**Application for a Five-Year Programmatic Permit**
**for**
**Small Takes of Marine Mammals Incidental to Launching of Space Launch Vehicles, Long Range Ballistic Target Missiles, and Smaller Missile Systems at Kodiak Launch Complex, Kodiak Island, Alaska**

**Submitted to:**
**NOAA National Marine Fisheries Service**
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**Table 2. Continued**



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**Table 2. Continued**

**1. Detailed Description of Specific Activity or Class of Activities Expected to Result in Incidental Taking of Marine Mammals.**

Alaska Aerospace Corporation (AAC), an entity of the State of Alaska, is applying for a five-year programmatic permit for the take of pinnipeds by harassment incidental to rocket launch operations from its Kodiak Launch Complex (KLC). KLC occupies 3,717 acres of state-owned lands on the Narrow Cape Peninsula on the eastern side of Kodiak Island, Alaska (Figure 1). Launch operations are authorized under license from the Federal Aviation Administration (FAA), Office of the Associate Administrator for Space Transportation, in accordance with the facility's Environmental Assessment (EA), stipulations in the EA's Finding of No Significant Impact (FAA 1996), and in subsequent licenses (FAA 1998, 2003, and 2005). 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's Environment and Natural Resources Institute), and government agencies represented by FAA, the U.S. National Marine Fisheries Service (NMFS), the U.S. Fish and Wildlife Service (FWS), and the Alaska Department of Environmental Conservation (ADEC). Attendees of 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 haulouts on Ugak Island, which lies about 3.5 miles distance from the launch pad area. Species of interest using Ugak Island haulouts include the Steller Sea Lion (*Eumatopias jubatus*) and Harbor Seal (*Phoca vitulina*).

KLC is a modern, state-of-the-industry commercial spaceport that supports civil and federal launch customers. Launch operations began in 1998, and KLC was the first commercial spaceport not to be collocated on a Federal range. It is designed specifically to provide optimal support for space launches to polar and high inclination orbits and for suborbital missions. KLC is the nation's sole high latitude space launch complex, and it is ideally situated to launch payloads into polar orbits, especially highly elliptical orbits, including Molniya and Tundra orbits, which are of increasing interest to Federal launch customers.

Launch operations are a major source of noise on Kodiak Island, as the operation of launch vehicle engines produce substantial sound pressures. Generally, four types of noise occur during a launch: 1) combustion noise, 2) jet noise from interaction of combustion exhaust gases with the atmosphere, 3) combustion noise proper, and 4) 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 (FAA 1996). Launch azimuths to orbit from KLC pass over the extreme northeastern most tip of Ugak Island, located 4.75 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 (FAA 1996).

**Table 2. Continued**

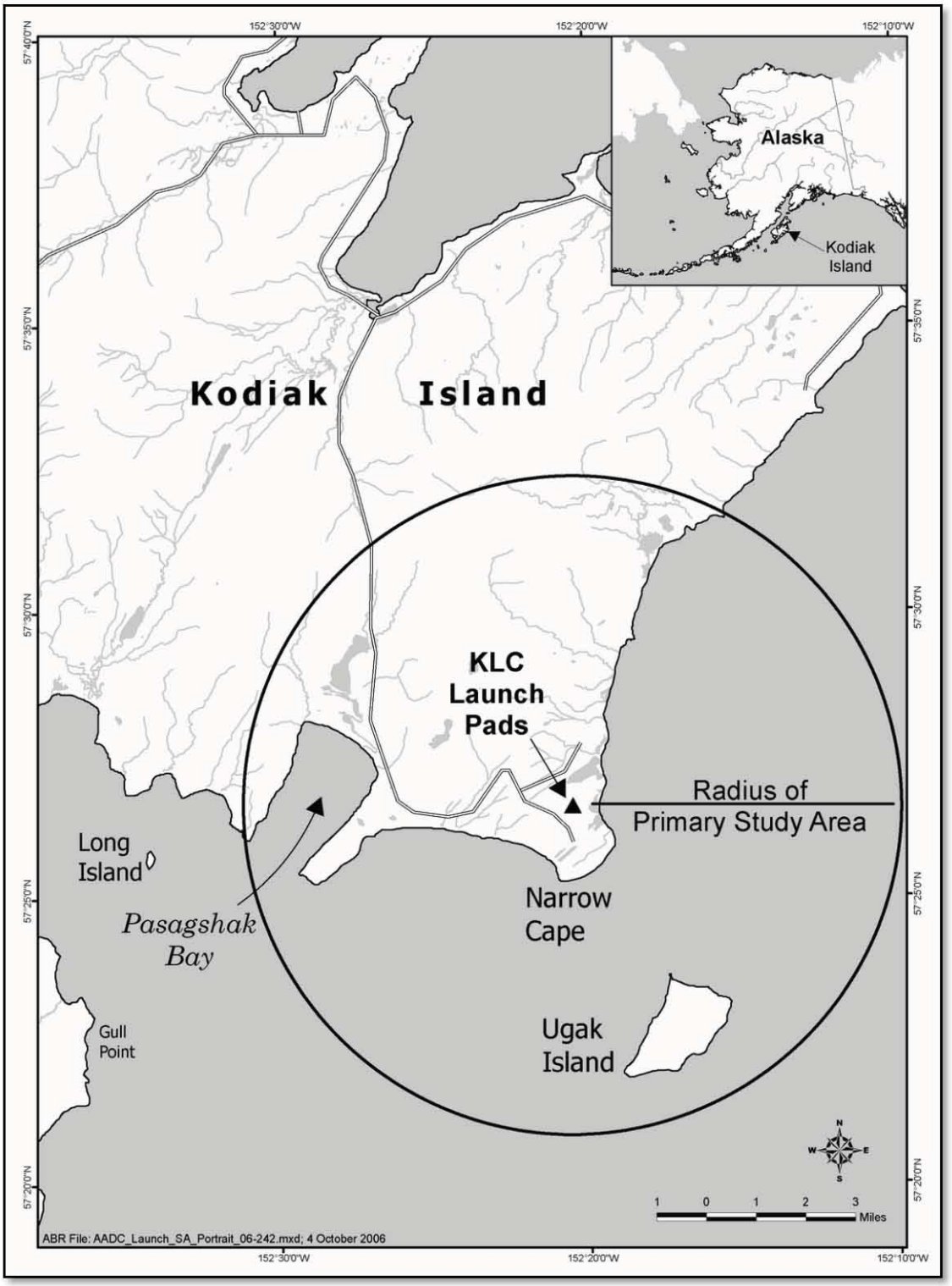



**Figure 1. KLC Vicinity Map.**

**Table 2. Continued**

KLC consists of several facilities that are intelligently sited to accommodate explosive safety quantity distance circles for the various vehicles that can be flown from the complex (Figure 2).

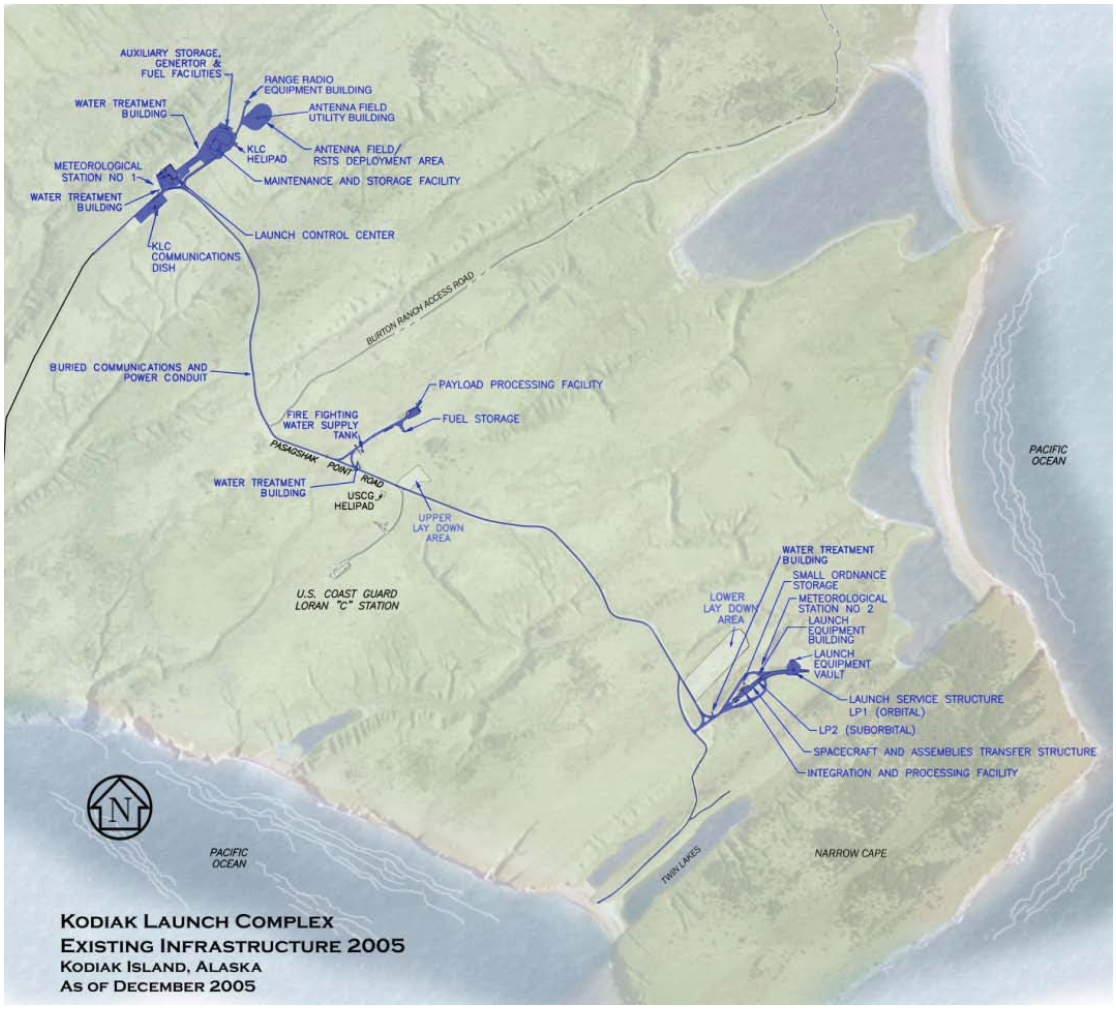



**Figure 2. Kodiak Launch Complex.**

The main facilities include the collocated Launch Control Center (LCC), the Maintenance Support Facility (MSF), and Antenna Field, all of which are about two miles from the pad complex; the Payload Processing Facility (PPF), which is about one mile from the pad complex; and the collocated Integration and Processing Facility (IPF), Spacecraft Assemblies Transfer (SCAT) Facility, and Launch Service Structure (LSS), which together consist of the launch pad complex (Figure 3).

**Table 2. Continued**

**Figure 3. Launch Pad Complex with from front to rear the IPF, SCAT, and LSS.**

In addition, a five bay Rocket Motor Storage Facility (RMSF) is under construction (the first two bays will be operational in 2010-2011), and there are plans laid for later construction of an additional launch pad complex.

The following subsections provide details on representative types of space launch vehicles and suborbital vehicles that might be launched over the five-year period covered by the requested rulemaking.

### 1.1 Representative Space Launch Vehicles, Target Vehicles, and Smaller Missile Systems That Might Be Launched From KLC

Space launch vehicles – which by definition are those used to boost satellites to orbit – are launched from the LSS, which sits over Launch Pad 1 (LP1). The LSS is an environmentally conditioned structure that rolls open for launch. This facility primarily supports launch of small to medium space launch vehicles ranging in size from the small space launch Castor 120 motor (used in the Athena, Minotaur IV, Minotaur V, and Taurus I systems) to the under-development medium-lift Taurus II. The Spaceport is also configured to support launch of the Minuteman I derived Minotaur I Space Launch System, and to support launch of long range ballistic systems such as the Polaris derived A-3 STARS, the Minuteman derived Minotaur II and III, and the C-4.

**Table 2. Continued**

Target vehicles are flown either out of the LSS at LP1 or from Launch Pad 2 (LP2), which is located midway between the IPF and the LSS. All weather indoor processing of erected boosters at LP2 is accomplished by parking the rail mobile SCAT Facility over the pad area. Representative target vehicles that might be flown from KLC range in size from modified C-4 Trident I vehicles, which have a range measured in thousands of miles, down to small vehicles built up from modified second or third stage components of larger missile systems, which have much shorter ranges. The Quick Reaction Launch Vehicle (QRLV) family serves as an example, being built around second stage motors used in the Minuteman I. Tactical missiles, such as the Patriot and Theater High Altitude Area Defense (THAAD) might also be flown from KLC, as might very small sounding rockets.

Table 1 provides motor diameters and representative sound pressures for various launch vehicles, some of which have been launched previously from KLC (where indicated below). The listed vehicles include various ballistic launch vehicles and the small lift Castor 120 space launch vehicle, as well as smaller target/interceptor systems and tactical rocket systems. All KLC sound measurements reported in Table 1 were taken at a distance of 3.5 miles from the launch pad on Ugak Island, the location of pinniped haulouts, where sound pressure monitors were installed prior to launch by skilled professionals. It is important to note that the Castor 120 (previously launched from KLC) is the loudest launch vehicle motor expected to be launched from KLC over the five year period covered by the requested permit.

**Table 1. Recorded and Estimated Sound Pressures at the Ugak Island Spit Haulout**

| **Previously Launched & Recorded at KLC (also Potentially Launched in Future)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Launch Designator** | **Launch Vehicle** | **Date** | **Distance to Haulout** | **Motor Diameter (feet)[1]** | **SEL (dBA)** | **Lmax (dBA)** | **LPeak (dCBA)** |
| *ait*-1 | QRLV | 11/5/98 | 3.5 miles[2] | 4.3 | 88.4 | 78.2 | 97.0 |
| *ait*-2 | QRLV | 9/15/99 | 3.5 miles[2] | 4.3 | 92.2 | 81.5 | 101.5 |
| QRLV | QRLV | 3/22/01 | 3.5 miles[2] | 4.3 | 80.3 | 73.3 | 87.2 |
| Athena | Castor 120 | 9/29/01 | 3.5 miles[2] | 7.75 | 101.4 | 90.8 | 115.9 |
| FT-04-1 | Polaris A-3 STARS | 2/23/06 | 4.1 miles[3] | 4.5 | 92.3 | 86.0 | 109.0 |
| FTG-02 | Polaris A-3 STARS | 9/01/06 | 4.1 miles[3] | 4.5 | 90.1 | 83.1 | 105.6 |
| FTG-03a | Polaris A-3 STARS | 9/28/07 | 4.5 miles[4] | 4.5 | 91.4 | 84.2 | 107.3 |
| FTX-03 | Polaris A-3 STARS | 7/18/08 | 4.5 miles[4] | 4.5 | 89.6 | 83.0 | 108.3 |

**Table 2. Continued**

| Table 1. Continued-Potentially Launched in Future | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Launch Designator** | **Launch Vehicle** | **Date** | **Distance to Haulout** | **Motor Diameter (feet)[1]** | **SEL (dBA)** | **Lmax (dBA)** | **LPeak (dCBA)** |
| - | Taurus II | - | - | - | <101.4[5] | - | - |
| - | Minotaur I | - | - | 4.5 | 90+[5] | - | - |
| - | C-4 Trident I | - | - | 6.1 | - | - | - |
| - | Castor I | - | - | 2.6 | - | - | - |
| - | SR19/SR773 | - | - | 4.3 | - | - | - |
| - | SR19/SR19 | - | - | 4.3 | - | - | - |
| - | Castor IVB | - | - | 3.3 | - | - | - |
| - | Patriot | - | - | 1.3 | - | - | - |
| - | THAAD | - | - | 1.25 | - | - | - |

**NOTES:**
1. Motor sound pressures from solid fueled motors are directly correlated to motor diameter.
2. Traditionally used Steller Sea Lion seasonal haulout; use has declined significantly in recent times
3. Alternate Steller Sea lion haulout, a tidally exposed small rock located midway between the traditional haulout and the northeastern most cape of Ugak Island
4. Second alternate Steller Sea Lion haulout located on the northeastern most cape of Ugak Island
5. Estimated – see text Section 1.1.2

### 1.1.1 Castor 120 (Athena, Peacekeeper Derived Minotaur IV and V, and Taurus I)

The Castor 120 is the civil version of the Peacekeeper SR 118 first stage motor. The SR 118 provides the first stage of both the Minotaur IV and V. For the purposes of this application, there are no substantive differences between the SR 118 and the Castor 120. The Castor 120 provides the first stage of two different civil launch systems. These include the Athena and the Taurus I.

The Castor 120 was the base vehicle analyzed in the EA done by the FAA (US FAA 1996) in support of the decision to issue a launch license to AAC. The Castor 120 uses solid fuel and produces about 371,000 pounds of thrust. The motor mass is about 116,000 pounds and the motor is 347 inches long and 93 inches wide. Modeling shows the rocket is about eight miles above the earth's surface when it overflies Ugak Island, and that 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 (US FAA 1996). Sound pressure from the Castor 120 at the traditional haulout on Ugak Island was measured to be 101.4 dBA (SEL) (Table 1). This location is 3.5 miles away from the launch pad. None of the vehicles expected to be flown from KLC over the five year period covered by this rule making and associated permit is known to be louder than the Castor 120.

**Table 2. Continued**

### 1.1.2 Taurus II

The Taurus II is an under development, medium class launch vehicle similar in capability to the Delta II, which is being withdrawn from service. The vehicle is liquid fueled and burns kerosene with liquid oxygen as the oxidizer. Orbital Sciences Inc. anticipates the first launch to be in 2011 or 2012, and AAC anticipates that KLC will be the west coast launch site for the vehicle. No sound pressure data is available, but because the Taurus II is very similar to the Delta II in design and capability, sound pressures produced by the Taurus II should be reasonably close to those of the Delta II. The U.S. Air Force reports that sound pressures of the Delta II were slightly less than those from the Taurus I (Castor 120) as measured from the same point (USAF 2008), thus the anticipated sound pressure from the Taurus II at the traditional Steller Sea Lion haulout on Ugak Island is likely to be at or somewhat less than the 101.4 dBA (SEL) recorded for the Castor 120 (see above).

### 1.1.3 Minotaur I

The Minotaur I is a small lift solid propellant space launch vehicle, the first stage of which is a modified Minuteman II first stage. The first stage motor has a diameter of 4.5 feet. This launch vehicle has not yet been flown from KLC. Sound pressure monitoring of two Minotaur I launches was accomplished at Vandenberg Air Force Base, California (VAFB). The data were collected 1.4 miles away from the launch point and show sound pressure levels of 104.9 to 107.0 dBA (SEL) at that distance. Sound energy at sea level decreases with the square of the distance, and given that the traditional Steller Sea Lion haulout on Ugak Island is two miles farther away (i.e. the haulout is 3.5 miles from the launch point), the anticipated sound pressure levels from a Minotaur I at the Ugak Island traditional haulout would range in the 90s dBA (SEL).

### 1.1.4 C-4 Trident I

The C-4 is a solid fueled vehicle and its first stage has a diameter of 6.1 feet, which is about 1.5 feet less than the Castor 120. The system's range is around 4,000 miles. It has never been flown from KLC, but given it is significantly smaller in diameter than the Castor 120 and uses a similar fuel, it is anticipated that sound pressure levels at the traditional Steller Sea Lion haulout would be less than those of the Castor120.

### 1.1.5 Polaris A-3 STARS

The Strategic Target System (STARS) utilizes the first stage of the Polaris A-3, which is solid fueled and measures 4.5 feet in diameter. Several STARS systems have been flown from KLC. Recorded sound pressure levels at Ugak Island have ranged from 90.2 to 91.4 dBA (SEL).

### 1.1.6 Smaller Target and Tactical Rocket Systems

A number of smaller missile systems have the possibility of being flown from KLC. Representative missile systems are the Castor 120 through the THAAD, shown at the bottom of Table 1. These are not the only such systems that might be flown, but they are representative of the sizes of such vehicles. As shown, representative smaller systems range from about a foot in

**Table 2. Continued**
diameter up to about four feet in diameter. As stated earlier, smaller systems ranging down in size to several inches in diameter and used as sounding rockets could conceivably be flown as well. Sound pressures from these smaller systems are not available, but will be substantially less than those from the space launch and ballistic vehicles described above and pose no potential for disturbance to marine mammals.

**2. Dates and Duration of Activities and Specific Geographical Region Where They Will Occur.**

Launch activities could occur at any time of day or night and in any weather during the period to be covered under this rulemaking (27 February 2011 through 28 February 2015). KLC launch azimuths range from 110° to 220°. The eastern most launch azimuth of 110° is within a few degrees of most orbital launches, and crosses the extreme eastern edge of Ugak Island where several pinniped haulouts are found. Modeling done of Castor 120 space launches indicates the vehicle is passing through 45,000 feet altitude by the time it reaches the island about seventy seconds post launch (US FAA 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 (US FAA 1996).

KLC is about 22 air miles from the City of Kodiak, which is the largest settlement on the Kodiak Island. The land area occupied by KLC is owned by the State of Alaska and is administered by AAC under terms of an Interagency Land Management Assignment (ILMA) issued by AAC's sister agency, the Alaska Department of Natural Resources. Land elevations at KLC range from about 140 feet near the pad complex to about 300 feet at the Launch Control Center. The vegetation includes a mix of grass-sedge, shrub, wetland, and Sitka spruce (*Picea sitchensis*) associations. There are no federally listed or proposed Threatened or Endangered species on the land.

The ILMA also grants AAC authority to restrict public access for safety purposes to an additional 7,000 acres of 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 haulout (Figures 4 and 5), 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 twenty 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. Harbor Seal haulouts are present mainly on Ugak Island's eastern shores.

**Table 2. Continued**

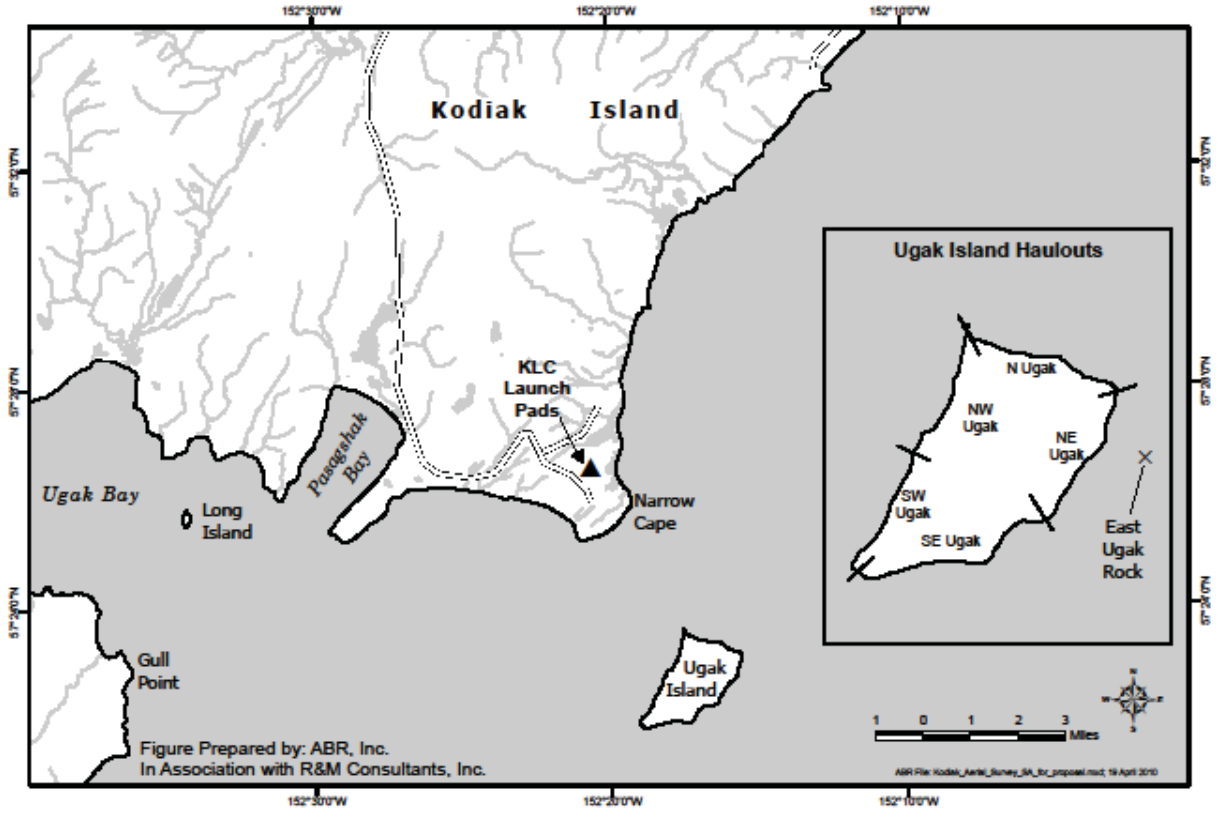



**Figure 4. Ugak Island Haulouts.**

**Figure 5. Ugak Island seen from the Southeast. The historic Steller Sea Lion haulout spit is visible, as is KLC across the strait. Most Harbor Seals use beaches beneath the 1,000 foot tall cliffs in the foreground.**

**Table 2. Continued**

**3. Species and Numbers of Marine Mammals Likely to be Found Within the Activity Area.**

Marine mammals that regularly occur in the vicinity of KLC include the Steller Sea Lion, Harbor Seal, Gray Whale (*Eschrichtius robustus*), Humpback Whale (*Megaptera novaeangliae*), and Sea Otter (*Enhydra lutris*) (Table 2). All are protected under the Marine Mammal Protection Act (MMPA), and in addition the Steller Sea Lion, Humpback Whale, and Sea Otter are listed as Threatened or Endangered under the Endangered Species Act (ESA). The U.S. Fish and Wildlife Service manages the Sea Otter, and NMFS does not have jurisdiction to issue takes of this species; therefore it is not discussed further in this application.

Table 2 presents daily counts, by species, of the MMPA-protected marine mammals that have been observed during launch-related environmental monitoring activities conducted since the current LOA became active in early 2006. The counts are specific to Ugak Island.

**Table 2. Marine Mammal Observations during Launch-Related Environmental Monitoring within Six-mile Radius Study Area**

| Date | Steller Sea Lion[1] | Harbor Seal[2] | Gray Whale | Humpback Whale | Pre-Launch Survey (# days pre-launch) | Post-Launch Survey (# days post-launch) |
|---|---|---|---|---|---|---|
| 2/18/2006 | | 684 | | | Yes (5) | |
| 2/19/2006 | | 519 | 2 | | Yes (4) | |
| 2/20/2006 | | 201 | | | Yes (3) | |
| 2/21/2006 | | 405 | 8 | | Yes (2) | |
| 2/22/2006 | | 350 | | | Yes (1) | |
| 2/23/2006 | | 211 | 1 | | | Yes (Same Day) |
| 2/24/2006 | | 270 | 1 | | | Yes (1) |
| 2/25/2006 | | 58 | | | | Yes (2) |
| 8/28/2006 | 3 | 495 | | | Yes (3) | |
| 8/29/2006 | 4 | 652 | | | Yes (2) | |
| 8/31/2006 | 8[3] | 901 | | | Yes (1) | |
| 9/1/2006 | 2 | 961 | | | | Yes (Same Day) |
| 9/2/2006 | 1 | 954 | 2 | 1 | | Yes (1) |
| 9/3/2006 | 1 | 789 | | 1 | | Yes (2) |
| 5/23/2007 | | 136 | 2 | | Yes (2) | |
| 5/27/2007 | | 402 | 3 | | | Yes (2) |
| 5/28/2007 | | 224 | 1 | | | Yes (3) |
| 9/25/2007 | | 381 | 4 | | Yes (3) | |
| 9/26/2007 | 2 | 265 | | | Yes (2) | |

**Table 2. Continued**

| Date | Steller Sea Lion[1] | Harbor Seal[2] | Gray Whale | Humpback Whale | Pre-Launch Survey (# days pre-launch) | Post-Launch Survey (# days post-launch) |
|---|---|---|---|---|---|---|
| 9/27/2007 | | 461 | 8 | | Yes (1) | |
| 9/30/2007 | | 686 | 6 | | | Yes (2) |
| 10/1/2007 | | 748 | | | | Yes (3) |
| 7/15/2008 | 4 | 700 | 9 | | Yes (3) | |
| 7/16/2008 | 5 | 611 | 32 | | Yes (2) | |
| 7/17/2008 | 1 | 853 | 9 | | Yes (1) | |
| 7/18/2008 | 4 | 840 | 12 | | | Yes (Same Day) |
| 7/19/2008 | 4 | 744 | 1 | | | Yes (1) |
| 7/20/2008 | 5 | 610 | 5 | | | Yes (2) |
| 7/21/2008 | 3 | 1534 | | | | Yes (3) |
| 12/7/2008 | 1 | 971 | 5 | | | Yes (2) |

**NOTES:**

1. Steller Sea Lions pup mid- May to mid-July and breed late-May to late-July at rookeries. Molt is late-July to early December (Hoover 1988). Haulouts are used for resting. Ugak Island is a haulout not a rookery. The Ugak Haulout has been used in the past between July and October.
2. Harbor Seals pup from ~15 May to end of June (Jemison and Kelly 2001) and molt from June to October. Both periods contain peaks in haulout attendance.
3. Five individuals observed by aerial survey, eight captured on unmanned video.

The primary monitoring method has involved conducting aerial surveys along set transect lines to observe and count Steller Sea Lions and Harbor Seals. Marine mammals other than sea lions and Harbor Seals, although observed and recorded, were not specifically targeted by the launch-related aerial surveys. Marine mammal abundance and distribution were recorded during aerial surveys flown in a single-engine fixed-wing airplane with floats. The aerial survey route was designed for Steller Sea Lions and Harbor Seals and was flown using a Global Positioning System (GPS) for navigation. All surveys were intended to be flown within two hours of the daytime low tide and during mid-day, when haul out attendance peaks for Harbor Seals. The aerial survey schedule during the formal monitoring period consisted of daily surveys one day prior to the launch, immediately following the launch (on the launch day), and each day of the three days following the launch date, weather conditions permitting (NMFS 2008). Two additional surveys were often conducted prior to the formal monitoring period at AAC's discretion. The two additional surveys were conducted to balance the pre-launch sample size with the three post-launch surveys to allow calculation of the variance in pre-launch counts for subsequent statistical analysis. The aerial surveys were flown 500 ft above sea level at 80–90 nautical mph and the flight line was kept ≥0.25 mi from known haulouts. Digital photographs of groups of seals (generally >10 seals) were taken with a Nikon D70 camera (equipped with a 70 to 300 millimeter zoom lens) or a Canon Powershot S5 camera with image stabilized zoom. Images were reviewed on a personal computer and counts of seals were summarized from sets of overlapping images. All counts of >15 seals were made from digital images taken from the

**Table 2. Continued**
aircraft, unless the images were blurred or underexposed, in which cases the visual estimates were used.

Foul weather, daylight considerations, launch timing, and timing of tidal flux have all contributed to the difficulty in collecting the data in Table 2. Foul weather precludes aerial surveys primarily due to visibility and/or excessive turbulence. In addition, rockets can often be launched during periods of weather that are not conducive to operation of small aircraft. Daylight, launch timing, and tidal flux create difficulty in timing of surveys, as low tide (when haulouts are more likely to be attended) may not coincide with daylight hours and/or aircraft availability. Table 2 does not reflect the several aerial surveys that were attempted and aborted, or that were scrubbed altogether due to the considerations just mentioned. Only successfully completed aerial surveys are listed above.

Descriptions of the various species that occur in the vicinity of KLC are set forth below, but the following general trends can be easily seen in Table 2. Previous rocket launches did not generally appear to depress the daily attendance of Harbor Seals at haulouts on Ugak Island. Harbor Seals appear to be increasing on Ugak Island. The number of Harbor Seals tallied at Ugak Island during the July 2008 FTX-03 surveys reached a new record for monitoring surveys, at 1,534 seals (R&M, 2008). Numbers in Table 2 are high during August and September surveys because they were conducted during the annual molt, when maximal numbers of seals tend to haulout (Calambokidis et al., 1987).

Marine mammals other than Steller Sea Lions and Harbor Seals, although observed and recorded, were not specifically targeted by the aerial survey and other monitoring efforts for this launch. A small number of Gray Whales (5) and sea otters (3) were the only other marine mammals observed.

### 3.1 Steller Sea Lion

The Steller Sea Lion population is described by two stocks. Those west of 144° west longitude, which includes the KLC area, are classified as Endangered. Mature and sub adult male Steller Sea Lions have historically used a post-breeding haulout found on a spit on Ugak Island. The spit is on the northwestern most shore of the island within 3.5 miles of the launch pad complex (Figures 4 and 5). This haulout is the closest haulout to the launch complex and experiences the highest sound pressures. Use has declined in recent times in keeping with general declines seen in the species as a whole. The historic occupancy period ranged from June to September (post breeding), with peak reported numbers in the few hundred (Sease 1997; ENRI 1995-1998). Numbers of individuals using the haulout have declined over time. The spit is designated a long term trend count site by NMFS and has been surveyed once yearly, with June as the target, since the 1990s. Counts since 2000 have generally been zero (e.g. US NMFS 2009; Fritz and Stinchcomb 2005), which is in line with the counts from all other long term trend count sites in the Kodiak Archipelago (known as Tonki Cape, Cape Barnabas, Cape Ugat, and Steep Cape) over the same time period. The low count data is supported by anecdotal reports from KLC

**Table 2. Continued**

staff. A decade ago it was normal to hear the bellows of sea lions on the spit from the vicinity of the Launch Control Center, which is about 5.5 miles away. This is no longer the case, and in fact, newer staff have never heard them. The spit haulout has not been used by Steller Sea Lions during launch-monitoring surveys since 1999 (ENRI, 2000, R&M, 2007a,b, 2008); however, since then only three launches from the KLC (FTG-02, FTG-03a, and FTX-03) have occurred during the June to September time frame. Seventeen aerial surveys have been conducted during those launches (Table 2). More often, when sea lions were present during recent monitoring surveys, they have occupied a haulout on a supratidal rock on eastern Ugak Island (termed East Ugak Rock). During one aerial survey that was completed outside the June-September timeframe (during the FTG-05 campaign in December 2008), a single sea lion was observed on East Ugak Rock. The same location was used daily by sea lions during previous monitoring surveys in the June-September timeframe. Two to eight (per day) sea lions were observed there during the FTG-02 launch (R&M, 2006b) and one to five (per day) were observed during the FTX-03 launch (R&M, 2008).

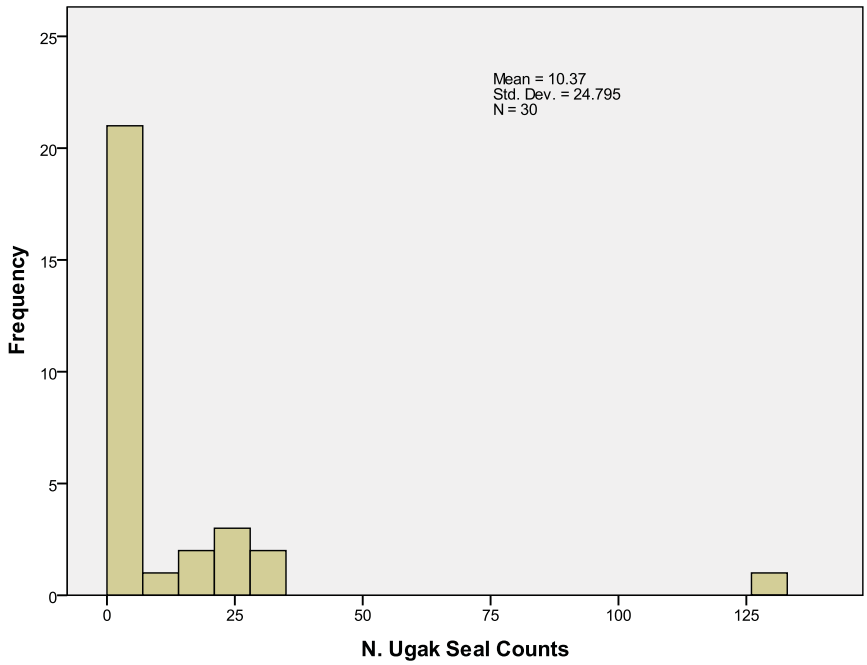
### 3.2 Harbor Seal

Harbor Seals are present on Ugak Island year round. Approximately 97% of all individuals are found on the eastern shore, based on aerial survey counts from launch monitoring reports conducted since January 2006 (Figure 6). The eastern shore is backed by high steep cliffs that reach up to 1,000 feet above sea level. These cliffs form a visual and acoustic barrier to rocket operations, and limit effects on the species. This conclusion is based on review of sound pressure recordings that showed surf and wind-generated sound pressures at sea level were generally in the >70 dBA (SEL) range on the best days (cf. Cuccarese et al. 1999, 2000). During inclement periods sound pressures at sea level can exceed 100dBA (SEL). Haulout on the eastern shore are all about five miles distance from the pad complex.

Because access to Ugak Island Harbor Seal haulouts is difficult and dangerous, nothing is known of how seals use these habitats. Harbor Seals generally breed and molt where they haulout, so it is assumed that both of these activities take place on Ugak Island. This assumption is supported by the fact that young seals have routinely been seen there during launch-related aerial surveys. These haulouts are the only haulouts used by Harbor Seals within the six mile radius area (Figure 1) designated as being affected by launch operations, and so they have a local importance. Pupping in Alaska takes place generally in the May-June time frame; molting occurs generally from June to October. Total counts on Ugak Island have increased steadily since the 1990s from several hundred (ENRI 1995-1998) up to a peak of about 1,500 today (R&M 2007a, 2007b, 2008, 2009) (Table 2). In the prior absence of reliable count data by area of Ugak Island, NMFS originally estimated that up to 25% of all Harbor Seals were using haulouts on the island's northern shores (NMFS 2005) to support its rule making on the previous request from AAC for a permit. Subsequent analysis of count data shows that the NMFS estimate of use of the northern shore of Ugak Island by seals was too high (Figure 6). As stated above, approximately 97% of all observed Harbor Seals since 2006 have used haulouts on the eastern shore of Ugak Island.

**Table 2. Continued**

**Figure 6. Percentage of Harbor Seals counted on Ugak Island's Northern Shore[1].**




1. Frequency of Harbor Seals counts using Northern Ugak Island haulouts during 30 aerial surveys conducted during six rocket launches, Kodiak Island, 2006–2008. Unpublished data collected by ABR, Inc. in association with R&M Consultants, Inc. Note: no seals were seen on North Ugak Island during 19 of 30 surveys.

### 3.3 Gray Whale

The migration path of the Gray Whale runs past Narrow Cape twice yearly as members of the population move between southern breeding grounds and northern feeding areas in the Chukchi and Beaufort Seas. The area from Cape Chiniak (which is about 15 miles north of Narrow Cape) to Narrow Cape/Ugak Island has been identified by NMFS as a major spring Gray Whale concentration area and probable feeding area (Consiglieri et al. 1989). The total stock size for this species is estimated to be around 18,000 (Allen and Angliss 2010). Nearly all of the population passes by KLC each spring and fall during migrations to feeding areas in the Chukchi and Beaufort Seas and winter grounds in Mexico. KLC operations do not affect Gray Whales because airborne noise is generally reflected at the sea surface outside of a 26° cone extending downward from the ascending rocket (Richardson et al. 1995). Little sound energy passes into the sea across the air-water boundary. Submerged animals would have to be directly underneath the rocket to hear it, and given the hypersonic velocity of launch vehicles in the atmosphere, the duration of sounds reaching Gray Whales will be negligible. Given the limited surface area involved, the very short time a cetacean would be exposed to the noise, and the attenuation that occurs at the sea-air interface, Gray Whales are not anticipated to be affected by launch operations, and they are not discussed further within this application.

**Table 2. Continued**

### 3.4 Humpback Whale

The Humpback Whale is seasonally present in small numbers in the near shore waters around Narrow Cape. A peak count of thirteen was recorded in 1997 about fifteen miles north of KLC at Cape Chiniak (ENRI 1995-1998). Sightings around Narrow Cape in the vicinity of the launch complex are sporadic (Table 2) and range from one to four. The total population of the stock(s) using the Gulf of Alaska is estimated to be around 2,200 (Allen and Angliss 2010). Humpback Whales will not be affected by launch operations from KLC for the identical reasons discussed for Gray Whales in section 3.4, and they will not be discussed further in this application.

## 4. Description of the Status, Distribution, and Seasonal Distribution of Species or Stocks of Marine Mammals Likely to be Impacted

### 4.1 Steller Sea Lion

The western stock of the Steller Sea Lions, which includes those found in the Narrow Cape area, is estimated to total around 41,000 (Allen and Angliss 2010). This stock is listed as Endangered under the ESA and depleted under the MMPA. The western stock occupies a huge geographic range that stretches around 1,800 from Kodiak Island to the end of the Aleutian Island chain. As stated in Section 3.1 above, numbers in the Narrow Cape area have diminished over time in concert with declines seen in the stock as a whole. The species is normally seen on Ugak Island between June and September (Table 2); current numbers are imprecisely known but are much lower than in the past. The prime area used historically as a haulout is a gravel substrate spit on Ugak Island's north side (see Section 3.1). The spit haulout has not been used by Steller Sea Lions during launch-monitoring surveys since 1999 (ENRI, 2000, R&M, 2007a,b, 2008). Since that time, observed animals have occurred on Ugak Island's east side. Historic data do indicate that when hauled out at the spit, the population has consisted of adult males only. The spit is under the influence of long shore currents and its geomorphology shifts over time. Currently the spit appears smaller in size than in the past.

### 4.2 Harbor Seal

The Harbor Seal is widely distributed in the Gulf of Alaska, an area that includes Narrow Cape. Harbor Seals have not been listed under the ESA, nor have they been listed as depleted under the MMPA. The Gulf of Alaska stock, which is found from Cape Suckling to Unimak Pass, is estimated to number around 44,000. The stock is rebounding from a crash that occurred in the 1990s. Current numbers on Ugak Island total around 1,500 (R&M 2009), which is an increase of about 1,100 since the 1990s (ENRI 1995-1998). As indicated in Section 3.2 above, pupping in this stock generally occurs from May to June and molting occurs from June to October.

## 5. Type of Incidental Taking Authorization Being Requested and the Method of Incidental Taking.

Pinnipeds might be taken by incidental harassment (e.g. head lifting, move toward or into the water) as a consequence of rocket motor noise or the sudden visual appearance of a rocket during

**Table 2. Continued**
its ascent from KLC. Pinniped responses to launches from VABF, with notes on related observations from Ugak Island are presented in Section 7.

## 6. By Age, Sex, and Reproductive Condition, the Number of Marine Mammals That Might be Taken by Harassment, and the Number of Times Such Takings are Likely to Occur.

### 6.1 Number of Space Launch Vehicles, Targets, and Smaller Missile System Launches.

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 numbers of vehicles 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.

Historically, launch operations have required months of preparation that included 1) shipment of individual motor stages and pay loads, 2) checkout and interim storage of motors and payloads, 3) Launch Operations Control Center and range safety system mission data integration, 4) integration of motors either horizontally for later erection of the complete motor assembly on the pad, or by building the complete motor assembly by stacking with use of a crane directly on the pad, 5) integration of the payload on the completed stack, 6) methodical checking of all completed launch vehicle and payload components, 7) multiple launch dress rehearsals, and 8) launch.

Following launch it is normal under present procedures to require months to reconfigure a launch complex for a new mission. This paradigm poses increasing problems for support of today's space asset infrastructure, which is vital to commerce and the military. If a critical space asset is lost, or if additional assets are required, it currently takes months to years to ready another launch. This is untenable and planning is underway to allow on demand launch when and as needed. The U.S. Department of Defense is leading this planning effort with an initiative called Operationally Responsive Space (ORS). This concept will allow the rapid launch after call up of assets to orbit. In brief, what is envisioned is revolutionary. Multiple fully integrated rocket systems (complete stacks of all boost motors) will be stored in bunkers on trailers that have the capability to function as strong back erectors. The motor stacks will be monitored by computer 24/7 with reports on vehicle health reported in real time as problems arise. This will assure a completed stack is ready on demand. Multiple satellites will also be stored on site, or available off site for delivery to a launch complex within 24 hours of issuance of a mission order. At the launch complex, multiple launch solutions and infrastructure configurations will be stored in electronic media in a launch library. On receipt of a launch order, a completed motor stack will be rolled out of its bunker and driven to the launch pad where it will be erected intact (fully complete) on the launch stool with the transporter's integral strong back erector. The satellite will then be brought from storage and integrated onto the stack. Satellite, vehicle and launch

**Table 2. Continued**

operations integration checks will then be performed. This concept holds promise of achieving launch in as little as 24 hours after call up.

AAC is actively configuring KLC to support ORS missions, and KLC will have the nation's first rapid on demand launch capability when complete. A five bay Rocket Motor Storage Facility is currently under construction and the first two bays are expected to be operational in the 2010-2011 time frame. Once available, KLC will be the first launch complex capable of supporting on-demand access to space. What this means is that instead of taking months to recycle the complex to support a new mission, the spaceport will be able to support multiple launches to space in days. For example, with initial capacity limited to the two bunkers, and assuming a third stack was held in reserve erect on the pad and that satellites were available along with launch and safety solutions, up to three launches from a single pad could be performed in a week's time.

AAC's estimate of the total number of vehicles that might be launched from KLC over the course of the five-year period covered by the requested rulemaking is 45, with an average of nine per year. Most of these vehicles are expected to be of the Minotaur I through V class, including civil versions of the Castor 120 known as the Athena and Taurus I (See Section 1) or smaller target vehicles (See Section 1). AAC estimates that up to three of the 45 launches will be of the now under development Taurus II (See Section 1), and that up to 10 of the 45 launches will be of smaller vehicles such as the THAAD, or even smaller sounding rockets. Thus, AAC estimates that of the 45 estimated launches from KLC over the five-year period in consideration, 32 will be of small space launch and target vehicles of the Castor 120 or smaller size, 10 will be of THAAD or smaller size, and three will be of the medium lift Taurus II. While it is difficult to estimate, the highest number of launches in any given year might be 12 if smaller tactical systems were flown for test and evaluation purposes. This is a high end number that represents the worst case for analysis.

Launch timing is out of the control of AAC and is driven by customer needs that include variables ranging from 1) availability of down range assets necessary to support launch, 2) orbital parameters, and 3) exigencies requiring rapid response to requests for replacement of lost assets, or to augment existing ones to support vital defense, humanitarian, or commercial needs. Launches can, and do occur year round and in all weather. Under the ORS paradigm, some of these launches will occur in clusters. AAC does not think ORS missions will happen that often, and the normal existing model of drawn out step wise launch campaigns will dominate its business through the foreseeable future. Thus, over time, most launches likely will be done as at present. What this means is that after a series of ORS launches is performed for a customer, it is likely that the next launch might be a month or more away.

### 6.2 Numbers of Pinnipeds That Might be Taken By Harassment

Total numbers of Steller Sea Lions seasonally present on Ugak Island today are imprecisely known, but numbers have declined to the point they are relatively uncommon. Numbers tallied during recent launch campaigns have been very low (See Sections 3 and 4). Based on available

**Table 2. Continued**
data, AAC assumes about ten currently use Ugak Island for haulout purposes. All might potentially be taken by harassment during launch operations.

The total number of Harbor Seals present on Ugak Island ranges up to about 1,500, most of which are found on the island's eastern shore where they are sheltered from launch effects by the 1,000 foot tall cliffs that stand between their haulouts and KLC. Relatively few Harbor Seals use haulouts on the northern side of the island across from KLC because of the lack of suitable beaches (See Section 3.2). No seals were seen on northern haulouts, which consist primarily of isolated rocks, during 19 of 30 surveys. When present, the majority of counts on northern haulouts were of less than 25 individuals (Figure 6). A one-time high count of about 125 animals has been made. Using the conservative and rare high number of 125 as being a representative figure, AAC estimates that up to 125 individuals might be taken per launch operation. Actual numbers will likely be smaller given the low and variable use of the area by Harbor Seals.

### 6.3 Numbers of Whales That Might be Taken By Harassment

No whales will be taken by harassment given that sound pressures in the range produced by rocket motors generally decouple at the air-water interface. AAC does not anticipate impacts to whales.

## 7. Anticipated Impact of the Activity by Species or Stock

Launch activities are generally considered to be subject to the terms of the National Environmental Policy Act (NEPA), as was the issuance of KLC's Launch Site Operator's License. Consequently, several NEPA processes have been done for launches from KLC. Pertinent ones are listed in Table 3 below. All have concluded in Findings of No Significant Impact (FONSI) or related determinations such as Records of Environmental Consideration.

Rocket operations at KLC analyzed under NEPA include those for the Castor 120 (US FAA 1996), small launch vehicles used in the *ait* and QRLV programs (USAF 1997, 2001), the Polaris A-3 STARS (US Army 2001), the Minotaur family including the Minuteman based Minotaur I through III and the Peacekeeper based Minotaur IV and V (USAF 2006), and the C-4 Trident I (US Army 2003). In addition NMFS completed an EA for rulemaking concerning issuance of Letters of Authorization for taking pinnipeds by harassment (NMFS 2005); FAA completed Environmental Impact Statements for licensing launches (US FAA 2001) and experimental flights of small reusable rockets (US FAA 2009); and the U.S. Army completed an EA for deployment and use of a variety of mobile sensors (US Army 2005), along with a companion Record of Environmental Consideration.

**Table 2. Continued**

**Table 3. Pertinent NEPA Processes Completed for KLC Operations.**

| Purpose | Environmental Assessment FONSI | Environmental Impact Statement FONSI | Record of Environmental Consideration | Analyzed Topic |
|---|---|---|---|---|
| FAA Site Operator's License | X | | | Launch of Up to 9 Castor 120s per year |
| USAF *ait* Program | X | | | SR19/M57 and Castor IVB/M57 |
| USAF QRLV Program | X | | | M56 and SR19 |
| USA STARS | X | | | Polaris A-3 |
| NMFS LOA Rulemaking | X | | | Launch Operations Effects on Marine Mammals |
| USAF OSP | X | | | Minotaur, All Classes (I through V) |
| FAA Programmatic Licenses | | X | | License Rulemaking |
| GMD ETR EIS | | X | | C-4 Trident I |
| FAA Experimental Flight Permits | | X | | Small Reusable Launch Vehicles |
| USA Mobile Sensors | X | | X | Use of Mobile Sensors |

Predicted effects in these NEPA analyses include unequivocal findings of no impact due to sound pressures being below 100 dBA (SEL), which is the general point at which pinnipeds will leave shore for the water (USAF 1997) to possible short term behavioral effects of no long lasting consequence due to expected sound pressures of about 100 dBA (SEL) (US Army 2003). The above documentation shows 100 dBA (SEL) is the threshold at which one can expect to dependably see short term behavioral responses.

Wildlife generally exhibit a startle response to sudden loud, uncommon, short term noises such as occur during a rocket launch. This statement is supported by observations from the Kennedy Space Center in Florida and VAFB (US Army 2003), as well as from KLC. As stated, response in pinnipeds is variable up to around 100 dBA (SEL), at which point affected animals tend to leave haulouts and move into the water (USAF 1997, 2001; US Army 2003). Once in the water

**Table 2. Continued**

affected pinnipeds tend to mill around just off the beach in an alert posture, and to return to shore within minutes to a few hours post disturbance (Portor 1997; Kouvaccs et al.1990; Thorson et al. 1999a, b; Perry et al. 2002). Pinnipeds can and do habituate to loud sounds, with older adults showing less concern than younger, less experienced ones (Thorson et al. 1999a, b).

Potential launch effects on pinnipeds are limited to disturbance from rocket motor noise (FAA 1996; USAF 1997, 2001, 2006; US Army 2001, 2003). Potential noise effects can be characterized as auditory and non-auditory. Auditory impacts to pinnipeds by definition consist of injury effects such as ruptured ear drums or behavioral impairments such as temporary threshold shift in hearing level. Auditory impacts are associated with exposure to close by explosive events, such as might happen were a rocket to suffer a highly unusual catastrophic failure on ignition. Given the distance from the pad area to Ugak Island, auditory impacts are not considered further in this request for permit. Non-auditory effects could include stress, behavioral changes, and interference with mating or care of young. Behavioral responses in animals can be highly variable depending on the situation and vary from startle behaviors to flight. Animals can be sensitive to sound pressures of a given level one day and not the next.

The effects of sound pressure on marine mammals are highly variable and were categorized by Richardson et al. 1995 to include: 1) sound pressures that are below the hearing threshold of the species or less than the prevailing ambient noise, 2) sound pressures that are within the audible range of the species but not strong enough to elicit an overt behavioral response, 3) sound pressures that elicit reactions of variable conspicuousness and variable relevance to the well being of an individual, 4) sound pressures for which repeated exposure elicits either diminishing responses (habituation) or persistence of effects, 5) sound pressures strong enough to reduce (mask) the ability of pinnipeds to hear natural sounds at similar frequencies, including calls from conspecifics, and environmental sounds such as surf noise, 6) sound pressures of such magnitude and frequency that they induce physiological stress and affect the well being or reproductive success of individuals, and 7) sound pressures that lead to permanent hearing impairment. With regard to number 7, received sound levels must far exceed an animal's hearing threshold for there to be even temporary threshold shift, and as indicated, any explosive events that might occur would be distant from Ugak Island; thus, they are not considered further in this application. The first six effects listed by Richardson et al. (1995) have varying potentials ranging from likely to unlikely in the vicinity of Ugak Island. For example, numbers 2 through 5 above are likely depending on the vehicle, while numbers 1 and 6 are unlikely.

Spent rocket motors will fall into the open ocean over deep water, far from Ugak Island and do not pose a threat to seals or sea lions. Similarly, sonic booms will occur well past the edge of the Outer Continental Shelf break over the deep ocean, and do not pose any threat to pinnipeds. Airborne launch sounds outside of a cone of 26° beneath an ascending rocket will not penetrate the water column to an appreciable extent, and of that portion which does, the transitory nature of the event (because of the very swift and rapidly increasing velocity of the rocket) will serve to mitigate effects; sounds that do penetrate the water column will not persist more than a few seconds at a time.

**Table 2. Continued**

As indicated previously, the primary historical Steller Sea Lion haulout on Ugak Island is on a spit facing the launch complex. Sound pressures recorded at this location from the launch of a Castor 120, which is expected to be the loudest vehicle to be flown from KLC over the course of the five year rule and related permit under request, are negligibly above the threshold known to generally induce flight response in pinnipeds. Sound pressure from the Castor 120 at the Ugak Island spit used historically by Steller Sea Lions, which is the closest pinniped haulout to the pad complex, is just above the 100 dBA (SEL) threshold that causes general disturbance to pinnipeds. This is the loudest sound pressure expected at the Ugak Island Steller Sea Lion haulout over the five year period to be covered by the requested permit. Consequently, any sea lions present on this haulout will likely exhibit stereotypical disturbance responses. As sound pressures rise, the initial response of sea lions could be expected to range from alert behaviors, described generally as having the head held erect while bellowing, to outright flight (stampede) off of the beach in the presence of stronger stimuli, where they will tend to mill around just offshore on alert with heads held up (Portor 1997). Time spent milling offshore by disturbed animals is generally of short duration and ranges from minutes to a few hours (Portor 1997).

Observations of rocket launch effects on sea lions on Ugak Island are limited, but show that any negative effects are of short duration. This is in keeping with observations of pinnipeds at other west coast launch ranges. During the launch of a small ballistic target vehicle from KLC in 1999, sound pressures exceeded 91dBA (SEL) at the haulout spit (Cuccarese et al 2000). Steller Sea Lions were found immediately post launch offshore of the haulout, milling about with heads held erect in alert posture, however a firm cause and effect could not be definitely ascribed. A video recorder set up to document stimulus-response behaviors failed in the hours before launch. The video record showed a mass stampede into the water had occurred several hours before launch, and the animals were still in the water when the system failed. Subsequent aerial survey data taken post launch found all of the animals to be in the water, but it is unknown whether they remained in the water since the time of the video record, or were later disturbed anew by the rocket launch. No stimulus for the stampede was apparent in either the video record or the sound pressure record, but given the animals were previously disturbed by something, it seems likely the launch contributed to the animals sense of unease despite the relatively low sond pressures involved.

As stated in Section 3.1, Steller Sea Lion numbers on Ugak Island have declined from highs recorded in the 1990s in keeping with trends seen in the entire stock. Pre and post launch counts of Steller Sea Lions show good concordance indicating that any disturbance effects from launch operations are of limited duration (Table 4—cf.*ait*-1 results with FTX-03 results per foot notes).

**Table 2. Continued**

**Table 4. Steller Sea Lions Present on the Ugak Island Haulout during expected occupancy period (15 June through 30 September) by launch.**

| *Launch Name/Date* | *Numbers Pre Launch* | *Numbers Post Launch* |
|---|---|---|
| *ait*-2 (09/15/99)[1] | 60-70 | 60-70 |
| Kodiak Star (09/29/01)[2] | 0 | 0 |
| FTG-02 (09/01/06)[3] | 0 | 0 |
| FTG-03a (09/28/07)[4] | 0 | 0 |
| FTX-03 (07/18/08)[5] | 0[6] | 0[7] |

1. Cuccarese et al. 2000. Kodiak Launch Complex, Alaska Environmental Monitoring Studies September 1999 *ait*-2 Launch. Report for Alaska Aerospace Development Corporation. Anchorage, Alaska. 30pp + Appendices.
2. Cuccarese et al.2002. Kodiak Launch Complex, Alaska Environmental Monitoring Studies September, 2001 Athena (Kodiak Star) Launch. Report for Alaska Aerospace Development Corporation. Anchorage, Alaska. 26pp + Appendices.
3. R&M et al. 2006. Environmental Monitoring Report FTG-02 Launch. Report for Alaska Aerospace Development Corporation. Anchorage, Alaska. 32pp + Appendices.
4. R&M et al. 2007. Environmental Monitoring Report FTG-03a. Report for Alaska Aerospace Development Corporation. Anchorage, Alaska. 28pp + Appendices.
5. R&M et al. 2008. Environmental Monitoring Report FTX-03 Launch. Report for Alaska Aerospace Development Corporation. Anchorage, Alaska, 29pp + Appendices.
6. Note: 1 Steller Sea Lion was seen pre launch on a supra littoral rock on the northeastern most cape of Ugak Island.
7. Up to 5 Steller Sea Lions were seen post launch on the supra littoral rock referenced in Note 6 above.

The numbers of Steller Sea Lions that might be taken by disturbance from rocket operations includes all that might be present on the north shore of Ugak Island during the launch event. Current numbers of Steller Sea Lions using Ugak Island are not precisely known, but appear to be $\leq 10$. This represents the worst case potential take by harassment per launch. Assuming that an average of 9 launches per year occur, that all 9 launches involve the Castor 120, the loudest vehicle expected to be flown from KLC over the period to be covered by the requested permit, and that there is no habituation to rocket motor effects with experience, then up to ninety takes by disturbance/harassment per year could occur.

Haulout behaviors of Harbor Seals are generally better understood than those of Steller Sea Lions. For example, haulout behavior of Harbor Seals has been investigated by radio tagging individuals in North America (Kovacs et al. 1990). Tagged seals ranged in age from pup through adult. Time of day rather than tidal stage or sea state was found to be the main influence on haulout use. However, combinations of high tide and high swell also influenced haulout behavior, with higher tides and swells limiting haulout behavior. Site fidelity as measured over six months was found to be high, i.e. seals generally returned to the same beach after leaving for the water over time (Kovacs et al. 1990, Suryan and Harvey 1998).

**Table 2. Continued**

Harbor Seal counts from Ugak Island during and immediately after launch operations show that seal numbers pre and post launch are generally congruent, indicating no lasting effects are accruing from launch operations (shown in Table 2 and summarized below in Table 5 with reference to the foot notes). Further, the seal population has been growing steadily since the 1990s, increasing from several hundred to more than 1,500 today. This indicates that rocket launch operations are not having a negative effect on reproductive behavior.

**Table 5. Harbor Seal counts pre and post launch since LOA was executed in 2006.**

| *Launch Name/Date* | *Numbers Pre Launch* | *Numbers Post Launch* |
|---|---|---|
| FT-04-1 (02/23/06)[1] | 350[7] | 211[7] |
| FTG-02 (09/01/06)[2] | 901[8] | 961[8] |
| FTG-03 (05/27/07)[3] | 136[8,9] | 402[8,9] |
| FTG-03a (09/28/07)[4] | 461[8] | 0[10] |
| FTX-03 (07/18/08)[5] | 853[8] | 840[8] |
| FTG-05 (12/05/08)[6] | No Data[11] | No Data[11] |

1. R&M et al. 2006. Environmental Monitoring Report FT-04-1 Launch. Report for Alaska Aerospace Development Corporation. Anchorage, Alaska. 28pp +Appendices.
2. R&M et al. 2006. Environmental Report FTG-02 Launch. Report for Alaska Aerospace Development Corporation. Anchorage, Alaska. 32pp + Appendices.
3. R&M et al. 2007. Environmental Monitoring Report FTG-03 Launch. Report for Alaska Aerospace Development Corporation. Anchorage, Alaska. 24pp + Appendices.
4. R&M et al. 2007. Environmental Monitoring Report FTG-03a Launch. Report for the Alaska Aerospace Development Corporation. Anchorage, Alaska. 28pp + Appendices.
5. R&M et al. 2008. Environmental Monitoring Report FTX-03 Launch. Report for Alaska Aerospace Development Corporation. Anchorage, Alaska. 29pp + Appendices.
6. R&M et al. 2009. Environmental Monitoring Report FTG-05 Launch. Report for Alaska Aerospace Development Corporation. Anchorage, Alaska. 25pp + Appendices.
7. Note: Visual count; launch coincided with execution of LOA that requires photographic documentation of seal numbers.
8. Note: Counts from photographs.
9. Note: Data are not representative of launch period. Sole pre launch survey was done two days pre launch (weather precluded surveys on launch day), and first post launch survey was done two days after launch due to adverse weather conditions.
10. Note: Survey occurred at high tide when haulouts were flooded.
11. Note: Survey cancelled due to adverse weather.

The primary haulouts for Harbor Seals are located on the eastern shore of Ugak Island, all of which are five miles or more from the pad complex. These haulouts, as described earlier, are shielded from rocket launch effects by 1,000 foot tall cliffs and by noise from the high energy shore line that characterizes that shore of the island. Distance from the pad complex also mitigates launch related sounds. Cumulatively over the term of the current Letter of Agreement (LOA), approximately 97% of all Harbor Seals present used this shoreline. Most of the

**Table 2. Continued**
remaining Harbor Seals are found in low numbers around the island. Anticipated sound pressures reaching these distributed Harbor Seal haulouts will be materially less than those reaching the Stellar Sea Lion haulout, as all are farther from the launch complex.

As stated in Section 3.2, Harbor Seal numbers in the waters around Narrow Cape have increased over time from several hundred to about 1,500 today. This is a strong indication that rocket launch operations are not having long term adverse effects on the species. Pre and post launch photographic count data indicate that any disturbance from launch operations is of limited duration (Table 5—cf. especially FTG-02 with FTX-03 results per foot notes).

Harbor Seals most affected by launch operations will be those using the rocks found between the Steller Sea Lion haulout spit and the northeastern most cape of Ugak Island. Numbers using this shore commonly range on any given day from several to approximately twenty, however on one occasion as many as 125 were tallied in a single aerial survey. This number represents approximately 1% of the total seals currently present on Ugak Island. This was a rare occurrence, but it serves to describe the worst case disturbance situation. Thus, up to 125 seals might be taken by disturbance per launch event assuming none habituate to rocket motor noise. Assuming that up to nine launches per year occur, that all launches are of the Castor 120, and that no habituation occurs, then up to 1,125 takes by disturbance/harassment could occur each year. This is an upper end worse case estimate that addresses foreseeable unknowns.

**8. Anticipated Impact of Activities on Availability of Marine Mammals for Subsistence Uses.**

There are no documented subsistence uses of marine mammal resources in the area, and thus, there will not be any impact on subsistence.

**9. Anticipated Impact of Activities Upon the Habitat of Marine Mammal Populations**

There will be no adverse effects on marine mammal habitat as a result of launch operations at KLC. Spent rocket motors fall to the sea well beyond the edge of the Outer Continental Shelf over the North Pacific abyss (See Section 2).

**10. Anticipated Impact of Loss of the Habitat on the Marine Mammal Populations Involved.**

Not Applicable.

**11. Availability and Feasibility of Equipment, Methods, and Manner of Conducting Activity or Other Means of Effecting the Least Practical Adverse Impact Upon Species or Stocks, Their Habitat, or Availability for Subsistence.**

As stated in Section 6, launch operations are controlled by a range of variables that are beyond the control of AAC. Launch operations are conducted at the control of the launch provider/sponsor, whose schedule is driven by variables beyond their influence including need to

**Table 2. Continued**
launch within certain windows to meet mission orbits, availability of critical down range assets including ships, planes, and ground stations worldwide, and international crises.

**12. Plan of Cooperation to Minimize Impacts on Subsistence Uses.**

Not applicable.

**13. Suggested Means of Accomplishing Necessary Monitoring and Reporting That Will Result in Increased Knowledge of Species, Levels of Taking, or Impacts on Populations of Marine Mammals expected to be Present During Launch Activities.**

AAC proposes to purchase and emplace one (1) remote live streaming video system overlooking a haulout selected in cooperation with NMFS and consultation with the video system's manufacturer. The system of choice was developed, tested, and first put into service in Alaska, and has proven itself over many years of operation both in Alaska and around the world. The video system is all weather proven and autonomous, drawing energy from a combination of wind and solar generators. It features a camera that includes a lens that can be focused (zoom and pan) on command and provides live streaming video that can be made available through internet access to interested researchers in real time. This system would be maintained year round.

The camera system would replace other study means used up to this point that have met with variable success due to the influences of the adverse weather that typifies the local environment. AAC proposes to purchase, install, and maintain one of the remotely operated video systems from the manufacturer. AAC would establish the system in a locale overlooking a known pinniped haulout in working cooperation with NMFS staff, AAC's research consultants, and the video manufacturer who has the expertise necessary to ensure optimal placement of the equipment. Launch monitoring would be done as follows. The selected haulout would be viewed either in real time or via "tape" delay for six days using the following schedule where day length permits. The six day schedule will be roughly centered on the day of launch, with launch day being day three of the monitoring schedule. The video stream will be viewed by professional biologists for four hours each day with monitoring centered on the time of launch on launch day, and on low tide on the other days.

Data will be taken from the animals present in the view; these will serve as a representative sample of the whole for the purposes of monitoring launch effects. Data will minimally include behavioral observations by time period including percent resting, percent on alert, and percent showing full disturbance as indicated by flight from the beach. This will provide a snapshot of normal pre and post launch behavior patterns.

Prelaunch data will be collected on days 1, 2, 4, 5, and 6 as follows. A CD will be made of the video record for later study. The period of record will begin two hours pre low tide and continue for two hours post low tide unless directed otherwise by NMFS. This will provide data on normal haulout behaviors.

**Table 2. Continued**

On launch day, if daylight allows, the period of record will include two hours pre launch and two hours post launch. The data will be collected to a CD. If the launch occurs in the hours of darkness the data record will begin as soon as there is sufficient daylight to collect data, and data will be recorded from that point post launch for two hours. All data will be subsequently reduced and analyzed with results extrapolated to all pinnipeds on Ugak Island. Copies of the report will be provided to NMFS within sixty working days of a launch.

The data record will be summarized after the first five monitoring efforts, and results reported to NMFS staff. Subsequently, AAC and NMFS will cooperatively determine if the system is optimally sited for permit purposes, or if an alternative location should be sought. The criteria for this determination shall be whether or not the system is capturing data of sufficient quality to determine if disturbance effects are occurring at time of launch, and if so, how long it takes for normal behavioral patterns (i.e. non disturbance) to resume. If an alternative location is desired for the system, AAC will search for one in cooperation with NMFS and the maker of the video system, and if a suitable/viable alternative is found, AAC will move the system to the new location within ninety days, weather permitting. Should it be determined that a viable alternative location for the video system was not available for any reason, AAC would resume in person monitoring done under the current permit, specific details of which are found in Section 3.

Additionally, regardless of which survey technique was used (live streaming video as proposed above, or video recorder plus aerial surveys as done under the present LOA), whenever a new class of rocket was flown from KLC, a real time sound pressure record will be obtained for documentation purposes and correlation with the behavioral response record. Two sound pressure monitors shall be used: one shall be placed at the established sound pressure recording location known as Narrow Cape and the other at the haulout at the Ugak Island spit used historically by Steller Sea Lions.

## 14. Suggested means of Learning of, Encouraging, and Coordinating Research Opportunities, Plans, and Activities Related to Reducing Such Incidental Taking and Evaluating its Impacts.

AAC will continue to publicly announce launch dates through open news media whenever possible. Additional benefits to researchers and the public would be realized from the proposed new video system discussed in Section 13. Finally, as in the past, reports of environmental monitoring activities would continue to be made available to the public via the Kodiak Library, local government offices, and NMFS.

**Table 2. Continued**

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