service considers 92 dBA[1] as the injury threshold guideline for foraging marbled murrelets (SAIC 2011); we therefore adopted this guideline for eiders, murrelets, and loons. Southall et al. (2007) recommended a 109 dB re: 20 µPa[2] (peak) threshold for airborne noise exposure for pinnipeds based on behavioral responses that could cause stampeding behavior and result in injury to some individuals or separate mothers from pups. However, Blackwell et al. (2004) and Moulton et al. (2005) documented pinnipeds that did not react or showed tolerant behavior to sounds as high as 112 dB peak and 96 dB RMS. Sea otters generally show a high degree of tolerance for shoreline activity and noise. We therefore considered 110 dB RMS as a conservative injury threshold for sea otters (USFWS 2012).

[1] dBA refers to A-weighted decibels

[2] dB refers to airborne noise levels, dB re: 20 µPa, unless otherwise indicated.

Minor (2012) conducted a comprehensive noise analysis to characterize the expected increases in noise associated with the new medium-lift rockets when compared to the old small-lift rockets. For this noise analysis a worst case scenario was developed based on measured noise levels of medium-lift launch vehicles proposed for use at KLC. The maximum noise levels of the larger rockets are predicted to increase the noise level by 3 to 5 dBA (peak) over the small-lift launch vehicles. When added to the noise levels monitored during a small-lift launch at KLC (as reported by ABR Inc. 2008), the expected maximum noise level that will be produced by a medium-lift launch vehicle is approximately 115.0 dBA (peak). Existing ambient noise levels return after 1 to 2 minutes for both, but larger rockets generate maximum noise levels for 2 to 3 seconds longer than smaller rockets (Minor 2012).

The expected noise level from medium-lift rockets is estimated to equal 100 dB RMS. This level falls below that expected to cause harm to sea otters, but exceeds that which may harm birds. To assess whether this noise level would harm eiders, murrelets, or loons near the KLC, avian surveys were conducted for the first five launches from KLC and continued through 2004. These surveys indicated that Kittlitz's murrelets occasionally occurred in low numbers near the launch area. The yellow-billed loon was not seen during any surveys. Steller's eiders were common between October and April. Pre- and post-launch monitoring showed that most eiders did not flee the area during rocket launches, and eiders that were not present during launches were willing to use the area within 30 minutes after a launch (ENRI 2002). The Service assessed the potential harm to eiders during consultation number 2006-065. Based on these monitoring results, the Service concluded that the KLC was not likely to cause harm to Steller's eiders.

The Service has not designated a harassment threshold above which noise may cause disturbance. In the case of the KLC, noise disturbance may cause animals to flee, increasing short-term energetic needs. These impacts are expected to last only as long as it will take an eider, otter, murrelet, or loon to reach an alternate foraging area. Surveys of otters, eiders, and murrelets around Kodiak show use of various locations; suitable habitat is readily available nearby. Thus, disturbance due to noise will not constitute significant disruption of normal behavioral patterns and is not likely to result in harm due to harassment.

Conclusion

Operations at the KLC may affect the Steller's eider, sea otter, or Kittlitz's murrelet due to noise impacts. The proposal to authorize medium-lift rockets will increase the noise levels above the current levels, but will not increase the numbers of launches (<9/yr) or significantly alter the temporary nature of this source of disturbance. The increased noise levels associated with launches will fall below the injury threshold for sea otters, but above the general guidelines for Steller's eiders and Kittlitz's murrelets. Pre- and post-launch monitoring at the KLC indicates Steller's eiders do not show a strong adverse behavioral reaction to the launch activities. Kittlitz's murrelets are present infrequently, and yellow-billed loons are rare. These species are therefore unlikely to be present when any single launch occurs. No habitat impacts are expected from contaminants or other sources. Therefore, the Service concurs with the FAA's determination that the proposed action is not likely to adversely affect the sea otter, Steller's eider, Kittlitz's murrelet, or yellow-billed loon.

In view of this, requirements of section 7 of the ESA have been satisfied. However, obligations under section 7 of the ESA must be reconsidered if new information reveals project impacts that may affect listed species or critical habitat in a manner not previously considered, if this action is

subsequently modified in a manner which was not considered in this assessment, or if a new species is listed or critical habitat is determined that may be affected by the proposed action.

The following voluntary recommendations will provide additional protection for these species:

1. Continue wildlife monitoring before and after launches;
2. Document the noise levels produced at the shoreline;
3. Continue to maintain, update, and enforce hazardous materials spill prevention and response plans for storage facilities;
4. Continue periodic water quality monitoring;
5. Submit any available reporting documents to the Service.

This letter relates only to federally listed or proposed species and/or designated or proposed critical habitat under jurisdiction of the Service. It does not address species under the jurisdiction of National Marine Fisheries Service, or other legislation or responsibilities under the Fish and Wildlife Coordination Act, Migratory Bird Treaty Act, Marine Mammal Protection Act, Clean Water Act, National Environmental Policy Act, or Bald and Golden Eagle Protection Act. Thank you for your cooperation in meeting our joint responsibilities under the ESA. If you have any questions, please contact me at (907) 271-1467 or Endangered Species Biologist Kimberly Klein at (907) 271-2660 and refer to consultation number 2012-0127.

Sincerely,

For Ellen W. Lance
Endangered Species Branch Chief

cc: Stacey Zee, FAA

Literature Cited

ABR, Inc.–Environmental Research & Services [ABR, Inc.]. 2009. 2008 Annual summary of marine mammal monitoring at the Kodiak Launch Complex, Alaska. Prepared for Alaska Aerospace Development Corporation in association with Michael Minor & Associates and R&M Consultants, Inc. Anchorage, Alaska. January 30, 2009.

Environment and Natural Resources Institute University of Alaska, Anchorage (ENRI, 2002). "Summary Findings of Environmental Monitoring Studies for the Kodiak Launch Complex, 1998-2001", Prepared for Alaska Aerospace Corporation, April, 2002.

Minor, M. of Michael Minor & Associates. 2012. Noise Impact Analysis Draft Kodiak Launch Complex Launch Pad 3 Project July 2012. Prepared for Alaska Aerospace Corporation, Anchorage, Alaska, in association with R&M Consultants, Inc. Portland, Oregon.

R&M Consultants, Inc. 2011. Final submittal environmental monitoring report Tacsat-4 Launch Kodiak Launch Complex Kodiak, Alaska. Prepared for: Alaska Aerospace Corporation. Anchorage, Alaska. December 19, 2011.

U.S. Fish and Wildlife Service [USFWS]. Biological Opinion For Diamond Point Granite Rock Quarry Consultation with U.S. Army Corps of Engineers. Prepared by: Anchorage Fish and Wildlife Field Office, 605 W. 4th Avenue, Anchorage, AK 99503. June 28, 2012.

APPENDIX D

U.S. Fish and Wildlife Service Technical Assistance, 23 May 2014

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Anchorage Fish & Wildlife Field Office
605 West 4th Avenue, Room G-61
Anchorage, Alaska 99501-2249

In reply refer to: AFWFO

May 23, 2014

Emailed to:
Jeff Roberts
Alaska Aerospace Corporation
Jeffrey Roberts <jeffrey.roberts@akaerospace.com>

Re: Kodiak Launch Complex Expansion (*Technical Assistance Number* 2012-0127)

Dear Mr. Jeff Roberts,

Thank you for your email of April 25, 2014, regarding bald eagles that may be affected by your proposal to expand launch capabilities at the Kodiak Launch Complex (KLC). The Alaska Aerospace Corporation (AAC) is performing an Environmental Assessment (EA) sponsored by the Federal Aviation Administration in order to build a new launch pad capable of launching medium lift rockets. The U.S. Fish and Wildlife Service (the Service) is responding to your request for recommendations to minimize impacts to active nests for compliance with the Bald and Golden Eagle Protection Act.

On 10 May 2013, Kodiak National Wildlife Refuge biologists conducted an aerial nesting bald eagle survey at Narrow Cape, Kodiak, in response to a request from AAC (Corcoran 2013). A total of seven bald eagles (six adult and one subadult) were seen on the 22 km^2 site. Three active nests were documented (Table 1). All three nests were just outside of ½-mile of the nearest launch facilities.

Table 1. GPS (datum WGS 84) locations of all bald eagle nest observations from the 10 May 2013 Narrow Cape nesting eagle aerial survey, Kodiak Alaska.

Observation	Latitude	Longitude	Comment
Bald eagle nest with 2 adults present	57.449707	-152.323143	On sea stack with adult in incubating/brooding posture on nest and second adult perched nearby
Bald eagle nest with 1 adult	57.430793	-152.316513	In spruce tree with adult in incubating/brooding posture on nest
Bald eagle nest with 1 adult	57.433770	-152.396303	On sea stack with adult in incubating/brooding posture on nest

The AAC proposes to expand the KLC to include medium-lift launch capabilities in addition to the currently-authorized small-lift operations. Based on sound level monitoring information presented in the KLC Noise Impact Analysis (MMA 2012) for the Athena III at the KLC monitoring site and a standard geometric acoustical attenuation rate of 6 dB per doubling of distance, we estimated that sound pressure levels at ½ mile from the launch pad may be up to 124 dBA. Medium-lift operations could increase the sound exposure levels by 5-6 dB and the exposure times by up to 30-60 seconds over current operations. Prolonged exposure (>30 seconds) to this level of sound is sufficient to cause some level of hearing damage in humans, and possibly, in eagles as well.

The Service's guidelines for protection of bald and golden eagles are available online at http://alaska.fws.gov/eaglepermit/pdf/national_guidelines.pdf. These guidelines recommend avoiding loud intermittent sounds within a 1/2 mile around active nests (or within 1 mile in open areas). While a ½-mile buffer is generally considered to be adequate to avoid disturbances from loud, intermittent activities, many factors influence sound attenuation and reception, and individual eagles vary in their tolerance for disturbance. Based on the available information, we cannot predict how eagles may respond to such sound levels. The best way to ensure that nesting eagles are not harmed is to avoid scheduling launches during the eagle nesting season, between February 1 and August 30. Otherwise, it may be possible for eagles nesting just outside of a ½-mile buffer to be disturbed by increased sound levels generated during medium-lift launches.

The recommendations of the Service's guidelines are intended to reduce the chances that eagles will be harmed and a violation of the Bald and Golden Eagle Act will occur. There may be impacts to eagles even if all reasonable avoidance measures are taken. You may wish to apply for a permit for take of eagles due to disturbance. In this case, a permit is not clearly necessary, but would ensure that AAC has appropriate protections in place if take were to occur. Please see our permits website for more information: http://www.fws.gov/alaska/eaglepermit/permit.htm.

Thank you for your concern regarding bald eagles. If you have any questions, please contact me at (907) 271-2066.

Sincerely,

Kimberly J. Klein
Biologist

References

Corcoran, Robin. 2013. Narrow cape bald eagle nest survey. US Fish and Wildlife Service Unpublished report. Kodiak National Wildlife Refuge, Kodiak, Alaska. May 2013.

Michael Minor & Associates [MMA]. 2012. Noise impact analysis, Kodiak Launch Complex launch pad 3 project. Prepared for Alaska Aerospace Corporation, in association with R&M Consultants, Inc., Anchorage, Alaska. October, 2012.

APPENDIX E

U.S. Fish and Wildlife Service
Narrow Cape Bald Eagle Nest Survey
May 2013

U.S. Fish & Wildlife Service

Trip Report May 2013

Narrow Cape Bald Eagle Nest Survey

Robin Corcoran

Kodiak National Wildlife Refuge
May, 2013

The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

Suggested Citation:

Corcoran, R.. 2013. Narrow Cape Bald Eagle Nest Survey. Unpublished trip report May 2013, Kodiak National Wildlife Refuge, U.S. Fish and Wildlife Service, Kodiak, AK.

Keywords:

Bald Eagle, *Haliaeetus leucocephalus*, nest location, Narrow Cape, Kodiak, Alaska

Narrow Cape Bald Eagle Nest Survey

Robin Corcoran

Abstract

On 10 May 2013 Kodiak Refuge biologists conducted an aerial nesting bald eagle survey at Narrow Cape in response to a request from Alaska Aerospace Corporation (AAC). AAC is performing an Environmental Assessment (EA) sponsored by the Federal Aviation Administration in order to build a new launch pad capable of launching medium lift rockets. A requirement of the EA is that bald eagle nesting locations be updated so that potential impacts to active nests can be minimized during the construction phase of the project. A total of seven bald eagles (six adult and one subadult) were seen on the 22 km^2 site and three active nests were documented. All three nests were within 100 meters of the ocean; two of the three nests were on sea stacks while the third was in a spruce tree.

Introduction

In response to a request from the Alaska Aerospace Corporation (AAC) Kodiak Refuge biologists flew an aerial nesting bald eagle survey in the area surrounding the Kodiak Launch Complex (KLC) at Narrow Cape, Kodiak Island, Alaska on 10 May 2013. A new launch pad is planned for the facility and AAC was required for permitting purposes to identity active bald eagle nests in the area. The area was originally surveyed for bald eagles in 1995 as part of the original KLC Environmental Assessment. The objectives of the survey were to locate and assess the status of bald eagles nesting in the KLC area and to generate a map and table of bald eagle nest sites.

Study Area

The study area included all suitable habitat that could be affected by the construction of the new launch site. The designated survey area was approximately 22 km^2 (10 square miles) and included the coastline of the cape and was bordered on the north by a stream that runs between the northern most KLC facilities at Narrow Cape (Figure 1).

Figure 1. Red shaded region is the bald eagle survey area of interest at Narrow Cape, Kodiak, Alaska.

Methods

The method chosen was a slight modification of an aerial survey recently used to determine coastal adult bald eagle abundance throughout the Kodiak Archipelago in a cooperative study conducted by Kodiak Refuge and the US Fish and Wildlife Service Migratory Bird Management Division (MBM). All shoreline was flown from an estimated height of 300 feet (100m) above the ground level at an airspeed of approximately 100 knots. The location and age of all eagles were recorded using a moving map system developed for wildlife surveys (dLOG3, R.G. Ford Consulting Co., Portland, OR) linked to a GPS receiver that provided precise locations of the flight path from which each observation was made. In addition to documenting adult and subadult eagles all nests were recorded along with behavior of adult (flying, perched, or incubating/brooding). General habitat type was also noted. The Refuge beaver airplane (N720) on floats (pilot Kevin Van Hatten) was used for the survey and we had two passenger-side observers (Robin Corcoran and Kent Sundseth). For this survey, in addition to the coastline, transects were flown across the interior spaced at approximately 500m apart to cover all potential habitat inland. Due to the small sample size we did not use double observer methodology to estimate detectability.

Results

The aerial bald eagle survey was flown on 10 May 2013, from approximately 0900 – 1000. We observed a total of seven bald eagles (six adult and one subadult) and three active nests on the survey area. Figure 2 shows the flight lines as recorded by the survey software and GPS (datum WGS84) along with all observations. Observations are placed on the flight line by the software

so Figures 3 and 4 are added to illustrate approximate locations of the nests as viewed from the flight line. Table 1 has GPS locations as recorded on the flight line, not at actual nest sites.

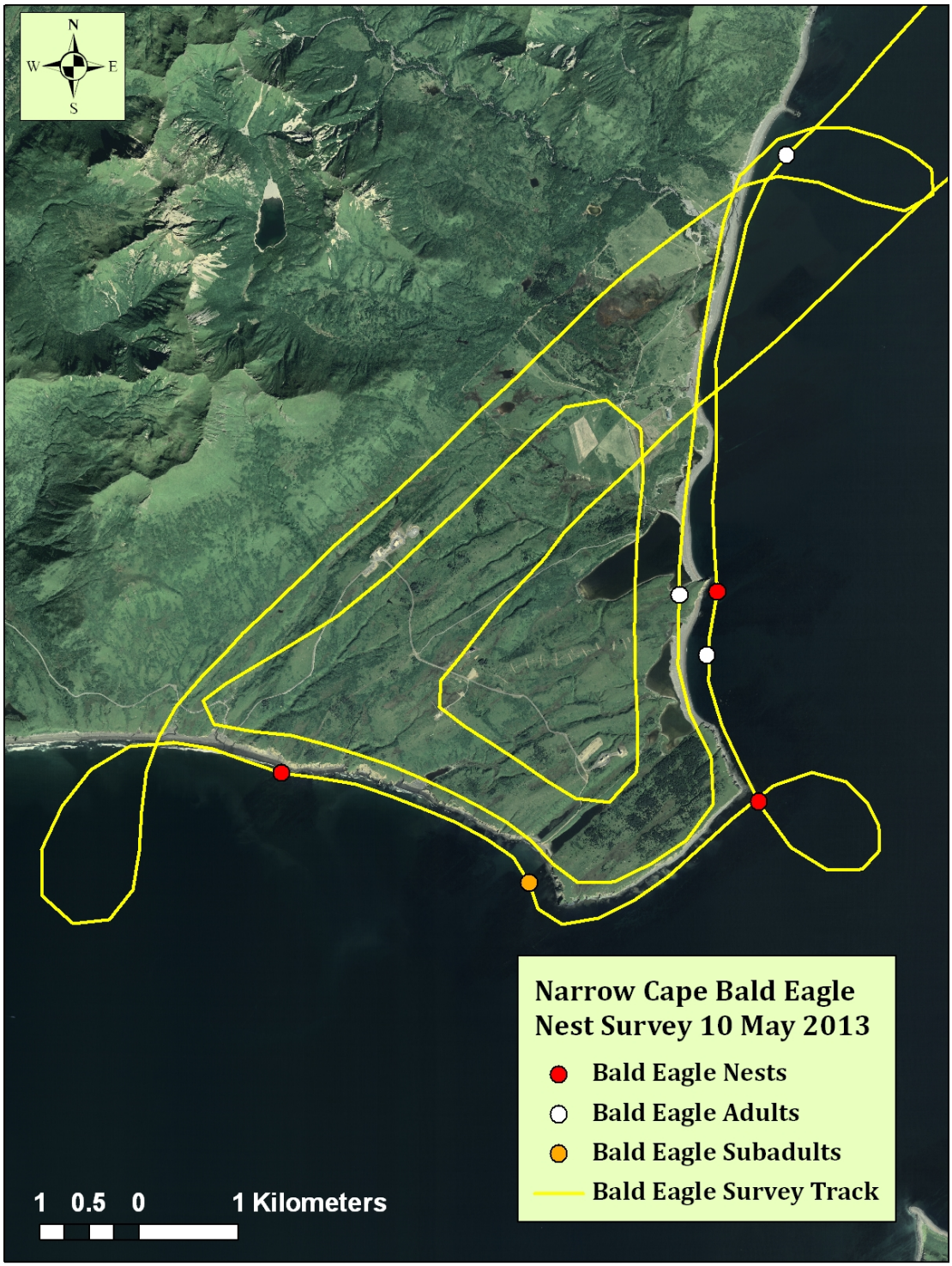


Figure 2. Flight line of the Narrow Cape bald eagle aerial survey conducted on 10 May 2013 in Kodiak, Alaska showing locations of all observations along the flight path.

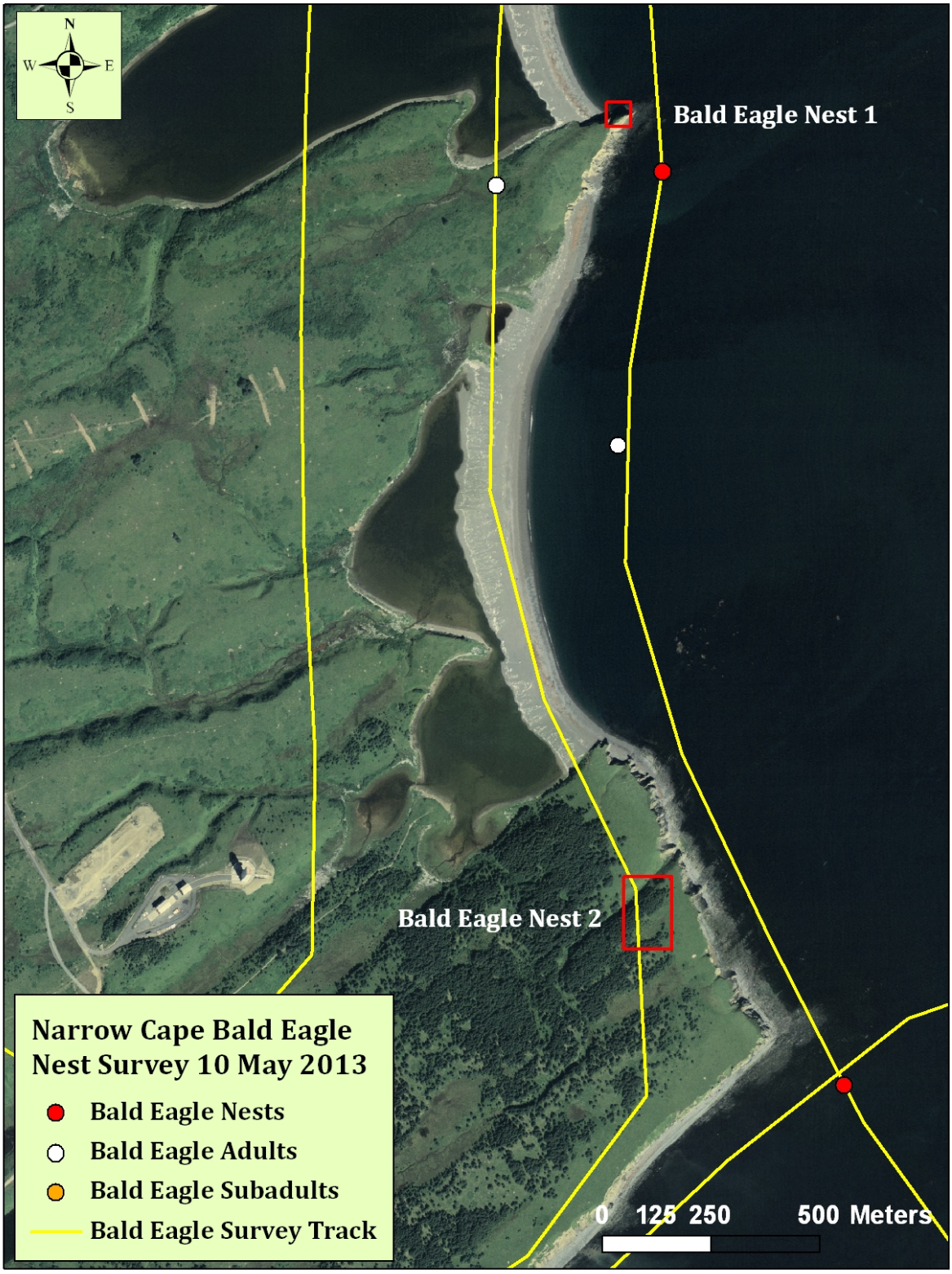


Figure 3. Approximate nest locations (in red rectangles) of two bald eagle nests in relation to the flight path of the aerial survey conducted 10 May 2013 on Narrow Cape, Kodiak, Alaska.

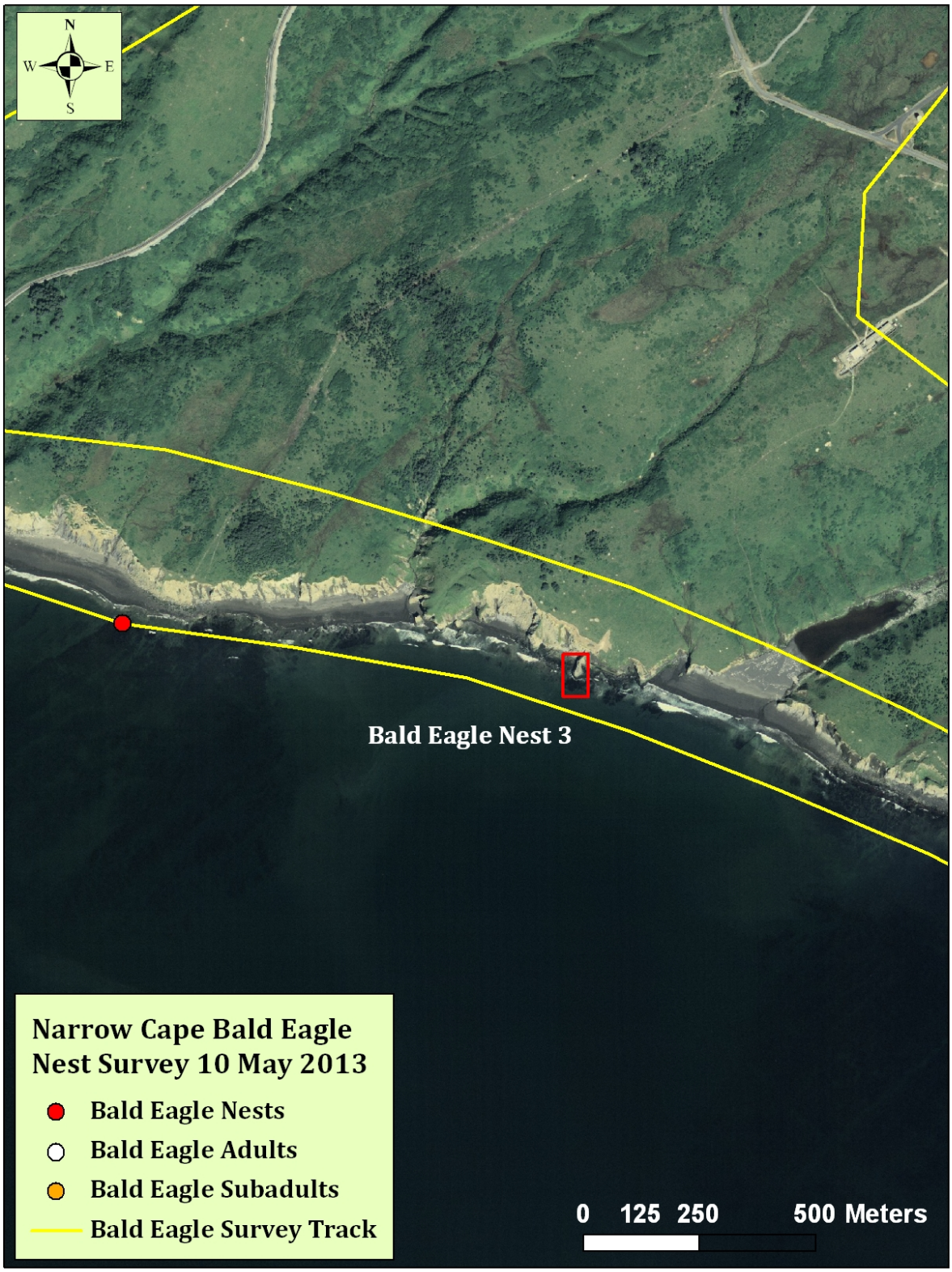


Figure 4. Approximate nest location (in red rectangle) of the third bald eagle nest in relation to the flight path of the aerial survey conducted 10 May 2013 on Narrow Cape, Kodiak, Alaska.

Table 2. GPS (datum WGS 84) locations along the flight path of all bald eagle observations from the 10 May 2013 Narrow Cape nesting eagle aerial survey, Kodiak Alaska.

Observation	Latitude	Longitude	Comment
Bald eagle adult	57.489108	-152.310760	Perched on sea stack, no nest seen
Bald eagle nest with 2 adults present	57.449707	-152.323143	On sea stack with adult in incubating/brooding posture on nest and second adult perched nearby
Bald eagle nest with 1 adult	57.430793	-152.316513	In spruce tree with adult in incubating/brooding posture on nest
Bald eagle subadult	57.423678	-152.355038	Perched on ground at point
Bald eagle nest with 1 adult	57.433770	-152.396303	On sea stack with adult in incubating/brooding posture on nest
Bald eagle adult	57.449448	-152.329503	Flying

APPENDIX F

State Historic Preservation Office Consultation, 13 July 2012

7.18.2012 3130-1R FAA

U.S. Department of Transportation
Federal Aviation Administration

Office of the Associate Administrator for Commercial Space Transportation

800 Independence Ave., SW
Washington, DC 20591

JUL 13 2012

RECEIVED
JUL 13 2012
OHA

No Historic Properties Affected
Alaska State Historic Preservation Officer
Date: 7.18.2012
File No. 3130-1R FAA
SHPO

Judith Bittner
State Historic Preservation Officer
Alaska Office of History and Archaeology
550 W. 7th Avenue, Suite 1310
Anchorage, Alaska 99501-3565

RE: Finding of No Historic Properties Affected pursuant to 36 CFR 800.4(d)(1)
Kodiak Launch Complex – Launch Pad 3 Project

Dear Ms. Bittner:

The Alaska Aerospace Corporation (AAC) is proposing to expand the launch capabilities at the Kodiak Launch Complex (KLC), located on Kodiak Island's Narrow Cape (Figure 1). This project (termed the Launch Pad 3 Project) includes six primary modifications to the KLC, as described in the following sections and depicted in Figure 1. The new facilities will be located in Township 31S, Range 19W, Sections 32/33, and Township 32S, Range 19W, Sections 4/5, Seward Meridian, Kodiak B-2 Quadrangle. Pursuant to 36 CFR 800.4(d)(1), implementing regulations of Section 106 of the *National Historic Preservation Act*, the Federal Aviation Administration (FAA) finds that no historic properties would be affected by the proposed project.

Project Description
The KLC is currently operated under a Launch Site Operator License issued by FAA. The license will have to be modified to include the new proposed facilities; therefore, an Environmental Assessment (EA) is being prepared, as the license modification is a federal action. The EA will analyze the potential environmental effects of modifying AAC's Launch Site Operator License to include a new launch pad and medium lift launch capability. The EA also may be used to support a future renewal of the Launch Site Operator License and the licenses for future vehicle operators and license renewals. Proposed improvements to the KLC include the following:

- Launch Pad 3 (LP3): The launch stool, flame trench, a new access road, and all related surface and subsurface construction.
- Vehicle Processing Facility (VPF): A rectangular tower where assembly of the solid rockets will take place on top of the pad.
- Rocket Staging Facility (RSF): A rectangular building for the short term storage of solid rocket motors and the processing of liquid fueled vehicles.
- Air Plant/Liquid Fueling Facility (LFF): On-site producing plant for liquid oxygen and liquid nitrogen. The liquid fueling facility will include holding tanks for liquid oxygen, liquid and gaseous nitrogen, gaseous helium, highly refined kerosene, and piping to fuel the rocket.

- Mission Control Center (MCC): A new control center in the vicinity of the current Launch Control Center. It should be noted that the MCC may be partly or entirely located on previously disturbed ground and existing fill, depending the ultimate site selected (Figure 1).
- Modifications to Pasagshak Point Road: Straightening the curves and flattening the dips of Pasagshak Point Road within the KLC.

Area of Potential Effect (APE)

The Area of Potential Effect (APE) for construction of the LP3 and associated facilities and Pasagshak Point Road upgrades will be primarily confined to the actual footprints of the planned roads and structures, as well as those immediately adjacent areas that will be used for equipment access and construction staging (Figure 1). A visual APE is not being considered, as there are many existing similar structures present in the viewshed, and no archeological resources observed in the APE during prior cultural resource surveys (OHA 1994 and 2005).

Identification Efforts

A cultural resources survey for the Kodiak Launch Complex was conducted in 1994 by the Office of History and Archaeology (OHA, 1994). During that survey, transects were walked through areas of the KLC, and a number of shovel probes were excavated in several key areas across the KLC site, including at or near the improvements proposed for the LP3 project. In addition, OHA staff inspected numerous geotechnical test pits that were excavated at the time in the area of the currently proposed LP3. No evidence of cultural resources were found during any of these activities.

More recently, a finding of "No Historic Properties Affected" letter for the then-proposed LP3 construction (not identical, but very similar to the currently proposed project) received concurrence from the State Historic Preservation Office on June 29, 2010. The Office of History and Archaeology's Alaska Heritage Resources Survey (AHRS) was reviewed at that time for information pertinent to the development of the site in question. A thorough review of the AHRS database revealed no historic properties within an approximately 0.5-mile radius of the then-proposed LP3 location. Five known AHRS sites in the general vicinity of the proposed improvements were noted during that research, KOD-66, KOD-81, KOD-441, KOD-456, and KOD-750. Since that time there have been some design changes to the LP3 proper, and the other project elements listed above have been added to the LP3 project. Therefore the APE is different from that concurred with in 2010, but the nature of the improvements and the likelihood of encountering cultural resources is generally the same.

An additional OHA survey was conducted in 2005 to the west-northwest of the KLC, in association with Pasagshak Point Road Improvements (MP 0 – 13.75). That effort encountered no new archaeological resources. Existing information and prior research indicates a low potential for encountering unknown cultural resources during the LP3 project, therefore the FAA and AAC are not proposing any additional survey efforts for this project.

Finding of Effect

There are no known eligible properties in or near the APE for the LP3 project. In addition, prior cultural resource surveys and AHRS research suggest a low potential for encountering undocumented cultural resources. Some improvements, such as the Mission Control Center, may be partly or entirely located on previously disturbed ground and existing fill. Subsequently, the FAA finds that no historic properties would be affected by the LP3 project.

Please direct your concurrence or comments to Stacey M. Zee, of my staff, at the address above, by telephone at 202-267-9305, or by e-mail at stacey.zee@faa.gov. Thank you for your input on this important matter.

Sincerely,

Michael McElligott
Manager, Space Transportation Development Division

Enclosures:

Figure 1: Area of Potential Effect
Figure 2: LP3 Illustration
Related AHRS Records
106 Mailing List

References:

Alaska Department of Natural Resources, Office of History and Archaeology
1994 Cultural Resources Survey for the Proposed Alaska Orbital Launch Complex, Kodiak Island, Alaska. October 1994. Document on file, Office of History and Archaeology, Anchorage.

Alaska Department of Natural Resources, Office of History and Archaeology
2005 Archaeological Survey of 2
the Pasagshak Road Improvements MP 0 – 13.75, Kodiak Island, Alaska. February 2005. Document on file, Office of History and Archaeology, Anchorage.

Alaska Department of Natural Resources, Office of History and Archaeology
No Historic Properties Affected Letter, File No. 3130-2R AAC. June 29, 2010. Document on file, Office of History and Archaeology, Anchorage.

U.S. Geological Survey
Kodiak B-2 Quadrangle, Alaska", 1:63,600 Scale Topographic Series, 1987.

APPENDIX G

National Marine Fisheries Service Biological Opinion, 2011

Endangered Species Act – Section 7 Consultation Biological Opinion

Activity Considered:	Issuance of regulations and letters of authorization under the Marine Mammal Protection Act to authorize incidental take of marine mammals by U.S. citizens engaged in space vehicle and missile launch operations at the Kodiak Launch Complex on Kodiak Island, Alaska
Action Agency:	National Marine Fisheries Service
Consultation Conducted By:	National Marine Fisheries Service, Alaska Region
Date Issued:	
Issued by:	James W. Balsiger, Ph.D. Administrator, Alaska Region

TABLE OF CONTENTS

1. INTRODUCTION

This introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3 below.

1.1 Background and Consultation History

The biological opinion (opinion) and incidental take statement portions of this document were prepared by the National Marine Fisheries Service, Alaska Region (NMFS AKR) in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 et seq.), and implementing regulations at 50 CFR 402.

The opinion is in compliance with section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-5444) ("Data Quality Act") and underwent pre-dissemination review.

The Kodiak Launch Complex (KLC) was originally licensed by the Federal Aviation Administration in 1998. On July 26, 2001, NMFS received an application from the Alaska Aerospace Corporation (AAC) under section 101(a)(5)(A) of the Marine Mammal Protection Act (MMPA) for authorization to take, by harassment, Steller sea lions (*Eumetopias jubatus*) and harbor seals (*Phoca vitulina*) incidental to rocket launches from KLC on Kodiak Island, Alaska. Since 1998, AAC has provided monitoring reports to U.S. Federal Aviation Administration (FAA) and NMFS related to noise and marine mammal impacts associated with ongoing rocket launches from KLC. After reviewing the information contained in the monitoring reports, NMFS then decided that a more current environmental analysis was necessary. In 2005, NMFS prepared an Environmental Assessment (EA) on the *Promulgation of Regulations Authorizing Take of Marine Mammals Incidental to Rocket Launches at Kodiak Launch Complex, Alaska, and the Issuance of Subsequent Letters of Authorization*. The analysis contained within the EA specifically addressed the impacts launches would have on Steller sea lions and harbor seals on nearby Ugak Island. NMFS found that the promulgation of a 5-year Rule and issuance of Letters of Authorization (LOA) would not significantly impact the quality of the human environment and issued a Finding of No Significant Impact (FONSI) on December 22, 2005. Accordingly, preparation of an Environmental Impact Statement or Supplemental Environmental Impact Statement for that action was not necessary.

There have been several past section 7 consultations by NMFS AKR regarding the KLC. These resulted in our determination that the facility would not likely jeopardize the continued existence of the endangered Steller sea lion or adversely modify its critical habitat. Monitoring was specified to ensure that launch noise would not harass Steller sea lions on a nearby haul-out, or that other listed species were not taken. Data from two KLC launches did not definitively establish that noise from the rocket launch harassed Steller sea lions.

The operator of the KLC, AAC has reapplied for authorization for the harassment taking of marine mammals under the MMPA (75 FR 80775, 23 December 2010). This authorization would permit the unintentional and incidental taking of small numbers of marine mammals due to the operation

of the KLC. Because the western population of Steller sea lions is also listed as an endangered species, those takings must also be authorized under the ESA. Incidental takes of endangered species which are associated with a Federal action (i.e., NMFS's issuing regulations and subsequent LOAs) are authorized through the issuance of an Incidental Take Statement (ITS), prepared by NMFS AKR, and an accompanying biological opinion, which concludes that the action as authorized will not jeopardize the continued existence of the endangered species or result in the destruction or adverse modification of its designated critical habitat.

It was therefore necessary for NMFS Permits, Conservation, and Education Division (PR1), to request formal consultation on its promulgation of incidental take regulations and issuance of LOAs to authorize KLC operations to take Steller sea lions by harassment, and for NMFS AKR to prepare the required opinion and ITS.

On November 10, 2010, NMFS AKR received a letter from PR1 requesting formal consultation on the issuance of incidental take regulations and LOAs. The scope of the action AAC has presented in its current MMPA authorization application is not significantly different than that analyzed in NMFS' 2005 EA:

1) AAC proposes to launch the same or similar type space vehicles and missiles as those assessed in the 2005 EA. Although new space vehicles may be used during future launches, none would be larger or louder than currently used vehicles.
2) Currently, AAC is to conduct no more than three launches per year within the season when Steller sea lions may occupy the haul-out on Ugak Island (15 June-30 September). AAC's present request is for a total of 45 launches within the 5-year period, an average of nine per year, with a maximum of 12 launches in a single year. Although PR1 and AAC do not propose to continue the current seasonal restrictions, the number of launches that may occur during these dates would not significantly increase. AAC estimates that no more than one launch could occur during a 4-week period, so at most AAC could conduct four launches during the season when Steller sea lions may occupy Ugak Island.
3) AAC will improve monitoring protocols by installing a camera system that will use live feed to monitor the Steller sea lion haul-out site during rocket launches instead of aerial surveys that are weather dependent in an area where harsh weather conditions often made it difficult to access the haul-out sites.

This opinion is based upon the best available science, including information from the following documents: AAC's 5-year programmatic permit application for small takes of marine mammals (2010), proposed rule (75 FR 80775, 23 December 2010), final rule (71 FR 4297, January 26, 2006), and NMFS EA on the *Promulgation of Regulations Authorizing Take of Marine Mammals Incidental to Rocket Launches at Kodiak Launch Complex, Alaska, and the Issuance of Subsequent Letters of Authorization* (2005). A complete record of the consultation is on file at the offices of NMFS AKR.

NMFS has prepared this biological opinion to reflect the current and proposed operation of the facility and to address impacts to the Steller sea lion which may be present in the action area during launch operations. The objective of this biological opinion is to determine whether the action is

likely to jeopardize the continued existence of the Steller sea lion, or result in the destruction or adverse modification of its critical habitat.

1.2 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

The proposed action by PR1 is to issue 5-year regulations and subsequent LOAs under section 101 (a)(5) of the MMPA to AAC to incidentally take the endangered Steller sea lions during operations of a commercial rocket launch facility. The new regulations would be effective from March 18, 2011 through March 17, 2016. Launch activities could occur at any time of day or night and in any weather during the period to be covered under this rulemaking. Under the proposed action, the KLC may launch up to 45 vehicles during the five year period, or an average of nine vehicles annually, by both government and private users. Detailed descriptions of the complex and launch operations are provided in several documents, including PR1 Environmental Assessment (NMFS 2005) on the *Promulgation of Regulations Authorizing Take of Marine Mammals Incidental to Rocket Launches at Kodiak Launch Complex, Alaska, and the Issuance of Subsequent Letters of Authorization* and the proposed rule (75 FR 80775, 23 December 2010)

The number of launches of space launch vehicles and ballistic target vehicles from KLC is variable. Launch planning is a dynamic process, and launch delays, which can last from hours to more than a year, can and do occur. Launch delays occur due to variables ranging from technical issues to adverse weather. These factors have controlling influence over the vehicle numbers by class that are actually launched in any given year from KLC. Launches take place year round when all variables affecting launch decisions are in correct alignment.

AAC estimates the total number of vehicles that might be launched from KLC during the course of the 5-year period covered by the requested rulemaking has increased to 45 vehicles, with an average of nine per year. AAC estimates that of the 45 estimated launches from KLC during the 5-year period in consideration:

- 32 launches will be the small space launch and target vehicles of the Castor 120 or smaller size and modeling shows this rocket is about eight miles above the earth's surface when it overflies Ugak Island. The sonic boom reaches earth between 21 to 35 miles down range, which is past the Outer Continental Shelf break and over the North Pacific abyss (USFAA 1996). Sound pressure from the Castor 120 at the traditional haul-out on Ugak Island was measured to be 101.4 dBA (SEL). This location is 3.5 miles away from the launch pad. None of the vehicles expected to be flown from KLC during the 5-year period covered by this rule making and associated permit is known to be louder than the Castor 120.
- 10 launces will be the tactical missiles or smaller size and sound pressures from these smaller systems are not available, but will be substantially less than those from Castor 120 (101.4 dBA (SEL)) and pose no potential for disturbance to marine mammals.

- Three launches will be the medium class launch vehicle and the anticipated sound pressure at the traditional Steller sea lion haul-out at Ugak Island is likely to be at or somewhat less than the 101.4 dBA (SEL) recorded for the Castor 120.

While it is difficult to estimate, the highest number of launches in any given year might be 12 events, if smaller tactical systems were flown for test and evaluation purposes. This is a high end number that represents the worst case scenario for analysis.

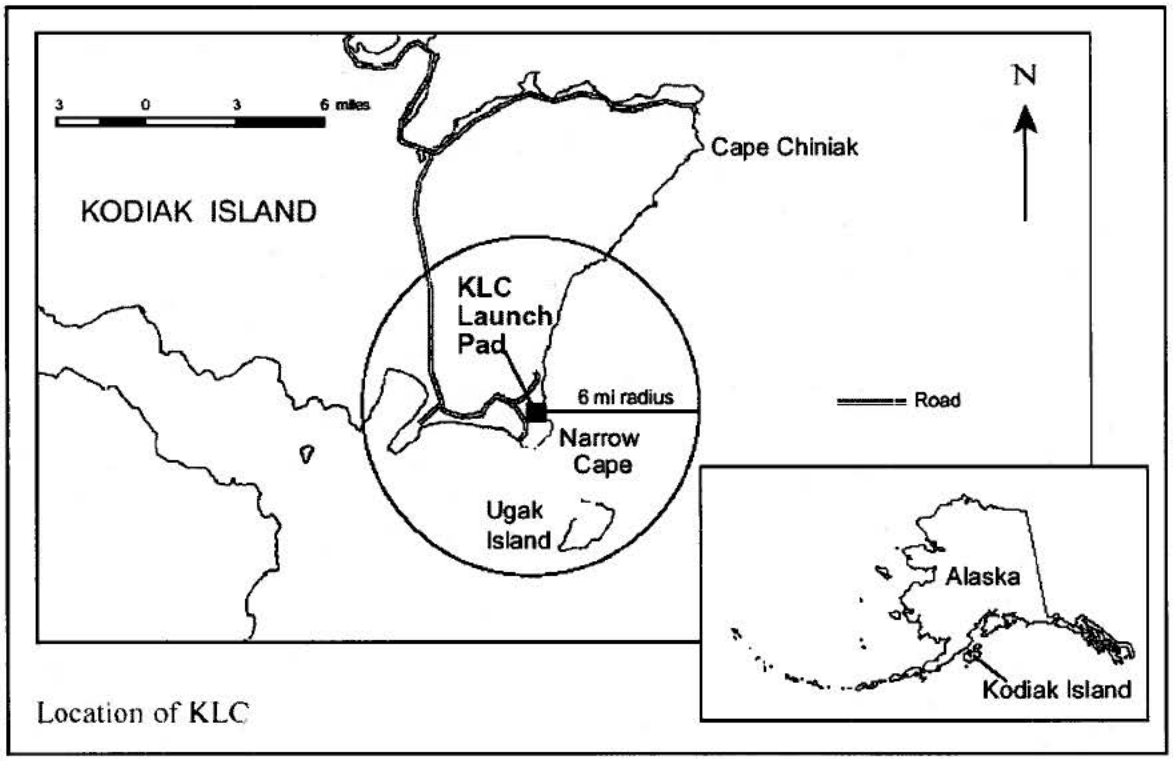
To minimize impacts to Steller sea lion haul-out sites, the AAC has proposed, as part of their specified activities, the following mitigation measures: 1) security over-flights immediately associated with the launch would not approach the occupied Steller sea lion haul-out on Ugak Island by closer than 0.25 mile (0.4 km), and would maintain a vertical distance of 1,000 ft (305 m) from the haul-outs when within 0.5 miles (0.8 km), unless indications of human presence or activity warrant closer inspection of the area to assure that national security interests are protected in accordance with law; 2) if launch monitoring or quarterly aerial surveys indicate that the distribution, size, or productivity of the potentially affected Steller sea lion population has been affected due to the specified activity, the launch procedures and the monitoring methods would be reviewed, in cooperation with NMFS, and, if necessary, appropriate changes may be made through modifications to a given LOA, prior to conducting the next launch of the same vehicle under that LOA.

1.3 Proposed Action Area

The action area is defined by NMFS' regulations (50 CFR 402.02) as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action."

The area considered to be affected by the facility and its operations was set in a September 1996 meeting involving AAC and its environmental consultant (University of Alaska Anchorage, Environment and Natural Resources Institute), and government agencies represented by FAA, NMFS, U.S. Fish and Wildlife Service (FWS), and Alaska Department of Environmental Conservation. Attendees at that meeting reviewed information on the known effects of rocket operations on the environment and set the expected impact area to be within a six mile radius of the launch pad area (Figure 1). There are no federally listed terrestrial threatened or endangered species within this six mile radius area; however, there are several federally listed marine mammals present in the waters offshore and on haul-outs on Ugak Island, which lies about 3.5 miles distance from the launch pad area.

Figure 1. KLC Vicinity Map.



KLC launch azimuths range from 110 degrees to 220 degrees. The eastern most launch azimuth of 110 degrees is within a few degrees of most orbital launches, and crosses the extreme eastern edge of Ugak Island where pinniped haul-outs are found. Modeling done of Castor 120, the loudest vehicle, space launches indicates the vehicle is passing through 45,000 feet altitude by the time it reaches the island about seventy seconds post launch (USFAA 1996). Spent first stage rocket motors impact the ocean from 11 to more than 300 miles down range, depending on launch vehicle. Sonic booms reach the earth's surface beyond the Outer Continental Shelf, which ends about 20 miles offshore, where it plunges precipitously to the North Pacific abyss (USFAA 1996).

KLC is about 22 air miles from the City of Kodiak, which is the largest settlement on the Kodiak Island. Land elevations at KLC range from about 140 feet near the pad complex to about 300 feet at the Launch Control Center. The AAC has authority to restrict public access for safety purposes to land abutting KLC's northern and western boundaries, as well as to all of Ugak Island, which lies immediately south of Narrow Cape. Ugak Island's axis trends northeast to southwest. The island is about two miles long by about one mile wide. The land slopes steeply upward from a spit on the island's northern most point, which is a traditionally used Steller Sea Lion haul-out, to the southwest, culminating in cliffs that are approximately 1,000 feet in elevation. These cliffs run the entire length of the island's long axis. Eastward, the narrow Outer Continental Shelf ends about 20 miles offshore, where it plunges precipitously to the North Pacific abyss. Near shore water depths to the immediate south and west of the island range to several hundred feet.

The action area is the actual launch facilities within the KLC, and waters in and adjacent to Narrow Cape, which are along the vehicle launch trajectories from the facility, and the adjacent shorelines.

2. ENDANGERED SPECIES ACT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat on which they depend. Section 7(a)(2) of the ESA requires Federal agencies to consult with the FWS, NMFS, or both, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or adversely modify or destroy their designated critical habitat. Section 7(b)(3) requires that at the conclusion of consultation, the Service provide an opinion stating how the agencies' actions will affect listed species or their critical habitat. If incidental take is expected, Section 7(b)(4) requires the provision of an incidental take statement (ITS) specifying the impact of any incidental taking, and including reasonable and prudent measures to minimize such impacts.

2.1 Biological Opinion

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to insure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts to the conservation value of the designated critical habitat.

"To jeopardize the continued existence of a listed species" means to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02).

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.[1]

NMFS AKR must determine whether the action is likely to jeopardize the listed species, or result in the destruction or adverse modification of designated critical habitat. This analysis involves the initial steps of defining the biological requirements of the listed species, and evaluating the relevance of the environmental baseline to the species' current status.

2.1.1 Status of the Species and Critical Habitat

Four endangered species may occur within the action area: Steller sea lions from the western Distinct Population Segment (DPS), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), and North Pacific right whale (*Eubalaena japonica*). The Steller sea

[1] Memorandum from William T. Hogarth to Regional Administrators, Office of Protected Resources, NMFS (Application of the "Destruction or Adverse Modification" Standard Under Section 7(a)(2) of the Endangered Species Act) (November 7, 2005).

lion is always around Kodiak Island, while the fin whale and humpback whale are seasonally-abundant, but may occur during all months of the year. The North Pacific right whale, with a population estimate at 31 whales (Wade et al. 2010), is rarely observed around Kodiak Island. Although the humpback whale can be found in waters near Ugak Bay during summer months, the fin whale is rarely observed, while the North Pacific right whale has not been observed there.

NMFS AKR has determined that all endangered whale species are not likely to be adversely affected by launch operations because they are not in the area (fin whale and Northern right whale) or would be below the surface of the water, and therefore not likely to be exposed to launch noise (humpback whale) that would significantly disrupt normal behavioral patterns. Airborne noise is generally reflected at the sea surface outside of a 26 degree cone extending downward from an airborne source (Richardson et al. 1995), directly below the launch vehicle. Submerged animals would normally have to be directly under the noise sources before they may hear it. Underwater acoustic transmissions are complex, and affected by the level and frequency of the noise, sea state, other surface conditions, water depth, and sea floor conditions. The launch sounds that would penetrate beneath the sea surface would not persist in the water for more than a few seconds. Given the recorded in-air noise levels from past launches (e.g. 80 to 101 dB re: 20μ Pa.), it is unlikely that underwater noise would reach levels that would affect fin whales, humpback whales, and/or North Pacific right whales: 1) behaviorally (under the MMPA, NMFS considers the threshold for Level B harassment for baleen whales to be received sound levels that exceed 160 dB re: 1μ Pa; the in-air equivalent would be approximately 98 dB re: 1μ Pa.) or 2) injuriously (under the MMPA, NMFS considers the threshold for Level A harassment for baleen whales to be received sound levels that exceed 180 dB re: 1μ Pa.; the in-air equivalent to this level would be approximately 116 dB re: 20μ Pa.). Additionally, underwater noise propagation is limited by frequency, with higher frequencies having greater attenuation. Noise signals in water normally decrease exponentially with distance. NMFS also realizes that other in-water and air-borne noise sources (boats and planes) exist in waters surrounding Narrow Strait.

Based on the best available scientific information, NMFS AKR has determined that the action being considered in the opinion may adversely affect the endangered western DPS of the Steller sea lion and designated critical habitat for Steller sea lions. Individual Steller sea lions may be adversely affected by this project mostly due to noise and visual stimuli associated with launches. Detailed information about the Steller sea lion status and biology may be found in several documents, including those found on the NMFS AKR website at: http://www.fakr.noaa.gov/.

The Steller sea lion is described by two DPSs: the western stock (those animals born on rookeries west of 144 degrees West longitude) listed as an endangered species, and the eastern stock (those animals born on rookeries east of 144 degrees West longitude) listed as a threatened species. Sea lions present in the action area are assumed to be from the endangered western stock.

References to original literature are made throughout this section to identify scientific sources and guide readers to further information. However, much of the following information in this section is derived from the biological opinion NMFS recently prepared to evaluate the effects of

authorizing federal groundfish fisheries in the Gulf of Alaska and Bering Sea and Aleutian Islands (NMFS 2010).

In the 1950s, the worldwide abundance of Steller sea lions was estimated at 240,000 to 300,000 animals, with a range that stretched across the Pacific Rim from southern California, Canada, Alaska, and into Russia and northern Japan. In the 1980s, annual rates of decline in the range of what is now recognized as the western DPS were as high as 15 percent per year. By 1990, the U.S. portion of the population had declined by about 80 percent. On November 26, 1990, NMFS issued a final rule (55 FR 49204) to list Steller sea lions as a threatened species under the ESA. After listing, the rate of decline decreased to about 5 percent per year.

NMFS subsequently reclassified Steller sea lions as two DPSs under the ESA. The western DPS that extends from Japan around the Pacific Rim to Cape Suckling in Alaska (144°W) was listed as endangered due to its continuous decline and lack of recovery. This endangered listing was supported by population viability analysis (PVA), which indicated that a continued decline at the 1985-1994 rate would result in extinction of the western DPS in 100 years or a 65 percent chance of extinction if the 1989-1994 trend continued for 100 years (62 FR 24354).

NMFS has also designated critical habitat for the Steller sea lion (58 FR 45269). The areas designated as critical habitat for the Steller sea lion were determined using the best scientific and commercial information available (see regulations at 50 CFR Part 226.202). Particular attention was paid to life history patterns and the areas where animals haul-out to rest, pup, nurse their pups, mate, and molt. In the final rule designating critical habitat (58 FR 45269), NMFS stated that essential habitat for Steller sea lions includes terrestrial, air, and aquatic areas, and that physical and biological features within this habitat that support reproduction, foraging, rest, and refuge are essential to the conservation of this species.

Designated critical habitat for Steller sea lions west of 144° W longitude includes specified major haul-outs and rookeries and 1) a terrestrial zone that extends 3,000 ft (0.9 km) landward from the baseline or base point of each major rookery and major haul-out, 2) an air zone that extends 3,000 ft (0.9 km) above the terrestrial zone, measured vertically from sea level, 3) an aquatic zone that extends 20 nm (37 km) seaward in State and Federally managed waters from the baseline or base-point of each major rookery and major haul-out in Alaska and 4) three special aquatic foraging areas in Alaska: the Shelikof Strait area, the Bogoslof area, and the Seguam Pass area.

Steller sea lions require both terrestrial and aquatic resources for survival in the wild. Land sites used by Steller sea lions are referred to as rookeries and haul-outs. Haul-outs can be used by all size and gender classes, but are generally not sites of reproductive activity. The continued use of particular sites may be due to site fidelity, or the tendency for Steller sea lions to return repeatedly to the same site, which is often the site of their birth. Presumably, the haul-out sites were chosen by Steller sea lions because of their substrate and terrain, the protection they offer from terrestrial and marine predators, protection from severe climate or sea surface conditions, and the availability of prey resources.

Two kinds of marine foraging habitat were designated as critical: 1) areas immediately around rookeries and haul-outs, and 2) three aquatic foraging areas where large concentrations of important prey species were known to occur (Shelikof Strait, southeastern Bering Sea, and Seguam area).

Areas around haul-out sites are important for juveniles, because most juveniles are found at haul-outs not rookeries. Young animals are almost certainly less efficient foragers and may have relatively greater food requirements, which suggests that they may be more easily limited or affected by reduced prey resources or greater energetic requirements associated with foraging at distant locations. Therefore, the areas around haul-out sites must contain essential prey resources for juveniles, and those areas were deemed essential to protect.

2.1.2 Environmental Baseline

The "environmental baseline" includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions which are contemporaneous with the consultation in process (50 CFR 402.02).

This section incorporates the relevant description of the environmental baseline in the biological opinion NMFS recently prepared in connection with its authorization of the federal groundfish fisheries in the Gulf of Alaska and Bering Sea and Aleutian Islands (NMFS 2010, sections 4.1-4.7). The reader should consult this source for a detailed description of the environmental baseline. The following briefly summarizes the environmental baseline as described therein and supplements it as appropriate for this action.

Presently, the western stock of the Steller sea lions, which includes those found in the Kodiak Island area, is estimated to total around 41,000 animals (Allen and Angliss 2010). The area inhabited by the western DPS is a fished ecosystem, from which large quantities of certain target species have been harvested since the 1960s, initially by foreign fisheries and by 1989, entirely domestic fisheries. The count of Steller sea lions in the western DPS in the Kenai to Kiska census area was more than 100,000 animals (non-pups) by the end of the 1950s, and about 90,000 animals by the end of the 1970s. Then a marked decline commenced with about 22,000 non-pups counted in this census area by 1990, and 15,000 non-pups counted by 2000. About 17,000 animals were counted as of 2008 in the Kenai to Kiska census area, the last survey date for non-pup animals. Because sea lion populations respond similarly within portions of their range and at finer scales than previously considered, the Alaskan western DPS were divided into 11 Rookery Cluster Areas (RCAs) (1-10 from west to east) (NMFS 2010). In RCA 9, essentially the eastern portion of the central Gulf of Alaska survey subarea (including Kodiak Island area), observed non-pup counts declined about six percent per year through the 1990s, and were stable from 2000 through 2008.

RCAs 8 and 9, essentially the central Gulf of Alaska, are characterized by a continental shelf and groundfish prey biomass of intermediate magnitudes compared to Areas 1-5 (smaller) and Areas 6-7 (larger). The Steller sea lion diet is relatively diverse in these areas, and the chief groundfish

prey species are pollock, salmon, Pacific cod, and arrowtooth flounder. A high proportion of the total catch for pollock and Pacific cod is caught in winter and within Steller sea lion critical habitat. Steller sea lion numbers have stabilized during the last 20 years, but have shown only slight increases in the 2000s in these RCAs, suggesting that fishery measures may have provided for limited recovery. High catch amounts for both pollock and Pacific cod within critical habitat during winter in RCAs 8 and 9, an intermediate Steller sea lion foraging environment, possibly resulted in chronic long-term nutritional stress that adversely affected reproduction, but probably not survival, resulting in the current population stability but lack of recovery.

Several critical habitat sites exist within the Gulf of Alaska and three occur along the southeastern shoreline of Kodiak Island: Cape Chiniak, Gull Point, and Ugak Island. Cape Chiniak and Gull Point are approximately 15 and 10 miles from the KLC, respectively, and the terrestrial portions of these areas would not be affected by launch operations as the expected impact area is within a six mile radius of the launch pad area. Ugak Island is located 3.5 miles from the launch pad complex and this critical habitat includes a 20 nm marine area. A Steller sea lion haul-out exists on a sand spit along the north eastern shoreline of Ugak Island. NMFS identified rest and refuge as two important habitat functions performed by haul-outs that were designated as critical habitat. In addition, NMFS identified the local prey availability in the marine area surrounding a haul-out as an important factor that affects sea lions' use of such habitat (NMFS 2010). NMFS recently evaluated the effect of federally authorized commercial fisheries on the conservation function of marine areas designated as Steller sea lion critical habitat, including those around Kodiak, and that discussion is incorporated by reference herein (NMFS 2010, section 7.5). NMFS does not expect this action to adversely affect the conservation function of Steller sea lion marine critical habitat. Therefore, the remainder of the discussion focuses on terrestrial habitat.

During breeding season, abundance estimates on Ugak Island was collected 18 times since 1957. On 13 surveys, Steller sea lions were not observed on Ugak Island (1989-1991, 1996-1998, 2000, 2002, 2004, and 2007-2010); while sea lions were observed in 1997 (318 animals), 1985 (17 animals), 1986 (270 animals), 1992 (four animals), and 1994 (one animal) (Fritz and Stinchcomb 2005, NMFS unpublished data). During non-breeding season, surveys were flown over Ugak Island in March 1993, 1994, 1997, and 1999; and December 1994 (NMFS unpublished data). Only during December 1994 were Steller sea lions observed (20 animals) (NMFS unpublished data). The survey data shows that use by Steller sea lions on Ugak Island is not consistent during the summer, as compared to other sites on eastern Kodiak Island; and during the off-season, what little information is available on Steller sea lions and Ugak Island, is also not consistent. More recent observations during launch-related environmental monitoring (2006-2008) within a six-mile radius study area identified 0-8 sea lions on Ugak Island.

These reduced counts are in line with the counts from other long-term trend count sites in the Kodiak Archipelago during the same time period (75 FR 80775, 23 December 2010). The low count data is supported by anecdotal reports from KLC staff (AAC 2010). Other long-term trend sites around Kodiak Island are removed from the six mile radius surrounding the KLC, in which impacts from the launch are anticipated to occur; and therefore these haul-out areas would not have been disturbed by launch noise. The Steller sea lion haul-out at Cape Chiniak has been surveyed 19

times since 1957 and Gull Point was surveyed 18 times since 1976. Although the Steller sea lion abundance estimates have declined at Cape Chiniak from 873 animals (1985) to 87 animals (2004) and at Gull Point from 281 animals (1985) to 40 animals (1996), the haul-outs were consistently used except when 0 animals were recorded in 1989 (Cape Chiniak); and 1986 and 1989 (Gull Point).

at the recently observed declines in Steller sea lions' use of Ugak Island is in keeping with general declines seen in the western DPS as a whole (AAC 2010, NMFs unpublished data). Because observed Steller sea lion abundance has declined throughout the region, not just the area affected by launches, NMFS AKR believes it is likely that any observed decline in the use of the Ugak Island haul-out is not attributable to the localized effect from past launches; rather, any decline in the use of the Ugak haul-out is likely due to the same factors that have affected the western stock throughout the region.

2.1.3 Analysis of Effects

2.1.3.1 Effects of the Proposed Action

"Effects of the action" means the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline (50 CFR 402.02). Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur.

This analysis evaluates the effects of the action during a 5-year period of time, which coincides with the 5-year duration of the incidental take regulations. As discussed below, the rocket launches associated with this action may disturb Steller sea lions. Based on observation data and the loudest measured sound pressure level recorded on Ugak Island (approximately 101.4 dBA), NMFS anticipates that if Steller sea lions are disturbed, they may begin to return to haul-out sites on Ugak Island within 2 to 55 minutes of the launch disturbance (75 FR 80773, December 23, 2010). As stated below, we do not expect this action to result in any discernible impacts to Steller sea lions that would persist beyond the 5-year duration of the incidental take regulations.

The Steller sea lion haul-out on Ugak Island, which is designated as critical habitat for this species, presents the opportunity for disturbance or harassment during launches. This site is 3.5 miles from the launch pad and, if sea lions are hauled out on the shoreline during a launch, they may be exposed to airborne noise and visual stimuli from the launch.

Launch operations are a major source of noise on Kodiak Island, as the operation of launch vehicle engines produce substantial sound pressures. Generally, launch related noise consists of: 1) combustion noise, 2) jet noise from interaction of combustion exhaust gases with the atmosphere, and 3) sonic booms. The latter noise, sonic booms, are not an issue with wildlife at KLC as modeling predicts that sonic booms created by ascending rockets launched from KLC reach the Earth's surface over deep ocean, well past the edge of the Outer Continental Shelf, which ends about 20 miles offshore, and well beyond Steller sea lion critical habitat. Launch azimuths to orbit from KLC pass over the extreme northeastern tip of Ugak Island, located about 3.5 miles

away from the launch pad area, at which location a rocket lifting to orbit will be nearing hypersonic velocities and be at an altitude of approximately eight miles above the Earth's surface. Spent first stage motors from space lift missions (i.e., those going to orbit) fall to Earth over the deep ocean beyond the edge of the Outer Continental Shelf (USFAA 1996).

There are other factors associated with the KLC which could impact Steller sea lions. These have been considered, but are not likely to adversely affect these animals for several reasons. The expendable solid rocket boosters from launch vehicles normally separate at very high altitudes, and spent rocket motors fall into the sea away from any sea lion habitat. Catastrophic failures are known to occur, but the combined probability of such an event and contact of an aborted launch vehicle with sea lions or their habitat would be very remote.

NMFS AKR recommended monitoring of the first five launches from the KLC to determine whether noise and other stimuli caused by launch activities would result in behavioral disturbance to sea lions and other marine mammals. Additionally, monitoring was to provide more detail on the seasonal occurrence of marine mammals in this region of Kodiak Island, as well as the noise signature of individual launch vehicles at this location. Through this work and past surveys, we now know that the Ugak Island Steller sea lion haul-out is seasonally occupied, largely between the months of June and September. Acoustic monitoring of several launches has shown received sound levels (RSL) at this haul-out may reach 101 dB re 20 μPa, but are not expected to exceed this level. RSLs are highly variable and depend on the launch vehicle (several different solid-fuel rockets may be launched from KLC), ambient noise levels, launch azimuth, and distance from the rocket engine. Behavioral reactions among hauled-out Steller sea lions could be anticipated at levels above 100 dB re 20 μPa, although this would depend largely on ambient noise levels as well as the behavior of the animals themselves. Unfortunately, remote behavioral observations of sea lion reactions to launch noise have not produced any definitive information that might allow a predictive model of RSL's and behavioral reaction. However, monitoring data suggest a likelihood that Steller sea lions present on Ugak Island at the time of a launch may be harassed due to noise and/or visual stimuli. Prior to the September 1999 launch from the KLC, 60 to 80 Steller sea lions were observed on the Ugak Island haul-out. A monitoring flight approximately one hour after this launch found the site abandoned, with sea lions swimming immediately offshore. While this provides evidence of disturbance and flight reactions due to launches, it was also noted that Steller sea lions were observed to stampede off this haul-out several hours prior to launch without any obvious stimuli, and that at other times sea lions on this site showed little reaction to transient noises from aircraft approaches or the presence of researchers (AADC 2001). The site appeared to be completely re-occupied by the following morning. Disturbances of this kind, occurring infrequently and unaccompanied by protracted harassment on the beach, are not known to cause abandonment of favored hauling areas, and usually the animals return to their previous hauling patterns within a day, as observed here (Bowles 2000).

The biological observations described above are consistent with the literature and applicable research regarding pinniped hearing and acoustic disturbance. In-air hearing deteriorates rapidly below 2 kHz, and pinnipeds appear to be considerably less sensitive to airborne sounds below 10

KHz than are humans (Richardson et al. 1995). Most of the acoustic energy associated with rocket launches of the type used at KLC falls below 2 kHz (AADC 2001).

Additionally, rocket launches from KLC will be infrequent, transient events characterized by an extremely rapid departure at a near-vertical trajectory. Typically, the launch vehicle will have attained an altitude of nearly eight miles before crossing above the Ugak Island haul-out (70 seconds after launch). Therefore, visually, the rocket launch effects on Steller sea lions on Ugak Island are limited, because they are of short duration and the vehicle would appear relatively small when it has reached an altitude of eight miles. The Castor 120 is the loudest launch vehicle motor expected to be launched from KLC during the 5-year period covered by the requested permit. Sound pressure from the Castor 120 at the traditional haul-out on Ugak Island (3.5 miles away from the launch pad) was measured to be 101.4 dBA (SEL) (ACC 2010). Such levels are likely to cause disturbance to Steller sea lions (e.g. greater than 100 dBA). However, acoustically, we expect most received noise levels at Ugak Island to be below these levels because all launch vehicles, but the largest and loudest Castor 120, will be somewhat less than or substantially less than the Castor 120 (75 FR 80775, 23 December 2010). When loud noises occur, their very short duration also would have some mitigating effect on the level of disturbance. Data for one California sea lion suggest an in-air hearing threshold of around 77 dB (re: 20 mPa) at 100 Hz. If hearing abilities of Steller sea lions are similar, then most of the launch noise that was recorded would have been audible to sea lions that may seasonally haul-out at Ugak Island; however, hearing impairment of sea lions exposed to this short duration noise event would not be likely (Stewart 1998). It is most likely the launch noise would trigger an alert (heads up) behavior and/or flush sea lions into the adjacent waters. NMFS anticipates that should Steller sea lions leave Ugak Island, they may begin to return to haul-out sites on Ugak Island within 2 to 55 minutes of the launch disturbance (75 FR 80773, December 23, 2010). These infrequent disturbances are unlikely to cause sea lions to abandon the Ugak Island site. Ugak Island is also exposed to disturbances from aircraft and fishing vessels transiting Narrow Strait. Although Steller sea lion breeding season is in May through June, Ugak Island haul-out is only used by non-breeding males and juveniles; therefore, the breeding segment of the population would be unaffected.

NMFS AKR anticipates that the action covered by this biological opinion is reasonably certain to result in the incidental take resulting from the disturbance and displacement of ESA listed Steller sea lions due to launch operations. Based on the best scientific and commercial data available, NMFS AKR expects this to be low level, non-lethal takes (Level B harassment). The Ugak Island haul-out is occupied for approximately four months each year, by up to eight Steller sea lions, and no more than four launches could occur during that time. NMFS AKR anticipates non-lethal incidental take of up to 32 individuals per year (eight animals per launch x four launches).

2.1.3.2 Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as those effects of "future State or private activities, not involving federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation." Future Federal actions that are unrelated to the proposed action are reviewed through separate section 7 consultation processes. Therefore, such actions are not considered cumulative to the proposed action.

Cumulative effects to Steller sea lions may result from the 1) subsistence harvest by Alaska Natives, 2) state-managed commercial and sport fisheries, and 3) climate change. Other than these, NMFS AKR is not aware of any specific future non-Federal activities within the action area. NMFS AKR assumes that future private and state actions will continue at similar intensities as in recent years.

Subsistence Harvest by Alaska Natives

Steller sea lions harvested by Alaska Natives result in direct lethal takes, and we expect subsistence harvest of these animals to continue into the foreseeable future. The western stock of sea lion harvest in 2008 by Alaska Natives were split among four main regions: Aleutian Islands (48 sea lions, or 33.1 percent of the total statewide take of Steller sea lions), Pribilof Islands (36 sea lions, or 24.7 percent of the total statewide take of Steller sea lions), North Pacific Rim (25 sea lions, or 16.8 percent of the total statewide take of Steller sea lions), and Kodiak Island (19 sea lions, or 12.9 percent of the total statewide take of Steller sea lions) (Wolfe et al. 2009). Kodiak City, about 22 air miles from KLC, is the closest community that could hunt Steller sea lions on Kodiak Island. However, no Steller sea lions were harvested from Kodiak City in 2008 (Wolfe et al. 2009b), 2007 (Wolfe et al. 2009a), and 2006-2003 (Wolfe et al. 2008); with a harvest of 1-3 Steller sea lions from 1994-2002 (Wolfe et al. 2008).

The overall future impact of the subsistence harvest on the western population will be determined by the number of animals taken, their gender, age class, and the location where they are harvested. As with other mortality sources, the significance of subsistence harvests to the western DPS may increase, especially in certain areas such as the western or central Aleutian Islands, if Steller sea lion abundance continues to decline. Future subsistence harvests may contribute to localized declines of Steller sea lions and/or impede recovery, if the harvest is concentrated geographically. However, it is expected that subsistence harvest from Kodiak City, nearest Ugak Island, will remain low and insignificant.

State-Managed Commercial and Sport Fisheries

With regard to direct effects, state managed commercial fisheries are likely to continue to account for an annual mortality for Steller sea lions; although it should be recognized that the data used to estimate direct mortality are almost twenty years old and are based on a relatively small sample. Observers monitored salmon drift gillnet and salmon set gillnet in Prince William Sound (1990-1991), Alaska Peninsula/Aleutian Islands (1990), Cook Inlet (1999-2000), and Kodiak Island (2002). Only the Prince William Sound salmon drift gillnet fishery recorded two mortalities in 1991, which were extrapolated to 29 dead sea lions (95 percent, CI = 1-108 animals) (Allen and Angliss 2010).

As another source of mortality data, observers also monitored the Alaska sport (non-commercial) salmon troll fisheries (1993-2005) and fisheries using miscellaneous fishing gear (2001-2005). NMFS stranding database has only a couple reports on Steller sea lions entangled in fishing gear or with injuries caused by interactions with gear (Allen and Angliss 2010). During the 5-year period from 2001 to 2005, there was only one confirmed fishery-related Steller sea lion stranding from

the western stock. This sighting involved an animal in Bristol Bay (Round Island) with netting or rope around its neck (Allen and Angliss 2010). In addition, a Steller sea lion was reported as entangled in a large flasher/spoon in 1998. It is likely this injury occurred as a result of a sport fishery, as there are sport fisheries for both salmon and shark in this area and there is no way to distinguish between them since both fisheries use a similar type of gear (Allen and Angliss 2010). However, it is understood that fishery interaction reports are considered a minimum estimate because not all entangled animals strand and not all stranded animals are found or reported.

Regarding indirect effects, NMFS concludes based on available information that State managed fisheries for pollock, Pacific cod, herring, and salmon are likely to continue to compete for fish with foraging Steller sea lions. Given the importance of near shore habitats to Steller sea lions, this competition for fish may have consequential effects (NMFS 2010). Specifically, these interactions may contribute to nutritional stress for Steller sea lions and may reduce the value of the marine portions of designated Steller sea lion critical habitat (NMFS 2010). The closure of State waters off the eastern side of Kodiak to non-pelagic trawl gear may mitigate these effects on animals in the vicinity of KLC to some extent. Nonetheless, State managed fisheries will likely continue to reduce prey availability within these marine foraging areas and may alter the distribution of certain prey resources in ways that reduce the foraging effectiveness of Steller sea lions (NMFS 2010).

Sport fisheries in Alaska are generally managed by the Alaska Department of Fish and Game and result in the harvest of several species, with salmon and halibut the most predominant harvested species. We expect that sport fisheries have an incremental effect on listed Steller sea lions relative to that in commercial fisheries. In 1998, Alaska's sport fishery harvests about 1 percent (4,000 mt) of the annual State of Alaska total fish harvests, while the commercial fisheries accounted for 97 percent (900,000 mt) of the annual harvest (NMFS 2010). Impacts are likely limited to minor removals of the potential foraging base, but in such small volumes, we expect only incremental adverse effects, if any.

Global Climate Change

There is growing concern about global climate change. Global air and ocean temperatures during this century are warming and evidence suggests that the productivity of the North Pacific is affected by changes in the environment (Quinn and Niebauer 1995, Mackas et al. 1998).

Increases in global temperatures are expected to have profound impacts on arctic and sub-arctic ecosystems, and some of these impacts have been documented during the last several decades. Specifically, 1) winter temperatures in Alaska and western Canada have increased as much as 3-4 °C during the past half century, 2) precipitation, mostly in the form of rain, has increased primarily in winter resulting in faster snowmelt, 3) sea ice extent has decreased about 8 percent during the past 30 years, with a loss of 15-20 percent of the late-summer ice coverage in the arctic, and 4) glacial retreat, particularly in Alaska, has accelerated contributing to sea level rise (ACIA 2004). These impacts, and others, are projected to accelerate during this century.

The effects of these changes to the marine ecosystems of the Bering Sea, Aleutian Islands, and the Gulf of Alaska, and how they may specifically affect western Steller sea lions are uncertain. Warmer waters could favor productivity of certain forage fish species, but the impact on recruitment dynamics of important fish to Steller sea lions is unpredictable. Recruitment of large year-classes of gadids (e.g., pollock) and herring has occurred more often in warm than cool years, while the distribution (with respect to foraging Steller sea lions) and recruitment of other fish (e.g., osmerids) could be negatively affected. Whether these patterns will continue as overall temperatures increase is uncertain, as are the effects on the duration and strength of atmospheric and oceanographic regimes (Trenburth and Hurrell 1994, Hare and Mantua 2000).

As temperatures warm and global ice coverage decreases, sea levels will rise. This will directly affect terrestrial rookery and haul-out sites currently used by Steller sea lions as well as those that may be used by a recovering population. Presumably, Steller sea lions that use terrestrial sites will simply move upslope as sea levels rise, assuming that the terrain at the site is suitable. However, sites on some islands with low relief (e.g., Aleutian Island: Agligadak Island) may be submerged. The net effect of a rise in sea level on overall terrestrial Steller sea lion habitat amount or availability is uncertain, but at the projected rate it is unlikely to have a significant effect for many years.

2.1.3.3 Integration and Synthesis

Pursuant to Section 7(a)(2) of the ESA, Federal agencies are directed to ensure that their activities are not likely to jeopardize the continued existence of any listed endangered and threatened species or result in the destruction or adverse modification of designated critical habitat. "Jeopardize the continued existence of" is defined in regulations as to engage any action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

In this section, we assess the effects from the annual take of 32 Steller sea lions from AAC activities at KLC and integrate those effects with the environmental baseline and cumulative effects. Finally, we consider the implication of those effects on the continued existence of the Steller sea lion and the destruction or adverse modification to its critical habitat.

In particular, we examine the scientific data available to determine if an individual's probable responses to the agency's action are likely to have consequences for the individual's growth, survival, annual reproductive success, and lifetime reproductive success. When individual animals exposed to an action are expected to experience reductions in fitness, we would expect reductions in the abundance, reproduction rates, and/or growth rates (or increase the variance in these measures) of the population those individuals represent. On the other hand, when animals are *not* expected to experience reductions in fitness, we would not expect the action to have adverse consequences on the population's viability.

In determining whether individual Steller sea lions would be affected, we analyzed when, where, and how an animal would be exposed to the various noise associated with the rocket launch. In

this biological opinion, NMFS has utilized the best available scientific and commercial data to evaluate the consequences from the rocket launch activities on the endangered Steller sea lion. Despite this fact, there exist numerous data deficiencies and uncertainties that limit our ability to accurately forecast the future effects of this activity. These include biological, ecological, political, social, and economic uncertainties.
NMFS scientists have developed population viability models and extinction risk analyses that describe the population impacts from mortalities within this DPS to their survival and recovery. Those models, however, do not include a conversion factor by which harassment takes can be assessed; how many harassments would equate to a mortality event? While science has not produced an answer to this question, a reasonable impact assessment can still be arrived at, by considering the population status, current growth trends, the sea lion reactions to harassment, the consequence of that reaction to individual sea lions, and the impact of those individual reactions to the population; along with the uncertainty of the relationship between harassments and mortalities. Were we to find little likelihood of a relationship between harassment and mortality, for example, the overall impact to this DPS might be low or moderate. On the other hand, if we were to find a high likelihood that harassments are linked with some mortality, the overall impact might become significant.

Uncertainty is also considered as we manage risk. To avoid Type II errors, (i.e., concluding that an animal was not affected when in fact it was) in situations with many unknowns or uncertainties, we may assume an effect would occur, thereby providing the "benefit of the doubt" to the species. The acceptability of risk is clearly dependent on the species/habitat status in question, and a relatively low level of risk is acceptable for populations such as the western DPS of Steller sea lions.

Synthesis
The primary concern associated with the impacts of the proposed action on the western DPS for Steller sea lions has to do with potential impacts due to noise. Exposure to anthropogenic noise may affect these sea lions by impacting their hearing (temporary threshold shifts or permanent threshold shifts indicating mechanical damage to the ear structure) or affecting their behavior (harassment). Therefore, the subject of noise receives much attention in our analysis. There is still uncertainty about the potential impacts of sound on marine mammals, on the factors that determine response and effects, and especially, on the long-term cumulative consequences from increasing noise from multiple sources.

Available evidence also indicates that behavioral reaction to sound, even within a species, may depend on the listener's gender and reproductive status, possibly age and/or accumulated hearing damage, type of activity engaged in at the time or, in some cases, group size. For example, reaction on Ugak Island to sound may vary depending on whether sea lion just arrived, or have been there for some time. Response may be influenced by whether, how often, and in what context, the individual animal has heard the sound before. All of this specificity greatly complicates our ability, in a given situation, to predict the behavioral response by a species, or on classes of individuals within a species, to a given sound. Therefore, we attempt to take a conservative approach in our analyses and base conclusions about potential impacts or potential

effects on the most sensitive members in a population.

For some Steller sea lions that respond behaviorally to the sounds associated with the rocket launches, the response could disrupt behavioral patterns such as resting or seeking refuge on a haul-out, which would amount to Level B harassment, as that term is defined in the MMPA. In order to avoid committing a Type II error, we assume that animals are harassed when their behavior appears to be disrupted, as indicated by an animal lifting its head or moving toward or into the water.

Tertiary effects, those resulting in population-level changes including increased mortality, reduced reproductive rate, or habitat abandonment, are also not well understood. A metric for the impacts of noise exposure on critical biological parameters such as growth, survival, and reproduction might improve our ability to forecast the effects of this action. Unfortunately, such information is not available at this time.

On integrating the effects from the proposed take of Steller sea lions and their critical habitat with the environmental baseline and cumulative effects, annually up to 32 individual sea lions may be harassed by noise from the action, assuming all launches involved the louder rockets (Castor 120). Some animals may exhibit minimal behavioral response, and some animals may leave the haul-out to enter the adjacent waters. Even if the action were to result in every one of these animals leaving the terrestrial haul-out to enter the water, remaining in the water for several hours and subsequently returning to the haul-out, we do not believe this project would have significant adverse consequences at the population level. Steller sea lions are unlikely to be killed or injured by this project, and harassment would be expected to be localized and of short duration. We do not anticipate such brief responses to infrequent disturbance events will adversely affect the fitness of individual animals. The most pronounced increase in noise levels would occur during the actual launch. However, annually only nine launches are planned, and AAC could practicably conduct at most four launches during the period when Steller sea lions may haul-out on Ugak Island (15 June-30 September). While Steller sea lions may be taken under the environmental baseline and through cumulative effects, we believe such takes will be non-lethal and will consist of non-injurious harassment and disturbance by noise. It is not presently possible to quantify the incremental effects of this harassment to the extinction risk probabilities for the western population of the Steller sea lion, when added to the environmental baseline and cumulative impacts. However, we believe it is unlikely that the limited number of non-injurious takes that may result from this action would have any discernible adverse consequences to the survival or reproductive capacity of the western DPS of Steller sea lions. Ugak Island is used by as a haul-out by non-breeding Steller sea lions, and when occupied, the island provides rest and refuge to these animals. When load noises occur from the KLC operations, Steller sea lions could be flushed into adjacent waters. However, the loud noises would be for a very short duration and Steller sea lions are expected to return to the haul-out within 2 to 55 minutes of the launch disturbance (75 FR 80773, December 23, 2010). This noise disturbance would be such a short time (minutes) that Ugak Island would remain a functional haul-out that Steller sea lions may use for rest and refuge. Moreover, NMFS does not expect launch noise to interfere with the ability of

the adjacent aquatic critical habitat to provide forage and refuge to Steller sea lions. Accordingly, critical habitat would not be destroyed or adversely modified by this action.

Conservation measures are included in this biological opinion, which, along with operational conditions on the proposed regulations, would further reduce the likelihood for biologically significant impacts to individual whales or this DPS.

2.1.4 Conclusion

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, NMFS AKR has determined that the proposed action is not likely to jeopardize the continued existence of the western stock of the Steller sea lion nor result in the destruction or adverse modification of Steller sea lion critical habitat.

NMFS AKR used the best available scientific and commercial data to analyze the effects of the proposed action on the biological requirements of the species relative to the environmental baseline, as well as for consideration of cumulative effects. NMFS AKR believes that the proposed action may result in behavioral reactions among individual Steller sea lions that may be present on Ugak Island during launches. These reactions may include temporary departure from the site and lethal take is not expected.

Due to the limited number of launches (nine per year), the limited number of Steller sea lions takes on Ugak Island that would be caused by any single launch (estimate eight during the peak season), and the short duration of the effects (both auditory and visual) from the rockets, NMFS concludes that the proposed action is not likely to jeopardize the continued existence of the western stock of Steller sea lions or destroy or adversely modify its critical habitat.

2.1.5 Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

PR1 identified the following conservation measures, which are adopted here as conservation recommendations. While adopting these conservation measures is not a condition of the findings in this opinion (other than those that are considered part of the proposed action), these measures will lessen the effects from the project on Steller sea lions.

The following conservation recommendations would minimize adverse effects to Steller sea lions during 5-year regulations and subsequent LOAs to AAC to incidentally take Steller sea lions during operations of a commercial rocket launch facility:

1. If the launch monitoring or quarterly aerial surveys indicate the distribution, size, or productivity of the Steller sea lion population was affected due to the specified activity, the launch procedures and the monitoring methods shall be reviewed, in cooperation with NMFS, and, if necessary, appropriate changes may be made through modifications to a given LOA, prior to conducting the next launch of the same vehicle under that LOA.

2. AAC shall install an Alaska Sea Life Center designed camera system that uses live feed to monitor a given haul-out site during rocket launches.

3. The AAC shall conduct quarterly aerial surveys to determine if marine mammal abundance is changing in the long term.

2.1.6 Reinitiation of Consultation

Consultation must be reinitiated if: (1) the amount or extent of taking specified in the ITS is exceeded, or is expected to be exceeded; (2) new information reveals effects of the action may affect listed species in a way not previously considered; (3) the action is modified in a way that causes an effect on listed species that was not previously considered; or (4) a new species is listed or critical habitat is designated that may be affected by the action (50 CFR 402.16). Moreover, if monitoring at the project site reveals that listed species are being stranded or delayed in their migration, consultation must be reinitiated.

2.2 Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by regulation to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. For purposes of this consultation, we interpret "harass" to mean an intentional or negligent action that has the potential to injure an animal or disrupt its normal behaviors to a point where such behaviors are abandoned or significantly altered.[2] Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of an ITS.

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2 NMFS has not adopted a regulatory definition of harassment under the ESA. The World English Dictionary defines harass as "to trouble, torment, or confuse by continual persistent attacks, questions, etc." The U.S. Fish and Wildlife Service defines "harass" in its regulations as

> an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering (50 CFR 17.3).

The interpretation we adopt in this consultation is consistent with our understanding of the dictionary definition of harass and is consistent with the U.S. Fish and Wildlife interpretation of the term.

Amount of take anticipated

NMFS AKR anticipates up to 32 individuals per year and a total of up to 160 individuals from the Steller sea lion western DPS could be taken as a result of this proposed action. The incidental take is expected to be in the form of non-injurious harassment. In this opinion, NMFS AKR determined that Level B harassment (non-lethal takes) of Steller sea lions at Ugak Island is reasonably likely to occur due to launch operation. The Ugak Island haul-out is occupied for approximately four months each year by up to eight Steller sea lions. No more than four launches could occur during that same time. Therefore,

Effect of the take

In this opinion, NMFS AKR determined that this level of anticipated take is not likely to jeopardize the continued existence of the western DPS of Steller sea lions and is not likely to result in the destruction or adverse modification of designated critical habitat.

Although NMFS AKR has specified the amount of take anticipated as a result of the proposed action and has evaluated the effect of such take, NMFS AKR is not including an incidental take authorization for the western DPS of Steller sea lions at this time because the incidental take of Steller sea lions has not been authorized under section 101(a)(5) of the Marine Mammal Protection Act and/or its 1994 amendments. Following issuance of such regulations and Letters of Authorization, NMFS AKR may amend this biological opinion to include an incidental take authorization for Steller sea lions, as appropriate.

3. LITERATURE CITED

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APPENDIX H

Alaska Department of Natural Resources 4(f) Decision, 29 May 2013

THE STATE of ALASKA
GOVERNOR SEAN PARNELL

Department of Natural Resources
DIVISION OF MINING, LAND & WATER
Resource Assessment & Development Section

550 West 7th Avenue, Suite 1050
Anchorage, Alaska 99501-3579
Main: 907.269.8534
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May 29, 2013

Jeffrey Roberts
Alaska Aerospace Corporation
4300 B St Ste 101
Anchorage, AK 99503

Dear Mr Roberts,

This is in reply to your letter of May 6, 2013, regarding whether the Kodiak Launch Complex at Narrow Cape, Kodiak Island, meets the definition of a 4(f) property as stated in the US Department of Transportation Act of 1966. This determination is required by the Federal Aviation Administration who is sponsoring your Corporation's Environmental Assessment of the Launch Complex.

This assessment deals with two of the four criteria described in your letter:

1. "Its major purpose must be for park, recreation, or refuge activities" . Included as components in this determination are, quoting from the Corporation's letter: "Major purpose is related to the property's primary function and how it is intended to be managed." "Lands used primarily for non-recreational purposes where recreational activities that are incidental, secondary, occasional, or dispersed activities similar to a park, recreation, or refuge activities take place are not considered Section 4(f) activities."

Determination: The Kodiak Area Plan (KAP) is the plan used by the Department to guide its decision making activities and is the appropriate document to be used in making this determination. There are two components to the Kodiak Launch Complex: a small recreational component and the much larger launch complex; see p. 3-69. The major purpose of this unit is the launch complex. The recreation area is incidental to this use and is related to dispersed recreation activities. I find that this criterion is not met.

2. "It must be significant as a park, recreation area, or refuge." The term significant means, according to FHWA, that the recreation area must play a major role in meeting the park and recreation functions of the agency, which in this case is the Department of Natural Resources.

Determination: This area is not significant to the overall objectives of the Department, as expressed in the KAP, and only functions as a limited component in its overall park and recreation planning objectives. I find that this criterion is not met.

DNR has jurisdiction of the area in question and the undersigned can represent the Department in this Determination.

Sincerely,

Bruce Phelps

Bruce Phelps, Chief
Resource Assessment and Development Section.

APPENDIX I

FAA Letter to the National Marine Fisheries Service, 29 January, 2013

U.S. Department
of Transportation
Federal Aviation Administration

Office of the Associate Administrator for
Commercial Space Transportation

800 Independence Ave., SW
Washington, DC 20591

JAN 29 2013

Barbara Mahoney
Protected Resources Division
National Marine Fisheries Service (NMFS) – Alaska region
222 W. 7th Avenue, #43
Anchorage, AK 99513-7577

SUBJECT: Kodiak Launch Complex Launch Pad 3, Kodiak Island, Alaska

Dear Ms. Mahoney:

On November 7, 2012, the Federal Aviation Administration (FAA) conducted a teleconference with you and Alaska Aerospace Corporation (AAC) to discuss the proposed Launch Pad 3 Project. This project would require the FAA to modify AAC's Launch Site Operator License (LSO-03-008) for the Kodiak Launch Complex (KLC) to allow for the construction of a new launch pad that would support launching rockets not currently authorized under the license. As discussed, the FAA is preparing an Environmental Assessment (EA) to assess potential environmental impacts of modifying the AAC Launch Site Operator License for KLC. The purpose of the call was to discuss how the proposed license modification would affect the analyses presented in the existing Biological Opinion (BO), 50 CFR 217 Subpart H and associated Letter of Authorization (LOA) under which AAC currently operates the KLC. During the November 7th teleconference, we discussed that a new analysis may be required if the proposed action would exceed the level of take that is currently authorized under the BO, 50 CFR 217 Subpart H and associated LOA. As discussed, the primary concern is the noise levels that will be generated from the new class of rockets and how it could affect marine mammals, particularly on Ugak Island. Other concerns discussed included noise generated during launch pad construction and rocket assembly, and the new use of liquid propellants. This letter is intended to provide additional information on the differences between the current launch operations and the proposed project, particularly noise levels that would be generated during launch events and any potential effects the new noise levels may have on federally-listed species and marine mammals addressed in the 2011 BO and LOAs.

Current KLC Launch Noise and "Take" Authorized Under BO and LOA

AAC's current Launch Site Operator License for the KLC allows up to nine launches per year of solid-propellant small-lift vehicles. The proposed license modification would maintain the maximum allowance of nine vehicle launches per year at KLC, but would allow launches of both solid- and liquid-propellant medium-lift launch vehicles at KLC. The current BO and LOA authorize incidental take of marine mammals resulting from a total of 45 launches of various rockets over a five-year period (Table 1), with an average of nine launches per year. The NMFS calculated take (Final Rule in 76 FR 16311) based on the maximum number of launches of nine per year using the rocket motor (Castor 120) with the highest noise levels at the time for all nine launches. The BO and LOA did also consider up to 3 launches from the medium-lift class of vehicles, specifically the liquid-propelled Taurus II (synonymous with the Antares that is described in the EA mentioned above).

Table 1. Launch Activities Authorized under the BO and LOA from KLC[1]

Vehicle Type and Number of Launches over 5 Years (2011-2016)	Rocket Motor Type	Max Sound Exposure Level Recorded at Ugak Island	Authorized Annual Take of Marine Mammals[3]
32 launches of small-lift vehicles	Castor 120[1] or smaller	101.4 dBA (SEL)[2]	32 steller sea lion; 1,125 harbor seals
10 launches of tactical missiles or smaller size	Not identified, but with substantially lower noise levels than Castor 120	< 101.4 dBA (SEL)	
3 launches of medium-lift vehicles (Antares (aka Taurus II))	Not identified, but the same or lower noise levels than Castor 120	≤ 101.4 dBA (SEL)	

Table Sources: 2011 NMFS Biological Assessment for Rocket Launch Operations at Kodiak Launch Complex; 2011 NMFS Final Rule: Taking Marine Mammals Incidental to Space Vehicle and Missile Launch Operations at Kodiak Launch Complex, AK (76 FR 16311); 2010 NMFS Proposed Rule: Taking Marine Mammals Incidental to Space Vehicle and Missile Launch Operations at Kodiak Launch Complex, Alaska (75 FR 80773).

[1] "The Castor 120 is the largest (and generates the highest noise levels) vehicle motor currently used to launch systems into space from KLC" (75 FR 80773).
[2] 101.4 dBA was the actual maximum recorded Sound Exposure Level at Ugak Island (75 FR 80773).
[3] The NMFS calculated take based on the Castor 120 for all nine annual launches (76 FR 16311). Therefore, the amount of take authorized is actually higher than what would likely occur because not all vehicles use the Castor 120. The Castor 120 was used as an upper bound (worst-case scenario).

[1] Please note that the current FAA launch license only allows small-lift vehicles to be launched from KLC, but the NMFS analyzed up to three medium-lift vehicles in the BO and LOA.

Based on the above, the FAA believes that the 2011 BO and LOA are valid for the proposed medium-lift vehicle launches from the KLC. A noise impact analysis, prepared as part of the EA, performs a detailed analysis of the launch noise from medium-lift rockets at KLC and includes an addendum that specifically addresses the impact on Ugak Island, where marine mammals haul out.

Construction Noise

Based on low ambient levels, construction noise and rocket assembly may be audible within 1,000 feet from the work area. Construction and rocket assembly noise would be temporary and would not reach Ugak Island, which is approximately 3.5 miles from the site of proposed Launch Pad 3. Therefore, FAA has determined that there would be *No Effect* to federally listed Steller sea lions on Ugak Island, and there would be no harassment (i.e. no take under the MMPA) to Steller sea lions or harbor seals on Ugak Island as a result of construction and rocket assembly noise. In addition, noise within this 1,000 foot action area would not reach open water areas that would support other marine mammals; and therefore, construction noise and rocket assembly would have *No Effect* on other federally-listed marine mammals and would cause no harassment (i.e. no take under MMPA) to non-federally-listed marine mammals that may be in open water areas around Narrow Cape.

Liquid Propellants

Launches of liquid-propellant rockets, using a combination of highly refined kerosene (called Rocket Propellant One or RP1) and liquid oxygen, would be new to the KLC. The primary emissions from liquid-propellant vehicles include carbon monoxide, carbon dioxide, hydrogen, water vapor, oxygen, and ozone. Exhaust plumes are concentrated within the geographic area near the launch pad (known as the near field) where the ground cloud forms and begins its thermal rise process. The near field for the Antares is approximately a circle with a 650-foot radius located 300 feet from the launch pad in the direction of the flame trench (northwest) . The far field is considered to be the geographic area where the stabilized and neutrally buoyant cloud material mixes back to the ground. Because of the rapid acceleration of the rocket, the vast bulk of the rocket exhaust products are expelled in the upper atmosphere where they disperse quickly. The primary chemical exhaust constituent of concern from a toxicity standpoint is carbon monoxide. Elevated ground level CO concentrations near the launch pad are estimated to be in the 4,000 to 20,000 parts per million (ppm) range; however, these concentrations dissipate quickly and the effects are extremely localized. Peak instantaneous CO concentrations beyond the immediate vicinity of the launch pad are estimated at typically less than 1 ppm but have the potential to reach 20 ppm. These concentration levels are well below published emergency exposure guidelines for humans and are considered to be benign. Based on the extremely localized area of the exhaust plume and the low concentrations of the CO in the immediate vicinity of the launch pad, there would be *No Effect* to federally-listed marine species and there would be no harassment (i.e. no take under the MMPA) to non-federally-listed marine mammals as a result of the exhaust plume generated by the use of liquid-propellants during a launch event.

Launch Noise from Proposed Medium-Lift Vehicles at Launch Pad 3

In addition to the previously considered Antares (aka Taurus II), the new vehicles proposed to be launched from KLC include the Athena III and a Notional Liquid-Propellant Launch Vehicle. The total number of nine annual launches authorized would not change with the inclusion of medium-lift vehicles. AAC conducted a noise study in support of the FAA's EA for the Launch Site Operator License modification. The noise study analyzed the noise levels at Ugak Island from medium-lift vehicles launched at Launch Pad 3. Table 2 compares modeled noise levels (at Ugak Island) of proposed medium-lift vehicles from Launch Pad 3 to the noise levels of the small lift class of vehicles (with a worst case Castor 120 motor) that was analyzed in the BO and LOA.

Table 2. Modeled Medium-Lift Noise Levels Compared to Castor 120 at Ugak Island

Vehicle Type	Rocket Motor Type	Sound Exposure Level at Ugak Island
Current Small-lift from KLC	Castor 120	101.4 dBA (SEL)
Worst Case Medium-Lift from KLC Launch Pad 3	Reusable Solid Rocket Motor (used in Athena III	93.4 dBA (SEL)

The medium-lift vehicle producing the highest noise levels proposed at KLC is the Athena III, which is anticipated to have a sound exposure level (SEL) of 93.4 dBA. As shown in Table 2, this is less than the level analyzed in the 2011 BO and LOA. The 2011 BO states that the small lift motor (Castor 120) has the highest noise level with a sound exposure level of 101.4 dBA -- based on actual measurements taken on Ugak Island during the 2001 Kodiak Star mission. To back check this finding, the acoustics expert for the EA revisited the raw data from the 2001 mission, and found clear anomalies indicating that the recording equipment on Ugak Island did not work properly. Noted discrepancies included multiple peaks on the launch noise data, repetitive flawed data values, a truncated recording (before the launch noise had returned to ambient noise levels), erroneously high ambient noise levels, pre- and post-launch SEL values that were above the launch-period SEL values, etc. These errors resulted in a higher than realistic 101.4 dBA (SEL) for the Castor 120 at Ugak Island. Despite this discrepancy, the NMFS analysis in the 2011 BO and LOA were based upon the 101.4 dBA (SEL) value, which is 8 dBA higher than the SEL from the Athena III medium-lift rocket.

The acoustical energy of an Athena III is contained primarily in the lower frequency range. In contrast, small lift vehicles currently in use at the KLC produce most of their acoustical energy in the mid to upper frequency range. This is noteworthy, because marine mammals are less adept at perceiving low frequency ranges.

Liquid-propellant rockets also require a water deluge system to reduce vibration loads and to reduce acoustic reflections from the flame trench into the launch vehicle. The deluge system consists of multiple large pressure vessels, totaling about 50,000 gallons of water. A suite of water nozzles distribute water directly into the rocket exhaust stream to immediately dampen vibrations after initial ignition and subsequent protection against reflected vibrations as the rocket lifts off from the launch pad. The expected duration of the water deluge system is 3-4 seconds. Deluge water would be captured in a containment pond at the end of the flame trench providing an area for the water to evaporate. In addition, the KLC Spill Prevention, Control, and Countermeasures (SPCC) Plan would ensure that the storage and potential spills of new liquid propellants and associated chemicals would not reach or contaminate surface waters. Because deluge water and liquid propellants and associated chemicals would not reach surface waters, there would be *No Effect* to federally listed marine species and there would be no harassment (i.e. no take under the MMPA) to non-federally-listed marine mammals.

Conclusions

The FAA has determined that the launch pad construction and rocket assembly noise, and the use of liquid propellants would not affect the analysis of the BO and the LOA, in that there would be *No Effect* to federally listed marine mammals or non-federally-listed marine mammals as a result of this noise or use of liquid propellants.

Based on the rocket launch noise analysis for the EA, the FAA calculates that the highest noise levels at Ugak Island from the proposed medium-lift launches would be an SEL of 93.4 dBA , or 8 dBA less than the 101.4 dBA (SEL) threshold used to calculate take in the 2011 NMFS BO, 50 CFR 217 Subpart H and associated LOA. In addition, the proposed action would maintain the maximum allowance of nine vehicle launches per year at KLC. Therefore, the FAA believes the 2011 BO, 50 CFR 217 Subpart H and associated LOA remain valid for the proposed action. Please notify FAA if NMFS agrees with this conclusion. If NMFS does not agree with this conclusion, please contact FAA so the issue can be resolved.

If you have any question or would like to discuss further, please contact Ms. Stacey Zee at 202-267-9305 or at stacey.zee@faa.gov.

Sincerely,

David P. Murg for Michael McElligott

Michael McElligott
Manager, Space Transportation Development Division

APPENDIX J

FAA Office of Environment and Energy Approval Letter for Noise Methodology 20 August, 2014

U.S. Department
of Transportation
**Federal Aviation
Administration**

Office of Environment and Energy

800 Independence Ave., S.W.
Washington, D.C. 20591

August 20, 2014

Stacey Zee
Office of Commercial Space Transport
Federal Aviation Administration
800 Independence Ave. SW
Washington, DC 20591

Dear Stacey,

The Office of Environment and Energy (AEE) has reviewed the proposed non-standard noise modeling method for the launch noise associated with the proposed project to expand the launch capabilities of the Kodiak Launch Complex (KLC), a commercial launch site currently operated under an FAA launch site operator license, to include medium-lift launch vehicle operations. This is in support of the noise impact analysis for the National Environmental Policy Act (NEPA) Draft Environmental Assessment for the Kodiak Launch Complex Launch Pad 3. In accordance with FAA Order 1050.1e, all non-standard noise analysis must be approved by AEE. This letter serves as AEE's response to the proposed noise method for the NEPA document.

The methodology uses both noise measurement and noise modeling to determine the noise impact. For small-lift launch vehicles, which currently depart from the facility, noise measurement data will be used. For the new medium-lift launch vehicles, noise prediction methods are based on the NASA Document NAS8-11217, Sonic and Vibration Environments for Ground Facilities – A Design Manual (NASA 1968) to calculate potential noise levels from the Athena III. The FAA does not currently have an approved model for launch vehicles. The proposed noise modeling method is based on the best available research and understanding.

Given the proposed launch noise method is based on the best available research on vehicle launches, this approach is appropriate for the Environmental Assessment for the Kodiak Launch Complex Launch Pad 3. AEE concurs with the launch noise methodology used for this project. Please understand that this approval is limited to this particular project and vehicles. Any additional projects using this or other launch noise methodologies or variations of launch vehicles not mentioned here will require separate approval.

Sincerely,

Rebecca Cointin, Manager
AEE/Noise Division